CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

(Autonomous)

Kokapet (Village), Gandipet, Hyderabad, Telangana – 500075

www.cbit.ac.in

1.1.3 Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution during the last five years

1.1.3.1 Number of courses having focus on employability/ entrepreneurship/ skill development year-wise during the last five years.

Year	2021-22	2020-21	2019-20	2018-19	2017-18
Number	1166	1106	985	922	984

List of courses courses having focus on employability/ entrepreneurship/ skill development offered by the institution during 2020 - 21 from S. No. 1172 - 1564

S.No	Course Name	Code
1172	Calculus	20MTC05
1173	Chemistry	20CYC01
1174	Engineering Mechanics-I	20CEC01
1175	Programming for Problem Solving	20CSC01
1176	Chemistry Lab	20CYC02
1177	Programming for Problem Solving Lab	20CSC02
1178	Workshop / Manufacturing Practice	20MEC02
1179	Engineering Exploration	20MEC03
1180	Vector Calculus and Differential Equations	20MTC06
1181	English	20EGC01
1182	Mechanics and Materials Science	20PYC05
1183	Basic Electrical Engineering	20EEC01
1184	English lab	20EGC02
1185	Mechanics and Materials Science Lab	20PYC08
1186	Basic Electrical Engineering Lab	20EEC02
1187	CAD and Drafting	20MEC01
1188	Community Engagement	20MBC02
1189	Mathematics -III	18MTC05
1190	Engineering Economics And Accountancy	18MB C01
1191	Material Science And Metallurgy	18ME C03
1192	Mechanics Of Materials	18ME C04
1193	Manufacturing Processes	18PE C01
1194	Indian Constitution And Fundamental Principles	18EG M01
1195	Indian Traditional Knowledge	18EE A01
1196	Material Science And Metallurgy Lab	18ME C05
1197	Mechanics Of Materials Lab	18ME C06
1198	Manufacturing Processes Lab	18PE C02
1199	Basics Of Data Structures	18CS C05
1200	Kinematics Of Machines	18ME C07
1201	Thermo Dynamics	18ME C08

1202	Principles Of Management	18ME C09
1203	Fluid Principles And Hydraulic Machines	18ME C10
1204	Environmental Science	18CE M01
1205	Basics Of Data Structures Lab	18CS C08
1206	Soft Skills Lab	18EG C03
1207	Fluid Principles And Hydraulic Machines Lab	18ME C11
1208	Dynamics of Machines	18ME C12
1209	Applied Thermodynamics and Heat Transfer	18ME C13
1210	Design of Machine Elements	18ME C14
1211	Metal Cutting and Machine Tool Engineering	18PE C07
1212	Refrigeration and Air Conditioning	18ME E01
1213	Values, Ethics and Society	18ME E02
1214	Plastics, Ceramics and Composite Materials	18PE E01
1215	Product Design and Process Planning	18PE E02
1216	Mechanical Vibrations	18ME E03
1217	Automobile Engineering	18ME E04
1218	Nano Science and Technology	18ME E05
1219	Rights, Duties and Legislation	18ME E06
1220	Non Destructive Testing and Evaluation	18PE E04
1221	Fuels, Combustion and Environment	18ME E07
1222	Dynamics and Vibrations Lab	18ME C15
1223	Applied Thermodynamics and Heat Transfer Lab	18ME C16
1224	Metal Cutting and Machine Tool Engineering Lab	18PE C08
1225	CAD/CAM	18ME C17
1226	Machine Design	18ME C18
1227	Thermal Turbo Machines	18ME C19
1228	Object Oriented Programming with C++	18ME E08
1229	Mechanics of Composite Materials	18ME E09
1230	Robotic Engineering	18ME E10
1231	Production and Operations Management	18PE E06
1232	Advanced IC Engines	18ME E11
1233	Computational Fluid Dynamics	18ME E12
1234	Principles of Entrepreneurship	18ME E13
1235	Modern Machining and Forming Methods	18PE E08
1236	Heat and Mass Transfer	18ME E14
1237	Blockchain Technology	18ME E15
1238	Renewable Energy Sources	18ME E17
1239	Control Systems Theory	18ME E18
1240	Artificial Intelligence	18ME E19
1241	Industrial Administration and Financial Management	18ME E20
1242	Principles and Applications of Additive Manufacturing	18PE E11
1243	CAD/CAM LAB	18ME C20
1244	Thermal Engineering Lab	18ME C21
1245	Metrology and Instrumentation	16ME C33
1246	Operations Research	16ME C34
1247	Production Drawing	16PE C10
1248	Production and Operations Management	16PE C11

1249	Finite Element Analysis	16ME C35
1250	Renewable Energy Sources	16ME E10
1251	Energy Conservation, Management and Audit	16ME E11
1252	Engineering Research Methodology	16ME E12
1253	Environmental Pollution	16ME E13
1254	Metrology and Instrumentation Lab	16ME C36
1255	Computer Aided Engineering Lab	16ME C37
1256	Project Seminar	16ME C38
1257	Power Plant Engineering	16ME E15
1258	Principles of Entrepreneurship	16ME E16
1259	Innovations, Protection and Legal Aspects	16ME E17
1260	Supply Chain Management	16PE E11
1261	Nano Science and Technology	16ME E18
1262	Disaster Mitigation and Management	16CE O02
1263	Principles of Internet of Things	16IT O02
1264	Energy Auditing	16EE O03
1265	System Automation and Control	16EC O07
1266	Basics of Artificial Intelligence	16CS O09
1267	Object Oriented Programming using JAVA	16IT O01
1268	History of Science and Technology	16PY O01
1269	Waste Management	16EE O05
1270	MEMS and its Applications	16EC O05
1271	Basics of Cyber Security	16CS O07
1272	Seminar	16ME C39
1273	Project	16ME C40
1274	Mathematics -III	18MTC05
1275	Engineering Economics And Accountancy	18MB C01
1276	Material Science And Metallurgy	18ME C03
1277	Mechanics Of Materials	18ME C04
1278	Fluid Principles And Hydraulic Machines	18ME C10
1279	Indian Constitution And Fundamental Principles	18EG M01
1280	Indian Traditional Knowledge	18EE A01
1281	Material Science And Metallurgy Lab	18ME C05
1282	Mechanics Of Materials Lab	18ME C06
1283	Fluid Principles And Hydraulic Machines Lab	18ME C11
1284	Basics Of Data Structures	18CS C05
1285	Kinematics Of Machines	18ME C07
1286	Thermo Dynamics	18ME C08
1287	Principles Of Management	18ME C09
1288	Metal Casting And Welding	18PE C03
1289	Environmental Science	18CE M01
1290	Basics Of Data Structures Lab	18CS C08
1291	Soft Skills Lab	18EG C03
1292	Metal Casting and Welding Lab	18PE C04
1293	Dynamics of Machines	18ME C12
1294	Applied Thermodynamics and Heat Transfer	18ME C13
1295	Design of Machine Elements	18ME C14

1296	Metal Forming Technology	18PE C05
1297	Refrigeration and Air Conditioning	18ME E01
1298	Values, Ethics and Society	18ME E02
1299	Plastics, Ceramics and Composite Materials	18PE E01
1300	Product Design and Process Planning	18PE E02
1301	Powder Processing	18PE E03
1302	Automobile Engineering	18ME E04
1303	Nano Science and Technology	18ME E05
1304	Rights, Duties and Legislation	18ME E06
1305	Non Destructive Testing and Evaluation	18PE E04
1306	Surface Engineering	18PE E05
1307	Dynamics and Vibrations Lab	18ME C15
1308	Applied Thermodynamics and Heat Transfer Lab	18ME C16
1309	Metal Forming Technology Lab	18PE C06
1310	CAD/CAM	18ME C17
1311	Machine Design	18ME C18
1312	Machine Tool Engineering	18PE C09
1313	Object Oriented Programming with C++	18ME E08
1314	Mechanics of Composite Materials	18ME E09
1315	Robotic Engineering	18ME E10
1316	Production and Operations Management	18PE E06
1317	Principles of Industrial Engineering	18PE E07
1318	Computational Fluid Dynamics	18ME E12
1319	Principles of Entrepreneurship	18ME E13
1320	Modern Machining and Forming Methods	18PE E08
1321	Finite Element Methods	18ME E16
1322	Blockchain Technology	18ME E15
1323	Renewable Energy Sources	18ME E17
1324	Control Systems Theory	18ME E18
1325	Artificial Intelligence	18ME E19
1326	Industrial Administration and Financial Management	18ME E20
1327	Total Quality Management	18PE E10
1328	CAD/CAM LAB	18ME C20
1329	Machine Tool Engineering Lab	18PE C10
1330	Metrology and Instrumentation	16ME C33
1331	Operations Research	16ME C34
1332	Production Drawing	16PE C10
1333	Production and Operations Management	16PE C11
1334	Tool Engineering	16PE C12
1335	Renewable Energy Sources	16ME E10
1336	Energy Conservation, Management and Audit	16ME E11
1337	Engineering Research Methodology	16ME E12
1338	Finite Element Methods	16ME E14
1339	Metrology and Instrumentation Lab	16ME C36
1340	Manufacturing Engineering Lab	16PE C13
1341	Project Seminar	16PE C14
1342	Power Plant Engineering	16ME E15

1343	Principles of Entrepreneurship	16ME E16
1344	Innovations, Protection and Legal Aspects	16ME E17
1345	Supply Chain Management	16PE E11
1346	Total Quality Management	16PE E12
1347	Disaster Mitigation and Management	16CE O02
1348	Principles of Internet of Things	16IT O02
1349	Energy Auditing	16EE O03
1350	System Automation and Control	16EC O07
1351	Basics of Artificial Intelligence	16CS O09
1352	Object Oriented Programming using JAVA	16IT O01
1353	History of Science and Technology	16PY O01
1354	Waste Management	16EE O05
1355	MEMS and its Applications	16EC O05
1356	Basics of Cyber Security	16CS O07
1357	Seminar	16PE C15
1358	Project	16PE C16
1359	Computer Aided Modeling and Design	20MEC 101
1360	Computer Integrated Manufacturing	20MEC 102
1361	Research Methodology and IPR	20MEC 103
1362	Advanced Machine Design	20MEE 101
1363	Advanced Vibrations and Acoustics	20MEE 102
1364	Optimization Techniques	20MEE 103
1365	Automation	20MEE 104
1366	Design for Manufacturing and Assembly	20MEE 105
1367	Industrial Robotics	20MEE 106
1368	Integrated Design and Manufacturing Lab	20MEC 104
1369	Vibrations and Acoustics Lab	20MEC 105
1370	Value Education	20ECA 101
1371	Pedagogy Studies	20ITA 101
1372	Disaster Mitigation and Management	20CEA 101
1373	Sanskrit for Technical Knowledge	20EEA 101
1374	Finite Element Techniques	20MEC 106
1375	Mechanical Design and Analysis	20MEC 107
1376	Computational Fluid Dynamics	20MEE 206
1377	Mechanics of Composite Materials	20MEE 107
1378	Fracture Mechanics	20MEE 108
1379	Multibody Dynamics	20MEE 109
1380	Tribology in Design	20MEE 110
1381	Failure Analysis and Design	20MEE 111
1382	Computer Aided Engineering Lab	20MEC 108
1383	Computational Fluid Dynamics Lab	20MEC 206
1384	Mini Project with Seminar	20MEC 109
1385	English for Research Paper Writing	20EGA 101
1386	Indian Constitution and Fundamental Rights	20EGA 102
1387	Stress Management by Yoga	20EGA 103
1388	Personality Development through Life’s Enlightenment Skills	20EGA 104
1389	Advanced Finite Element Method	19MEE 112

1390	Product Design and Process Planning	19MEE 113
1391	Theory of Elasticity and Plasticity	19MEE 114
1392	Industrial Safety	19MEO 101
1393	Introduction to Optimization Techniques	19MEO 102
1394	Composite Materials	19MEO 103
1395	Cost Management of Engineering Projects	19CEO 101
1396	Waste to Energy	19EEO 101
1397	Dissertation Phase - I	19MEC 110
1398	DISSERTATION PHASE - II	19MEC 111
1399	Thermodynamics and Combustion	20ME C201
1400	Advanced Fluid Dynamics	20ME C202
1401	Research Methodology and IPR	20ME M103
1402	Thermal and Nuclear Power Plants	20ME E201
1403	Environmental Engineering and Pollution Control	20ME E202
1404	Optimization Techniques	20ME E103
1405	Air Conditioning System Design	20ME E203
1406	Design of Solar and Wind Systems	20ME E205
1407	Disaster Mitigation and Management	20CE A101
1408	English for Research Paper Writing	20EG A101
1409	Indian Constitution and Fundamental Rights	20EG A102
1410	Energy Conservation and Management	20ME E204
1411	Personality Development through Life’s Enlightenment Skills	20EG A104
1412	Thermal Systems Lab	20ME C203
1413	Design of Solar and Wind Systems Lab	20ME C204
1414	Finite Element Techniques	20ME C106
1415	Advanced Heat and Mass Transfer	20ME C205
1416	Computational Fluid Dynamics	20ME E206
1417	Refrigeration and Cryogenics	20ME E207
1418	Design of Heat Exchangers	20ME E208
1419	Turbo Machines	20ME E209
1420	Gas Turbines	20ME E210
1421	Power Plant Control andInstrumentation	20ME E211
1422	Sanskrit for Technical Knowledge	20EE A101
1423	Value Education	20EC A101
1424	Pedagogy Studies	20IT A101
1425	Stress Management by Yoga	20EG A103
1426	Computer Aided Engineering Lab	20ME C108
1427	Computational Fluid Dynamics Lab	20ME C206
1428	Mini Project with Seminar	20ME C207
1429	Advances in IC Engines	19MEE 212
1430	Convective Heat Transfer	19MEE 213
1431	Heat Pipe	19MEE 214
1432	Cost Management of Engineering Projects	19CEO 101
1433	Waste to Energy	19EEO 101
1434	Industrial Safety	19MEO 101
1435	Introduction to Optimization Techniques	19MEO 102
1436	Composite Materials	19MEO 103

1437	Dissertation Phase - I	19MEC 208
1438	Dissertation Phase - II	19MEC 209
1439	Mathematics-I	20MT C21
1440	Basics of Biology-1	20BT C01
1441	English	20 EG C01
1442	Physics	20PY C02
1443	Programming for Problem Solving	20CS C01
1444	Physics lab	20PY C04
1445	English lab	20EG C02
1446	Programming for Problem Solving lab	20CS C02
1447	Mathematics –II	20MT C22
1448	Basics Of Biology-II	20BT C02
1449	Process Principles and Reaction Engineering	20BT C03
1450	Basic Electrical Engineering lab	20EE C02
1451	Workshop/Manufacturing Practices	20ME C02
1452	Engineering Exploration	20ME C03
1453	Community Engagement	20MBC02
1454	Engineering Mathematics-III	18MTC06
1455	Cell and Molecular Biology	18BT C03
1456	Biochemistry	18BT C04
1457	Microbiology and Industrial Biotechnology	18BT C05
1458	Process Principles and Reaction Engineering	18BT C06
1459	Genetics	18BT C07
1460	Biochemistry Lab	18BT C08
1461	Microbiology Lab	18BT C09
1462	Fluid Mechanics and Heat Transfer	18BT C15
1463	Enzyme Technology	18BT C16
1464	Genetic Engineering and rDNA Technology	18BT C17
1465	Virology	18BT E01
1466	Phytochemicals and Herbal Products	18BT E02
1467	Introduction to Anatomy and Physiology of Humans	18BT E03
1468	Environmental Biotechnology	18BT E04
1469	Developmental Biology	18BT E05
1470	Metabolic Engineering	18BT E06
1471	Engineering Economics and Accountancy	18MB C01
1472	Fluid Mechanics and Heat Transfer Lab	18BT C18
1473	Enzyme Technology Lab	18BT C19
1474	Genetic Engineering Lab	18BT C20
1475	Basics of Data Structures	18CS C05
1476	Immunology	18BT C10
1477	Instrumental Methods in Biotechnology	18BT C11
1478	Chemical and Biochemical Thermodynamics	18BT C12
1479	Principles of Management	18ME C09
1480	Basics of Data Structures	18CS C06
1481	Immunology Lab	18BT C13
1482	Instrumentation Lab	18BT C14
1483	Soft Skills Lab	18EG C03

1484	Fermentation Technology	18BT C21
1485	Bioinformatics	18BT C22
1486	Mass Transfer Operations	18BT C23
1487	Medical Biotechnology	18BT E07
1488	Food Biotechnology	18BT E08
1489	Bioprocess Dynamics and Control	18BT E09
1490	Artificial Intelligence in Biology	18BT E10
1491	Pharmaceutical Biotechnology	18BT E11
1492	Intellectual Property Rights Regulatory Affairs and Clinical Trials	18BT E12
1493	Nanobiotechnology	18BT E13
1494	Biomedical Instrumentation	18EC O02
1495	Research Methodologies	18ME O03
1496	Fermentation Lab	18BT C24
1497	Bioinformatics Lab	18BT C25
1498	Down Stream Processing	16BT C41
1499	Plant Biotechnology	16BT C42
1500	Animal Biotechnology	16BT C43
1501	Bioprocess Dynamics & Control	16BT C44
1502	Genomics & Proteomics	16BT E46
1503	Cancer Biology	16BT E47
1504	Intellectual Property Rights Regulatory Affairs & Clinical Trials	16BT E48
1505	Down Stream Processing Lab	16BT C49
1506	Tissue Culture Lab	16BT C50
1507	Tissue Engineering	16BT E52
1508	Immunodiagnostics	16BT E53
1509	Molecular Modeling & Drug Design	16BT E54
1510	Research Methodologies	16ME O06
1511	Biomedical Instrumentation	16EC O02
1512	Technical Writing Skills	16EG O01
1513	IOT and Applications	16CS O03
1514	Basics of Data Science Using R	16CS O04
1515	Entrepreneurship	16ME O01
1516	Seminar	16BT C55
1517	Project	16BT C56
1518	Computer Programming using ‘C’	20MCC101
1519	Computer Organization and Architecture	20MCC102
1520	Software Engineering	20MCC103
1521	Mathematical Foundations for Computer Applications	20MCC104
1522	Probability& Statistics	20MTC27
1523	Computer Programming Lab using ‘C’	20MCC105
1524	Python Programming Lab	20MCC106
1525	Professional Communication in English Lab	20EG101
1526	Data Structures and Algorithms	20MCC107
1527	Artificial Intelligence	20MCC108
1528	Object Oriented Programming using Java	20MCC109
1529	Database Management Systems	20MCC110
1530	Entrepreneurship	20MCE102

1531	Business Intelligence & Analytics	20MCE103
1532	Data Structures Lab using C++	20MCC111
1533	Object Oriented Programming Lab using Java	20MCC112
1534	Database Management Systems Lab	20MCC113
1535	Database Management Systems	16MCC113
1536	Web Technologies	16MCC114
1537	Design and Analysis of Algorithms	16MCC115
1538	Operating Systems	16MCC116
1539	Database Management Systems Lab	16MCC117
1540	Web Technologies Lab	16MCC118
1541	Operating Systems Lab	16MCC119
1542	Human Values and Professional Ethics	16CE C03
1543	Entrepreneurship	16ME E20
1544	Computer Networks	16MCC120
1545	Data warehousing and Data Mining	16MCC121
1546	Advanced Java Programming	16MCC122
1547	Computer Networks Lab	16MCC123
1548	Data warehousing and Data Mining Lab	16MCC124
1549	Mini Projects	16MCC125
1550	Software Testing	16MCE102
1551	Artificial Neural Networks	16MCE103
1552	Cloud Computing	16MCE106
1553	Software Project Management	16MCE107
1554	Object Oriented System Development(OOSD)	16MCC126
1555	Machine Learning	16MCC127
1556	Cryptography & Network Security	16MCC128
1557	Object Oriented System Development Lab	16MCC129
1558	Machine Learning Lab using Python	16MCC130
1559	Seminar	16MCC131
1560	Internet of Things	16MCE110
1561	Business Intelligence and Analytics	16MC E111
1562	Big Data Analytics	16MC E113
1563	E-Commerce	16MC E114
1564	MAJOR PROJECT WORK	16MC C132

20-21

20MT C05

with effect from the Academic Year 2020-21

CALCULUS
(Common to ECE, EEE, MECH, CHEM, CIVIL)

Instruction	3 L+1T /2P Hours per week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	4

Course Objectives:

1. To explain the solutions of system of linear equations by Matrix Methods.
2. To discuss mean value theorems.
3. To explain the Partial Derivatives and the extreme values of functions of two variables.
4. To discuss the convergence and divergence of the series.
5. To explain the expansion of functions in sine and cosine series.

Course Outcomes:

Upon completing this course, students will be able to:

1. Apply the Matrix Methods to solve system of linear equations.
2. Analyse the geometrical interpretation of Mean value theorems.
3. Determine the extreme values of functions of two variables.
4. Examine the convergence and divergence of infinite Series.
5. Calculate the Euler's coefficients for Fourier series of a function.

UNIT-I

Matrices: Rank of a matrix, Echelon form, consistency of linear system of equations, Linear dependence and independence of vectors. Eigen values, Eigenvectors, Properties of Eigen values & Eigen vectors, Cayley-Hamilton theorem, Quadratic form, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-II

Calculus: Rolle's Theorem, Lagrange's Mean value theorem, Cauchy's mean value theorem (without proofs). Curvature, Radius of curvature, Centre of curvature, Evolute and Involute.

UNIT-III

Multivariable Calculus (Differentiation): Functions of two variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions , Change of variables, Jacobians, Taylor's theorem for functions of two variables, Maxima and minima of functions of two variables.

UNIT-IV

Sequences and Series: Convergence of sequence and series. Tests for convergence of series: Comparison test, limit comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, alternating series, Leibnitz's series, absolute and conditional convergence.

UNIT-V

Fourier series: Periodic functions, Euler' formulae, Conditions for a Fourier expansion, functions having points of discontinuity, change of interval, even and odd functions, half range sine series, half range cosine series, and its applications in practical Harmonic analysis.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. B.V.Ramana., Higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

Suggested Reading:

1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw- Hill, New Delhi, 2008.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th edition, 2016.
3. David.Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/ Cole, 2005.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20CY C01

with effect from the Academic Year 2020-21

CHEMISTRY

(Common to all branches)

Instruction:	3Hours per Week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method.Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2 , He_2^+ ,N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity).Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)-electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations.Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.
Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell.

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism - Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis.Specifications of potable water & industrial water.Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:
Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber).Conducting polymers- Definition, classification and applications.
Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation-Sol-gel method.Carbon nanotubes and their applications.Characterisation of nanomaterials by SEM and TEM (only Principle).
Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla, Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20CE C01 with effect from the Academic Year 2020-21

ENGINEERING MECHANICS – I

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Outcomes: At the end of the course the student will be able to

1. Calculate the components and resultant of coplanar forces system.
2. Understand free body diagram and apply equilibrium equations to solve for unknown forces.
3. Apply concepts of friction for solving engineering problems.
4. Analyse simple trusses for forces in various members of a truss.
5. Determine centroid for elementary, composite figures and bodies.

UNIT- I:

Resolution and Resultant of Force System: Basic concepts of a force system. Components of forces in a plane. Resultant of coplanar concurrent force system. Moment of a force, couple and their applications. Resultant of coplanar non-concurrent force system.

UNIT - II:

Equilibrium of Force System: Free body diagram, equations of equilibrium. Lami's theorem, equilibrium of coplanar force systems.

UNIT - III:

Friction: Theory of static friction, Laws of friction, applications to single body, connected systems, wedge friction and belt friction.

UNIT - IV:

Analysis of Simple Trusses: Introduction to trusses, analysis of simple trusses using method of joints and method of sections.

UNIT - V:

Centroid and Centre of Gravity:

Centroid of lines and areas from first principles, centroid of composite figures, theorems of Pappus, centre of gravity of bodies and composite bodies.

Text Books:

1. K. Vijaya Kumar Reddy and J. Suresh Kumar, "*Singer's Engineering Mechanics: Statics and Dynamics*", B. S. Publications (SI Units), 3rd edn. Rpt., 2019.
2. A. Nelson., "*Engineering Mechanics*", Tata McGraw Hill, Delhi, 2010.

Suggested Reading:

1. Irving H. Shames, "*Engineering Mechanics*", 4th Edition, Prentice Hall, 2006.
2. R. C. Hibbeler, "*Engineering Mechanics: Principles of Statics and Dynamics*", Pearson Press, 2006.
3. Basudeb Bhattacharyya, "*Engineering Mechanics*", Oxford University Press, 2nd edn., 2016.

PROGRAMMING FOR PROBLEM SOLVING
(Common to all Programs)

Instruction	3 Periods per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: The objectives of this course are
1. Identification of computer components, Operating environments, IDEs.
2. Understanding the steps in problem solving and formulation of algorithms to problems.
3. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
4. Develop in tuition to enable students to come up with creative approaches to problems.
5. Manipulation of text data using files.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I
Introduction to computers and Problem Solving: Components of a computer, Operating system, compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode with examples.
Introduction to programming: Programming languages and generations, categorization of high-level languages.
Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II
Introduction to decision control statements: Selective, looping, and nested statements.
Functions: Introduction, uses of functions, Function definition, declaration, passing parameters to functions, recursion, scope of variables and storage classes, Case study using functions and control statements.

UNIT – III
Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.
Strings: Introduction, strings representation, string operations with examples. Case study using arrays.

UNIT – IV
Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.
Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

UNIT-V
Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during file operations.
Preprocessor Directives: Types of preprocessor directives, examples.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. M.T. Somashekar "Problem Solving with C", 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma, "Computer Fundamentals and Programming", 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017

Suggested Reading:

1. Byron Gottfried, Schaum's Outline of Programming with C", Mc Graw-Hill.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. ReemaTharaja "Introduction to C Programming", Second Edition, OXFORDPress,2015.

Online Resources:

1. https://www.tutorialspoint.com/cprogramming/index.htm.
2. https://onlinecourses.nptel.ac.in/noc18-cs10/preview

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	4 Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2}Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books:

1. J. Mendham and Thomas , "Vogel's text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi ,6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg&A.Gulati,; R. Chand & Co. : New Delhi (2011).

Suggested Readings:

1. Dr.Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara , "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction	4 Periods per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50 Marks
Credits	2

Course Objectives: The objectives of this course are
1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.
4. Identification and rectification of coding errors in program.
5. Develop applications in a modular fashion.
6. Manage data using files.

Course Outcomes: On Successful completion of the course, students will be able to
1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab experiments
1. Familiarization with programming environment.
2. Simple computational problems using arithmetic expressions.
3. Problems involving if-then-else structures.
4. Iterative problems e.g., sum of series.
5. 1D Array manipulation.
6. 2D arrays and strings.
7. Matrix problems, String operations.
8. Simple functions.
9. Recursive functions.
10. Pointers and structures.
11. Dynamic memory allocation and error handling.
12. File handling:

Text Books:

1. Pradeep Dey and Manas Ghosh, "Programming in C", Oxford Press, 2nd Edition, 2017.
2. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

Online Resources:
1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C02

WORKSHOP / MANUFACTURING PRACTICE

Instruction	5 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2.5

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive &team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: At the end of the course, the students are able to

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes.
3. Make a given model by using workshop trades including fitting, carpentry, tinsmithy and House wiring.
4. Perform various operations in welding, machining and casting processes.
5. Conceptualize and produce simple device/mechanism of their choice.

List of Exercises

CYCLE 1

Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy

1. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
2. To make a scoop.
3. To make a pamphlet box.

Exercises in Fitting

1. To make a perfect rectangular MS flat and to do parallel cuts using Hacksaw
2. To make male and female fitting using MSflats-Assembly1
3. To make male and female fitting using MSflats-Assembly2

Exercises in House Wiring

1. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bellpush
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
3. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications.
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

1. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
2. Study of Arc welding process, making Butt joint with DCSP, DCRP
3. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

1. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
2. Facing, Plain turning and Step turning operations on Lathe machine.
3. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology",4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House,2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I", Pearson Education,2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India,1998.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

with effect from the Academic Year 2020-21

20ME C03

ENGINEERING EXPLORATION

Instruction	4 Hours per week
Duration of SEE	Nil
SEE	Nil
CIE	50 Marks
Credits	1.5

Prerequisites: Nil

Course Outcomes: At the end of the course, the students are able to

1. Understand the role of an engineer as a problem solver.
2. Identify multi-disciplinary approaches in solving an engineering problem.
3. Build simple systems using engineering design process.
4. Analyze engineering solutions from ethical and sustainability perspectives.
5. Use basics of engineering project management skills in doing projects.

UNIT- I

Role of Engineers: Introduction, science, engineering, technology, engineer, scientist, role of engineer, various disciplines of engineering, misconception of engineering, expectations for the 21st century engineer and NBA graduate attributes.

Engineering problems and Design: Multidisciplinary facet of design, pair wise comparison chart, introduction to econometrics system, generation of multiple solution, Pugh chart, motor and battery sizing concepts, introduction to PCB design.

UNIT- II

Mechanisms: Basic components of a mechanism, degrees of freedom or mobility of a mechanism, 4-bar chain, crank rocker mechanism, slider crank mechanism, simple robotic arm building.

Platform-based development: Introduction to programming platforms (Arduino) and its essentials, sensors, transducers and actuators and their interfacing with Arduino.

UNIT- III

Data Acquisition and Analysis: Types of data, descriptive statistics techniques as applicable to different types of data, types of graphs and their applicability, usage of tools (MS-Office /Open Office/ Libre Office / Scilab) for descriptive statistics, data acquisition (temperature and humidity) using sensors interfaced with Arduino, exporting acquired data to spreadsheets, and analysis using representation.

UNIT- IV

Process Management: Introduction to Agile practice, significance of team work, importance of communication in engineering profession, project management tools, checklist, timeline, Gantt chart, significance of documentation.

UNIT -V

Engineering Ethics & Sustainability in Engineering: Identifying Engineering as a profession, significance of professional ethics, code of conduct for engineers, identifying ethical dimensions in different tasks of engineering, applying moral theories and codes of conduct for resolution of ethical dilemmas.

Sustainability in Engineering: Introduction, sustainability leadership, life cycle assessment, carbon foot print.

Text Books:

1. Clive L. Dym, Patric Little, Elizabeth J Orwin, "Engineering Design: A project-based introduction", 4th edition,Willey.
2. Matthew Python, "Arduino programming for beginners", Independently published,2020.
3. Patrick F. Dunn , "Measurement and data Analysis for engineering and science" , thirdedition,2014.
4. Andrew Stellman, Jennifer Greene, "Head First Agile: A brain-friendly guide to Agile principles, ideas, and real-world practices", Kindle Edition.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Charles B. Fleddermann, "Engineering ethics", fourth edition, Prentice Hall,2012.
2. Rob Lawlor, "Engineering in society", second edition, Royal academy of engineering.
3. Richard Dodds, Roger Venables, "Engineering for sustainable development: Guiding principles", The Royal Academy of engineering,2005.
4. Richard S. Paul, "Robot Manipulators: Mathematics, Programming, and Control", MIT Press.

ENGINEERING EXPLORATION ASSESSMENT SCHEME

S. No	Name of the module	Work Hours	Marks	Evaluation
1	Role of Engineers	4	-	Evaluation - I
2	Engineering Design	16	5	
3	Mechanisms	6	3	
4	Engineering Ethics	2	2	
5	Platform-based Development	16	5	Evaluation - II
6	Data Acquisition and Analysis	6	4	Evaluation-III
7	Project Management	4	4	
8	Sustainability in Engineering	6	2	
9	Course Project Reviews	12	20	Final Evaluation
10	Code of conduct	-	5	
	Total	**72**	**50**	

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20MT C06

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS
(Common to ECE, EEE, MECH, CHEM, CIVIL)

Instruction	3 L+1T /2P Hours per week
Duration of SEE	3Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives:

1. To explain double and triple integrals of various functions and their significance.
2. To explain Scalar and vector functions with its Physical interpretations.
3. To discuss vector line, surface and volume integrals.
4. To explain relevant methods to solve first order differential equations.
5. To discuss the solution of higher order differential equations.

Course Outcomes:

Upon completing this course, students will be able to:

1. Calculate the areas and volumes.
2. Apply the vector differential operators to Scalars and Vector functions.
3. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
4. Calculate the solutions of first order linear differential equations.
5. Solve higher order linear differential equations.

UNIT-I

Multivariable Calculus (Integration): Applications of definite integrals to evaluate surface areas and volumes of revolutions. Double integrals, Change of order of integration, Area enclosed by plane curves, Triple integrals, Volumes of solids.

UNIT-II

Vector Differential Calculus: Scalar and vector point functions, Gradient, Directional derivative, potential function. Divergence, Physical interpretation of Divergence, Curl, Physical interpretation of curl, vector identities.

UNIT-III

Vector Integral Calculus: Line integral, Surface integral and Volume integral, Green's theorem in a plane, Stoke's theorem and Gauss's divergence theorem (without proof).Fluid flow, Physical interpretation of the divergence.

UNIT-IV

First Order Ordinary Differential Equations: Exact differential equations, Equations reducible to exact equations, Linear equations, Bernoulli's equation, Clairaut's equation, Riccati's equation, Orthogonal trajectories, Chemical reactions and solutions, Rate of decay of Radio-active materials.

UNIT-V

Higher Orders Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding Complementary function, Particular Integral and General solution. Method of variation of parameters, solution of Euler-Cauchy equation. Ordinary point, singular point, regular singular point and Power Series solution. Applications: LR and LCR circuits.

Text Books:

1. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition,2017.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.

Suggested Reading:

1. N.P.Bali and Dr.Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,9th edition, 2014.
2. R.K.Jain, S.R.K.Iyengar, Advanced Engineering Mathematics, Narosa Publications,5thedition,2016.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, Reprint,2002

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20 EG C01

ENGLISH

(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	2

Course Objectives: This course will introduce the students:

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes: After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I Understanding Communication in English:

Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.

Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II Developing Writing SkillsI:

Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.

Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III Developing Writing Skills II:

Prècis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response

Vocabulary and Grammar: Subject-verb agreement.

Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT-IV Developing Writing Skills III:

Report writing – Importance, structure, elements of style of formal reports ; Writing a formal report.

Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT-V Developing Reading Skills:

The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.

Vocabulary and Grammar: Words often confused; Use of standard abbreviations.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan,2017.
2. Swan Michael, Practical English Usage.OUP.1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar,Macmillan,2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press,2011.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20PY C05

MECHANICS AND MATERIALS SCIENCE
(Common to Civil & Mechanical)

Instruction	3L/week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	3

Course Objectives: The objectives of the course is to make the student
1. Acquire knowledge about physics of oscillations and rotational motion
2. Understand the physical properties of crystalline and magnetic materials
3. Aware of characteristic properties of dielectric materials and super conductors
4. Familiarize with coherent properties of light waves.

Course Outcomes: At the end of the course, the student will be able to
1. Compare the various types of oscillations
2. Demonstrate rotational motion of rigid body
3. Classify different types of crystals and their imperfections
4. Identify magnetic and dielectric materials for engineering applications
5. Make use of lasers and superconductors in technological applications

UNIT-I

Oscillations: Simple harmonic motion–Harmonic oscillator–Damped harmonic motion – over damped, critically damped and under damped oscillators–Forced oscillations and resonance.

UNIT-II

Rigid body Dynamics: Definition of rigid body–Rotational kinematic relations–Angular momentum and torque–Equation of motion for a rotating rigid body–Inertia tensor and its properties– Euler's equations and applications: law of energy conservation and law of conservation of angular momentum.

UNIT-III

Crystallography: Space lattice –Unit cell –Crystal systems –Bravais lattices –Number of atoms per unit cell – Coordination number –Atomic radius –Packing fraction (for *sc, bcc, fcc*) –Lattice planes – Miller indices – Bragg's law –Experimental determination of lattice constant of a cubic crystal by powder X-ray diffraction method–Structure of NaCl.

Crystal Imperfections: Classification of defects –Point defects –Concentration of Schottky and Frenkel defects.

UNIT-IV

Dielectric Materials: Introduction –Dielectric polarization –Types of dielectric polarization: electronic & ionic polarizations (quantitative); orientation & space-charge polarizations (qualitative) –Frequency and temperature dependence of dielectric polarization –Determination of dielectric constant (Schering bridge method) –Ferroelectricity–Barium titanate–Applications of ferroelectrics.

Magnetic Materials: Origin of magnetism – Magnetic moment - Bohr magneton–Classification of magnetic materials: dia, para, ferro, anti-ferro and ferrimagnetic materials – Weiss molecular field theory – Domain theory –Hysteresis curve, soft and hard magnetic materials –Applications.

UNIT-V

Lasers: Characteristics of lasers – Einstein's coefficients – Amplification of light by population inversion - Ruby, He-Ne, semiconductor laser – Applications of lasers in engineering and medicine.

Fiber Optics: Introduction – Construction – Principle – Propagation of light through an optical fiber – Numerical aperture and acceptance angle – Step-index and graded-index fibers – Pulse dispersion – Fiber losses – Fiber optic communication system – Applications

Superconductors: General properties of superconductors – Meissner's effect – Type I and Type II superconductors – BCS theory (qualitative) – Applications.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications,2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications,2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications,2011.

Suggested Reading:

1. R. Murugeshan and KiruthigaSivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications,2014.
2. V. Rajendran, *Engineering Physics*, McGraw-Hill Education Publications,2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications,2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition,2015.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EEC01

BASIC ELECTRICALENGINEERING

Instruction	3 Hours per week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	3

Course Objectives:

1. To understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. To understand the basic principle of operation of AC and DC machines
3. To know about different types of electrical wires and cables, domestic and industrial wiring, safety rules and methods of earthing

Course Outcomes: After the completion of this course, the student will be able to

1. Understand the concepts of Kirchhoff's laws and to apply them in superposition, Thevenin's and Norton's theorems to get the solution of simple dc circuits
2. Obtain the steady state response of RLC circuits with AC input and to acquire the basics, relationship between voltage and current in three phase circuits.
3. Understand the principle of operation, the EMF and torque equations and classification of AC and DC machines
4. Explain various tests and speed control methods to determine the characteristic of DC and AC machines.
5. Acquire the knowledge of electrical wiring, types of wires, cables used and Electrical safety precautions to be followed in electrical installations.
6. Recognize importance of earthing, methods of earthing and various low-tension switchgear used in electrical installations

UNIT-I

DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of first-order RL and RC circuits.

UNIT-II

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III

Transformers: Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation

UNIT-IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt, series and compound generators.

DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors.

Three - Phase Induction Motors: Principle of operation, Applications,

UNIT-V

Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, first aid for electric shock, safety rules.

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press,2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson,2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India,1989
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGrawHill,2009
4. P.V. Prasad, S. sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition,2013

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

with effect from the Academic Year 2020-21

20EG C02

ENGLISH LAB
(Common to all branches)

Instruction	2 Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	1

Course Objectives: This course will introduce the students:

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behavior while developing their ability to discuss in groups and making oral presentations.

Course Outcomes: After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams ,and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs . The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation** : Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material
6. **Public speaking** – Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions** - Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary** – weaving an imaginative story around a given picture.
9. **Information Gap Activity** – Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation** – Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt. Ltd., 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

with effect from the Academic Year 2020-21

20PY C08

MECHANICS AND MATERIALS SCIENCELAB
(Common to Civil &Mechanical)

Instruction	4Periods/week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2

Course Objectives:

The objectives of the course is to make the student

1. Apply the concepts of physics while doing experiments
2. Learn the working of lasers and optical fibers
3. Understand the properties of magnetic and dielectric materials
4. Capable of measuring mechanical properties of solids and liquids
5. Understand the motion electrons in electric and magnetic fields

Course Outcomes:

At the end of the course, the student will be able to

1. Estimate the error in an experimental measurement
2. Make use of lasers and optical fibers in engineering applications
3. Recall the physical properties of dielectrics and magnetic materials
4. Find the mechanical properties of solids and viscosity of liquids
5. Demonstrate the motion of electrons in electric and magnetic fields

Experiments

1.	Error Analysis	:	Estimation of errors in the determination of time period of a torsional pendulum
2.	Flywheel	:	Determination of moment of inertia of given flywheel
3.	Compound Pendulum	:	Determination of acceleration due to gravity
4.	Young's Modulus	:	Determination of Young's modulus of the given steel bar/wooden scale by non-uniform bending method
5.	Helmholtz's Resonator	:	Determination of resonating volume of air and neck correction
6.	Melde's Experiment -	:	Determination of frequency of the electrically maintained vibrating bar/fork
7.	Viscosity of Liquid	:	Determination of viscosity of a given liquid by oscillating disc method
8.	Coupled Oscillator	:	To determine the coupling constant of a coupled oscillator performing parallel and antiparallel oscillation
9.	Dielectric Constant	:	Determination of dielectric constant of given PZT sample
10.	M & H Values	:	Determination of magnetic moment M of a bar magnet and absolute value H of horizontal component of earth's magnetic field
11.	B-H Curve	:	Determination of hysteresis loss of given specimen
12.	Thermoelectric Power	:	Determination of thermoelectric power of given sample
13.	Laser	:	Determination of wavelength of given semiconductor laser
14.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
15.	e/m of an electron	:	Determination of specific charge of an electron by J.J. Thomson method

NOTE: A minimum of TWELVE experiments should be conducted.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements and to verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil, calculate the time and frequency responses of RLC circuits and to familiarize with measurement of electric power & energy.
3. To determine the characteristics of Transformers, dc, ac machines and switchgear components

Course Outcomes: At the end of the course, the students are expected to

1. Get an exposure to common electrical components, their ratings and basic electrical measuring equipment.
2. Make electrical connections by wires of appropriate ratings and able to measure electric power and energy.
3. Comprehend the circuit analysis techniques using various circuital laws and theorems.
4. Determine the parameters of the given coil and calculate the time response of RL & RC series circuits.
5. Recognize the basic characteristics of transformer and components of switchgear.
6. Understand the basic characteristics of dc and ac machine by conducting different types of tests on them.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components.
2. Verification of KCL and KVL.
3. Time response of RL and RC series circuits.
4. Determination of parameters of a choke or coil by Wattmeter Method
5. Verification of Thevenin's and Norton's theorems
6. Turns ratio /voltage ratio verification of single phase Transformers
7. Open Circuit and Short Circuit tests on a given single phase Transformer
8. Observation of Excitation Phenomenon in Transformer
9. Measurement of three phase power in a balanced system using two Wattmeter method.
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle)
11. Load test on DC Shunt motor
12. Speed control of DC Shunt motor
13. Demonstration of Low Tension Switchgear Equipment/Components
14. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: TEN experiments to be conducted from the above list.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

with effect from the Academic Year 2020-21

20ME C01

CAD AND DRAFTING

Instruction	1 T + 3 D Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2.5

Course Objectives:

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

Outcomes: At the end of the course, the Students are able to

1. Become conversant with appropriate use of CAD software for drafting. (BL-3)
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting. (BL-2)
3. Construct the projections of points, lines, planes, solids (BL-3)
4. Analyse the internal details of solids through sectional views (BL-4)
5. Create an isometric projections and views (BL-6)

List of Exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, "Elementary Engineering Drawing", Charotar Publishers, 2012.
2. K.Venugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt. Ltd,2011.
3. Basanth Agrawal and C M Agrawal, "Engineering Drawing", 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., "Engineering Drawing", 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

with effect from the Academic Year 2020-21

20MBC02

COMMUNITY ENGAGEMENT

Instruction	3 Hours per week (30 hours field work & 2 hours per week)
SEE	Nil
CIE	50 Marks
Credits	1.5 Credits

Course Objectives: The main Objectives of this Course are to:
1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

Course Outcomes: After the completion of this Course, Student will be able to:
2. Gain an understanding of Rural life, Culture and Social realities.
3. Develop a sense of empathy and bonds of mutuality with Local Communities.
4. Appreciate significant contributions of Local communities to Indian Society and Economy.
5. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio-Economic improvements.
6. Utilise the opportunities provided by Rural Development Programmes.

Module I Appreciation of Rural Society
Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II Understanding Rural Economy and Livelihood
Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III Rural Institutions
Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV Rural Development Programmes
History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

Text Books:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

Journals:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
AICTE MODEL CURRICULUM
B.E. (MECHANICAL ENGINEERING)

SEMESTER – III

S. No.	Course Code	Title of the Course	Scheme of Instruction: Hours per week			Scheme of Examination			Credits
			L	T	P/D	Duration in Hours	Maximum Marks: CIE	SEE	
THEORY									
1	18MT C05	Mathematics – III	3	1	–	3	30	70	4
2	18ME C01	Engineering Economics and Accountancy	3	–	–	3	30	70	3
3	18ME C03	Material Science and Metallurgy	3	–	–	3	30	70	3
4	18ME C04	Mechanics of Materials	3	1	–	3	30	70	4
5	18PE C01	Manufacturing Processes	3	–	–	3	30	70	3
6	18EG M01	Indian Constitution and Fundamental Principles	2	–	–	2	–	50*	Non-Credit
7	18EE A01	Indian Traditional Knowledge	2	–	–	2	–	50*	Non-Credit
PRACTICALS									
8	18ME C05	Material Science and Metallurgy Lab	–	–	2	2	15	35	1
9	18ME C06	Mechanics of Materials Lab	–	–	2	2	15	35	1
10	18PE C02	Manufacturing Processes Lab	–	–	2	2	15	35	1
		TOTAL	19	02	06	–	195	455	20

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE – Semester End Examination

18MT C05

MATHEMATICS – III

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives:

1. To form PDE and to find its solution.
2. To solve wave and heat equations.
3. To learn the Laplace and Inverse Laplace transforms for solving engineering problems.
4. To learn Fourier transform and Z-transforms for solving engineering problems.
5. Learning the basic concepts of probability and Statistical Analysis.

Outcomes: On successful completion of this course, the students shall be able to

1. Solve Linear and Non-Linear PDE's.
2. Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation.
3. Find Laplace transform and inverse Laplace transform and can solve Linear Differential equations.
4. Find the solutions ofvarious Transforms.
5. Find moments of discrete and continuous random variables as well as familiar with distribution.

UNIT - I

Partial Differential Equations: Formation of Partial Differential Equations, Solution of First Order Linear Partial Differential Equations by Lagrange's Method, Solution of First Order Non-linear Partial Differential Equationby Standard types and Charpits Method.

UNIT - II

Applications of Partial Differential Equation: Solution by Method of Separation of Variables, Solution of One dimensional Wave equation, One dimensional Heat equation, Two dimensional Laplace equation and its related problems.

UNIT - III

Laplace Transform: Laplace Transform of standard functions, Linearity property, change of scale property. Shifting theorems, Laplace Transform of Periodic

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Function, Unit step function and Unit impulse function. Transforms of derivatives, Transforms of integrals, Multiplication by t^n and division by t. Inverse Laplace Transform properties, Inverse Laplace Transform by partial fractions and Convolution theorem, Applications of Laplace Transform (Solution of Linear Differential Equations).

UNIT - IV

Fourier Transforms and Z-Transforms:

Fourier Transforms: Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

Z-Transforms: Z-transforms of standard functions, linearity property, damping rule, shifting theorems, multiplication by 'n', initial and final value theorems. Inverse Z-Transform: Inverse Z-transform by Convolution theorem, partial fractions. Z-transform application to difference equations.

UNIT - V

Basic Statistics: Random variable, discrete probability distribution and continuous probability distribution. Expectation, Addition theorem and Multiplication theorem of expectation, properties of variance, Poisson distribution (Mean, variance, MGF& CGF), Normal distribution (Mean, variance, MGF& CGF), Properties of Normal distribution, Areas of under normal curve. Correlation and regression.

Textbooks:

1. Erwin kreyszig, "Advanced Engineering Mathematics", 9/e, John Wiley & Sons, 2006.
2. B.S. Grewal, "Higher Engineering Mathematics", 35/e, Khanna Publishers, 2000.
3. Sheldon Ross, "A First Course in Probability", 9/e, Pearson publications, 2014.

Suggested Reading:

1. S. J. Farlow, "Partial Differential Equations for Scientists and Engineers", Dover Publications, 1993.
2. Ian Snedon, "Elements of Partial Differential equations", McGraw Hill, 1964.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

18MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3	Hours per week
Duration of Semester End Examination	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives: The objectives of the course are

1. To demonstrate the importance of Managerial Economics in decision making.
2. To understand the importance of project evaluation in achieving a firm's objective.
3. To explain the concept of Accountancy and provided knowledge on preparation and analysis of Final accounts

Outcomes: At the end of the course a student will be able to

1. Apply fundamental knowledge of Managerial economics concepts and tools.
2. Understand various aspects of demand analysis and forecasting.
3. Analyze production and cost relationships to make best use of resources available.
4. Analyze different opportunities and come out with best feasible capital investment decisions
5. Apply accountancy concepts and conventions and preparation of final accounts .

UNIT - I

Introduction to Managerial Economics: Introduction to Economics and its evolution - Managerial Economics - its scope, importance, relationship with other subjects, its usefulness to engineers - Basic concepts of Managerial economics

UNIT - II

Demand and Supply Analysis: Demand Analysis - Concept of demand, determinants, Law of demand, its assumptions, Elasticity of demand, price, income and cross elasticity, Concept of supply, determinants of supply, law of supply, Demand Forecasting – simple numerical problems.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - III

Production and Cost Analysis: Theory of Production, Production function - input-output relations - laws of returns - internal and external economies of scale.

Cost Analysis: Cost concepts - fixed and variable costs - explicit and implicit costs - out of pocket costs and imputed costs - Opportunity cost - Cost output relationship – Firm and industry, types of market structures, Break-even analysis, numerical problems.

UNIT - IV

Accountancy: Book-keeping, principles and significance of double entry book keeping, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments

UNIT - V

Capital Budgeting: Introduction to capital budgeting, Methods: traditional and discounted cash flow methods, Introduction to working capital management, Numerical problems

Text Books:

1. Mehta P.L., "Managerial Economics – Analysis, Problems and Cases", Sultan Chand and Son's Educational publishers, 2016.
2. Maheswari S.N., "Introduction to Accountancy", 11/e, Vikas Publishing House, 2013.
3. Panday I.M., "Financial Management", 11/e, Vikas Publishing House, 2015

Suggested Reading:

1. Varshney and K.L Maheswari, "Managerial Economics", Sultan Chand, 2014.
2. M.Kasi Reddy and S.Saraswathi, "Managerial Economics and Financial Accounting", PHI Pvt Ltd, 2007.
3. A.R.Aryasri, "Managerial Economics and Financial Analysis", McGraw-Hill, 2013.

18ME C03

MATERIAL SCIENCE AND METALLURGY

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand

1. Structure property relations, analyze the failures of metals and their prevention.
2. Fatigue, creep and diffusion mechanisms.
3. Classification of steels and their application .
4. Working principle of various heat treatment operations
5. Principles of extractive metallurgy.

Outcomes: At the end of the course a student will be able to

1. Understand the imperfections of crystals.
2. Understand crack propagation by fatigue, creep deformation and diffusion theory.
3. Understand the importance of steel in engineering applications.
4. Understand to the methods of improvement of mechanical properties by various heat treatment operations
5. Understand the methods of production of various metals by extractive metallurgy.

UNIT - I

Plastic deformation: Imperfections in crystals, dislocation in crystals, types of dislocations, effect of slip and twinning on the plastic deformation, cold and hot working, strain hardening and Bauchinger effect, recovery, recrystallization, grain growth and its effect on mechanical properties of metals.

Fracture: Types of fracture in metals, modes of fracture, Griffith theory of brittle fracture, crack propagation, ductile fracture, fracture under combined stress.

UNIT - II

Fatigue: S–N curve, Structure of fatigue fracture specimen. Fatigue crack propagation, effect of metallurgical variables on fatigue of metal, low cycle fatigue, experimental determination of fatigue strength (RR–Moore Test).

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Creep: Creep strength, creep curve, creep deformation mechanisms, creep test.
Diffusion: Fick's law of diffusion, application of diffusion theory in mechanical engineering.

UNIT - III

Structure of Alloys: study of eutectic, eutectoid, peritectic and peritectoid reactions, Iron–Iron Carbide equilibrium diagram, construction and interpretation. Types of plain carbon steels, cast irons and their properties and characteristics.

UNIT - IV

Heat Treatment: Annealing, normalising, hardening, tempering, Construction and interpretation of T–T–T diagram, austempering and martempering, case hardening, carburizing, nitriding, carbo–nitriding, flame hardening, induction hardening.

UNIT - V

Introduction to Extractive Metallurgy: Method of production of pig iron by blast furnace, cast iron by cupola furnace, Method of production of steel by Bessemer convertor, L.D process and electric arc process.
Alloy Steels: Effects of alloying elements like nickel, chromium, manganese, silicon tungsten, and titanium, Study about stainless steels, HSS, brass, bronze; their composition and properties.
Polymers and Ceramics: Polymerization, thermoplastics and thermosetting plastics, elastomers, resins. Types and applications of ceramics

Text Books:

1. V. Raghavan, "Materials Science and Engineering", 4/e, Prentice Hall of India Ltd., 2005.
2. S.H. Avner, "Introduction to Physical Metallurgy", 2/e, Tata McGraw Hill Publishers, 2005.

Suggested Reading:

1. S.P. Nayak, "Engineering Metallurgy and Material Science", 6/e, Charoter Publishing House, 2005.
2. E. Dieter, "Mechanical Metallurgy", 3/e,Metric Edition, Tata McGraw Hill, 2005.
3. K.L. Kakani, "Material Science", New Age Publications (P) Ltd., 2008.

18ME C04

MECHANICS OF MATERIALS

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives:

1. Student is exposed to the concept of different types of loads, stresses, strains and analysis of members for axial loads.
2. Student will acquire knowledge in drawing bending and shear force diagrams of beams of various loads and configurations.
3. Student becomes familiar with methods of evaluation of deflection of beams of various configurations and stresses that arise due to simple bending.
4. Student is exposed to the concept of shear stresses in beams, principal stresses, strains and phenomenon of torsion.
5. Student will acquire knowledge in estimating stresses for thin, thick cylindrical shells and buckling of columns.

Outcomes: At the end of the course a student will be able to

1. Determine stresses and strains in members subjected to axial loads and temperature changes.
2. Draw shear force, bending moment diagrams for different types of beams and calculate stresses and strains due to simple bending.
3. Determine slope and deflection for various configurations of beams using different methods. analyze stress, strain and deflection due to torsion in circular members.
4. Analyze shear stress distribution in different sections of beams and find out principal stresses and strains.
5. Find out stresses and strains in thin, thick cylindrical shells and also able to calculate critical buckling loads in columns and struts.

UNIT - I

Stresses and Strains: Definitions, types of stresses and strains, elasticity and plasticity. Hooke's law, stress-strain diagrams for engineering materials, modulus of elasticity. Poisson's ratio, relationship between elastic constants, linear and volumetric strains, bars of uniform strength, temperature stresses, compound bars.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

UNIT - II

Beams: Definition of bending moment and shear force; relationship between intensity of loading, shear force and bending moment; bending moment and shear force diagrams for cantilever, simply supported and overhanging beams; simple theory of bending, moment of resistance, modulus of section.

UNIT - III

Slopes and Deflections: Slope and deflection calculations of cantilever, simply supported beams subjected to point loads and uniformly distributed loads with Macaulay's and double integration methods.

Torsion: Derivation of torsion formula for circular sections, power transmission, effect of combined bending and torsion.

UNIT - IV

Shear Stresses in beams: Distribution of shear stresses in rectangular, I-section, T-section, solid and hollow circular sections.

Compound stresses: principal stresses and strains. Mohr's circle of stress.

UNIT - V

Cylinders: Stresses in thin and thick cylinders with internal and external pressures. Stresses in compound cylinders. **Columns and struts**: Euler's and Rankine's formulae for axial load applications. Secant and Perry formulae for eccentrically loaded columns.

Text Books:

1. S.S.Rattan, "Strength of Materials", 3/e, Tata Mc-Graw Hill, 2016.
2. S. Ramamrutham, "Strength of Materials", Dhanpatrai and Sons, 1993.
3. G.H.Ryder, "Strength of Materials", 3/e, Macmillan India Limited, Delhi 2002.

Suggested Reading:

1. S.S. Bhavakatti, "Strength of Materials", Vikas Publication, 2003.
2. James M Gere, "Mechanics of materials", 8/e, cengage learning, 2013.
3. R.C. Hibbeler, "Mechanics of Materials", 9/e, Pearson, 2018.

18PE C01

MANUFACTURING PROCESSES

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: To enable the students to

1. Understand various terms related to manufacturing processes
2. Understand various manufacturing processes
3. Provide the ability to solve simple problems such as riser design and sheet metal calculations
4. Compare various Manufacturing processes
5. Select suitable manufacturing process for a given component

Outcomes: At the end of the course, a student will be able to

1. Students should able to define various terms related to manufacturing processes (Level-1)
2. Demonstrate the understanding of various manufacturing processes (Level 2)
3. Solve simple problems such as riser design and sheet metal calculations (Level 3)
4. Compare various Manufacturing processes (Level 4)
5. Choose suitable manufacturing process for a given component (level 5)

UNIT - I

Pattern Design and Methoding: Introduction to casting, classification of casting processes, pattern design: Types of patterns, pattern materials, pattern allowances; Gating system: purpose, elements, requirements, types of gates, Risering: purpose, requirements, chvorinov's rule, optimum shape and dimensions of riser, riser design by Caine's method, and Modulus method.

UNIT - II

Moulding, Melting and Special Casting Processes: Moulding sand: ingredients, required properties of moulding sand; Core : purpose, core prints, Melting by ,Cupoa furnace, induction and arc furnace; casting defects and remedies; Special casting processes: Pressure die casting, Centrifugal casting, shell moulding, investment casting, CO2 moulding.

Reddy

UNIT - III

Welding: Introduction, Classification of welding processes, Physics of arc, DCSP, DCRP, AC, shielded Metal Arc Welding, Submerged arc welding, Gas Tungsten arc welding, Plasma arc welding, Resistance welding: spot, projection, seam, butt and percussion welding. Oxy-Acetylene welding, Thermit welding, laser beam welding, Electron beam welding. solid state welding: friction welding, ultrasonic welding and explosive welding Soldering and brazing.

UNIT – IV

Metal Forming Processes: forging: open die ,closed die and isothermal forging processes, Rolling: process, nomenclature, geometric relationships, rolling mills; Extrusion: Direct, indirect, hydrostatic and impact extrusion processes ; Wire Drawing Process, shearing: shearing load, energy required, types of shearing processes; Cup Drawing : process, calculation of blank diameter for a given cup, drawing load; sheet bending: process, bend allowance.

UNIT – V

Additive Manufacturing: Introduction, Liquid based, powder based and deposition based layer wise manufacturing. Applications of additive manufacturing.

Powder Processing: Introduction, Production of powders, mixing, blending, compacting and sintering. Secondary processes such as repressing, coining, sizing, P/M Forging, Impregnation and infiltration. Merits, demerits and application of powder metallurgy products

Processing of Plastics, Ceramics and Composites: Injection moulding, Blow moulding, Thermoforming, Extrusion, Compression and transfer moulding processes. Ceramic processing techniques such as injection moulding and slip casting. Processing methods of composites such as roll bending, diffusion bonding, Pultrusion and filament winding processes.

Text Books:

1. P.N.Rao, "Manufacturing Technology", Vol.1, 3/e, Tata McGraw Hill Publ., 2011.
2. Amitabh Ghosh and Mallick, "Manufacturing Science", 4/e, Assoc. East West Press Pvt. Ltd., 2011.

Suggested Reading:

1. G.K.Lal and S.K.Choudhury," Fundamentals of Manufacturing Processes" Alpha science international ltd.,2005.
2. Schey, "Introduction To Manufacturing Processes", 2/e, Mcgraw - hill Education.
3. Mikell P.Grover, "Fundamentals of Modern Manufacturing Materials, Processes and Systems", 3/e, Willey A.

18EG M01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

Instruction	2	Hours per week
Duration of Semester End Examination	2	Hours
SEE	50	Marks
CIE	———	
Credits	0	

Objectives: The course will introduce the students to

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Outcomes: After successful completion of the course the students will be able to

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

UNIT-I

Constitution of India: Introduction and salient features, Constitutional history, Directive principles of state policy - Its importance and implementation.

UNIT-II

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States, Parliamentary form of government in India. **President**: role, power and position.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)

UNIT - III

Emergency Provisions in India: National emergency, President rule, Financial emergency

UNIT – IV

Local Self Government: District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT – V

Scheme of the Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme of the Fundamental Rights: To Equality, to certain Freedom under Article 19, to Life and Personal Liberty under Article 21.

Text Books:

1. "The Constitution of India", 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1/e, 2015.

Suggested Reading:

1. M. P. Jain, "Indian Constitution Law", 7/e, Lexis Nexis, 2014.
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

18EE A01

INDIAN TRADITIONAL KNOWLEDGE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: The course will introduce the students to

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India.

Outcomes: After successful completion of the course the students will be able to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature: Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – IV

Fine Arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music,

Reddy

Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT – V

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition",ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450-494-X, 2006
4. S. Narain, "Examinations in ancient India", Arya Book Depot, 1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
6. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. Kapil Kapoor, "Language, Linguistics and Literature: The Indian Perspective", ISBN-10: 8171880649, 1994
2. Karan Singh, "A Treasury of Indian Wisdom: An Anthology of Spiritual Learn", ISBN: 978-0143426158, 2016.

18ME C05

MATERIAL SCIENCE AND METALLURGY LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: Students will

1. Acquire basic knowledge by understanding iron-carbide diagram and its application in engineering.
2. Expose to Metallographic study and analysis of various metals.
3. Acquire knowledge in determining the hardness of metals before and after various Heattreatment operations.
4. Understand differences between different heat treatment methods.
5. Understand the relation between micro structure and properties.

Outcomes: At the end of the course, a student will be able to

1. Identify crystal structure of various metals.
2. Measure hardness and can correlate with microstructure.
3. Perform a suitable heat treatment operation based on desired properties.
4. Underlines the importance of grain size in evaluating the desired mechanical properties.
5. Correlate the heat treatment methods and the mechanical properties obtained.

List of the Experiments

1. Study of: Metallurgical Microscope, Allotropes of Iron, Iron-Iron carbide diagram, Procedure for specimen preparation.
2. Observations for the following specimens - i) Low carbon steels, ii) Medium carbon steels, iii) Eutectoid steels, iv) High Carbon steels, v) Stainless steels, vi) Case carburized, vii)HSS, viii) White cast iron, ix) Gray cast iron, x) alleable iron, xi) Spheroidal iron, xii) Al-Si alloy and determination of grain size using Image Analyzer.
3. Preparations of the following specimens : i) á " â Brass, ii) Normalised steel iii) Medium carbon steel iv) Nodular cast iron v) Grey cast iron.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

4. Heat Treatment Processes
   i) Annealing
   ii) Normalizing
   iii) Hardening

Text Books:

1. V. Raghavan, "Materials Science and Engineering", 4/e, Prentice Hall of India Ltd., 2005.
2. S.H. Avner, "Introduction to Physical Metallurgy", 2/e, Tata McGraw Hill Publishers, 2005.

Suggested Reading:

1. S.P. Nayak, "Engineering Metallurgy and Material Science", 6/e, Charoter Publishing House, 2005.
2. E. Dieter, "Mechanical Metallurgy", 3/e, Metric Edition, Tata McGraw Hill, 2005.
3. K.L. Kakani, "Material Science", New Age Publications (P) Ltd., 2008.

18ME C06

MECHANICS OF MATERIALS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: Students will

1. Demonstrate an understanding of tension, and the relationship between stress, strain and application of Hooke's law.
2. Demonstrate an understanding of types of beams, deflections and measurement of material property through deflections.
3. Demonstrate an understanding of torsion and deformations resulting from torsion.
4. Demonstrate the understanding of hardness and its measurement using different scales like Brinnel and Rockwell.
5. Demonstrate an understanding of measurement of shear modulus and young's modulus for machine members like helical and leaf springs through loading respectively.

Outcomes: At the end of the course, a student will be able to

1. Draw stress-strain curve for an isotropic material and understand the salient features of it.
2. Determine the Young's modulus of various beam materials by conducting load-deflection test and. rigidity modulus of a given shaft specimen by torsion test.
3. Able to find out Young's modulus and shear modulus for mechanical components like leaf spring and closely coiled helical spring through load-deflection test respectively.
4. Evaluate hardness of different materials using different scales
5. Find the compressive and crushing strengths of concrete cubes and bricks.

List of the Experiments

1. Uni-axial tension test using UTM.
2. Brinell's and Rockwell's hardness tests.
3. Load-deflection test on a leaf spring to find out the young's modulus of leaf material.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

4. Deflection test on a helical spring to determine the rigidity modulus.
5. Torsion of shaft to determine the rigidity modulus of shaft material.
6. Defection test on a cantilever beam to determine the Young's modulus.
7. Deflection test on a simply supported beam to determine the Young's modulus.
8. Deflection test on propped cantilever to determine the Young's modulus.
9. Deflection test on continuous beam to determine the Young's modulus.
10. Crushing and compression test on bricks and concrete cubes.
11. Measuring mechanical strain in a cantilever beam using strain gages and to compare the results with theoretical strain values calculated from an equation derived from solid mechanics.
12. To measure load (tensile/compressive) using load cell on tutor.

Text Books:

1. S.S.Rattan, "Strength of Materials", 3/e, Tata Mc-Graw Hill, 2016.
2. S. Ramamrutham, "Strength of Materials", Dhanpatrai and Sons, 1993.
3. G.H.Ryder, "Strength of Materials", 3/e, Macmillan India Limited, Delhi 2002.

Suggested Reading:

1. S.S. Bhavakatti, "Strength of Materials", Vikas Publication, 2003.
2. James M Gere, "Mechanics of materials", 8/e, cengage learning, 2013.
3. R.C. Hibbeler, "Mechanics of Materials", 9/e, Pearson, 2018

18PE C02

MANUFACTURING PROCESSES LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: To enable the students to

1. Test the moulding sand and analyze the same.
2. Test the bead geometry and correlate the results to the input parameters.
3. Use TIG, MIG and Spot welding machines and experiment with them.
4. Test the formability characteristics of a given sheet metal and study different types of dies.
5. Understand the various type of sheet metal forming dies.

Outcomes: Students will be able to

1. Test the moulding sand and analyze the same.
2. Test the bead geometry and correlate the results to the input parameters.
3. Use TIG, MIG and Spot welding machines and experiment with them.
4. Test the formability characteristics of a given sheet metal and
5. Demonstrate the understanding of various types of dies

List of the Experiments:

Casting:

1. Design of a simple pattern with various allowances.
2. Moulding sand testing: GCS, GSS, DCS and DSS
3. Moulding sand testing: Permeability and shatter index.
4. Finding out the GFN and Moisture content for a given sand sample.
5. Melting and Pouring of Aluminum.

Welding:

6. Study of Arc welding process, comparison of the bead geometry with DCSP, DCRP and A.C.
7. Study of resistance welding process and spot of welding of MS Sheets.
8. Study of TIG welding process and plotting cooling curve in TIG welding process.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

9. Study of SAW Welding process and finding out deposition efficiency of the process.
10. Study of MIG welding process and testing of weld bead formed by MIG welding.

Metal Forming:

11. Evaluation of Formability of a given sheet material using Erichsen cupping test.
12. Study of Progressive die design and manufacturing of washer components using the same on a fly press (capacity 6 Tons) and estimation of forces.
13. Study of Compound die design and manufacturing of washer components using the same on double body fly press (capacity 8 Tons) and estimation of forces.
14. Study of Combination die design and manufacturing of cylindrical cups using the same on a hydraulic power press (capacity 50 Tons) and estimation of drawing force.
15. Study of extrusion dies and demonstration of extruding lead material

Note: Minimum 12 Experiments need to be conducted by choosing any 4 from each section.

Text Books:

1. P.N.Rao, "Manufacturing Technology", Vol.1, 3/e, Tata McGraw Hill Publ., 2011.
2. Amitabh Ghosh and Mallick, "Manufacturing Science", 4/e, Assoc. East West Press Pvt. Ltd., 2011.

Suggested Reading:

1. Schey, "Introduction To Manufacturing Processes", 2/e, Mcgraw - hill Education
2. Roy A.Lindberg, "Materials and Process of Manufacturing", 5/e, Prentice Hall of India, 1992.
3. Mikell P.Grover, "Fundamentals of Modern Manufacturing Materials, Processes and Systems", 3/e, Willey A.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
AICTE MODEL CURRICULUM
B.E. (MECHANICAL ENGINEERING)

SEMESTER – IV

S. No.	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	18CS C05	Basics of Data Structures	2	–	–	3	20	50	2
2	18ME C07	Kinematics of Machines	3	1	–	3	30	70	4
3	18ME C08	Thermodynamics	3	1	–	3	30	70	4
4	18ME C09	Principles of Management	3	–	–	3	30	70	3
5	18ME C10	Fluid Principles and Hydraulic Machines	3	1	–	3	30	70	4
6	18CE M01	Environmental Science	2	–	–	3	–	50*	Non Credit
PRACTICALS									
7	18CS C06	Basics of Data Structures Lab	–	–	2	3	15	35	1
8	18EG C03	Soft Skills Lab	–	–	2	3	15	35	1
9	18ME C11	Fluid Principles and Hydraulic Machines Lab	–	–	2	3	15	35	1
		TOTAL	16	03	06	–	185	485	20

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE – Semester End Examination
* Pass / Fail

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18CS C05

BASICS OF DATA STRUCTURES

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Objectives: To introduce

1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Outcomes: The Student will be able to

1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT - I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. **Recursion:** Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT - II

Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT - III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

CBIT (A) With Effect from the Academic Year 2019-2020

UNIT - IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT - V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.
Searching and Sorting: Linear searching, binary Searching, sorting algorithms-bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimhaarumanchi, Data Structures and Algorithms Made Easy, CareerMonk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, Fundamentals of Data structures in C,E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, Data Structures using C, Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, Data structures A Programming Approach with C, PHI.
2. Seymour Lipschutz, Data Structures with C, Schaums Outlines, Kindle Edition

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-1#DS

18ME C07

KINEMATICS OF MACHINES

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives: Students will acquire knowledge in

1. Fundamental definitions of kinematics of mechanism.
2. Drawing velocity and acceleration diagrams for various mechanisms
3. Working principles of brakes and dynamometers
4. Drawing displacement diagrams for various types of followers with various types of motions.
5. Estimation of transmission of power by belts and application of various gears and gear trains.

Outcomes: At the end of the course, student will be able to understand

1. Basic elements of mechanisms and their motion characteristics.
2. Designing a suitable mechanism depending on application.
3. Principles involved in functioning of brakes and dynamometer
4. Drawing displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers.
5. Selecting gear and gear train depending on application.

UNIT - I

Introduction: Definition of link, element, pair, kinematic chain, mechanism and machine, Grubler's criterion, single and double slider chains, inversions of quadratic chain, inversions of single and double slider crank chains. Mechanism with lower pairs and straight line motion mechanism, Pantograph and Geneva mechanisms. Ackerman and Davis steering gear mechanisms and Hooke's Joint. Peaucellier, Hart, Scott-Russel, Watt and Tchebicheff mechanisms.

UNIT - II

Analysis of mechanisms: Graphical methods to find velocities of mechanisms, instantaneous centre, body centre and space centre. Kennedy's theorem, graphical determination of acceleration of different mechanisms including Coriolis component of acceleration, analytical method to find the velocity and

acceleration, analysis of four bar mechanism with turning pairs, Freudenstein's method for synthesis of four bar linkage.

UNIT - III

Laws of Friction: Friction in screw threads, pivots, collars, Clutches - Single and Multi plate, Cone and centrifugal clutches. Friction circle and friction axis of a link.

Brakes and Dynamometers: Block or shoe, band and block, internal expanding shoe brake, Prony, rope brake, belt transmission, torsion dynamometers.

UNIT - IV

Cams: Types of cams and followers, displacement diagrams for followers, uniform motion, parabolic motion, simple harmonic motion, cycloidal motion, drawing cam profile with knife edge follower, translating roller follower and translating flat follower. Cams of specified contours, tangent cam with roller follower, circular arc (convex) cam with roller follower.

UNIT - V

Gears: Classification of gears, spur gears, nomenclature, law of gear tooth action, involute as gear tooth profile, interference of involute gears, minimum number of teeth to avoid interference, contact ratio, cycloidal tooth profile, comparison of involute and cycliodal tooth profile. **Helical Gears**: Helical gear tooth relations, contact of helical gear teeth,

Gear trains: Gear trains-simple and compound, reverted and epicyclic gear trains. Differential of an Automobile.

Text Books:

1. Thomas Bevan, "Theory of Machines", CBS Publishers, 2009.
2. S.S. Rattan, "Theory of Machines", 4/e, Tata McGraw Hill Publishers, 2013.
3. J.E.Shigley, "Theory of Machines", 3/e, Tata Mc.Graw Hill Publishers, New Delhi, 2005.

Suggested Reading:

1. C.S. Sharma and Kamlesh Purohit, "Theory of Mechanisms and Machines", PHI Learning Pvt. Limited, 2006.
2. Amitabh Ghosh and A.K.Mallik, "Theory of Machines", 3/e, East West Publications, 2009.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C08

THERMO DYNAMICS

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives: Students will understand

1. Basic definitions of thermodynamics and significance of Zeroth law of thermodynamics.
2. The importance and application of first law of thermodynamics.
3. The principles associated with second law of thermodynamics.
4. Properties of pure substances and use of Mollier diagram.
5. Various air standard cycles, vapour power cycles and their importance.

Outcomes: At the end of the course a student will be able to

1. Estimate the temperature of different scales of thermometers.
2. Apply the first law of thermodynamics to various thermodynamic processes.
3. Understand the meaning of perpetual motion of machine of second kind and its significance.
4. Read data from steam tables, Mollier diagram and its applications.
5. Distinguish working principles of various air standard cycles, vapour power cycles and determine air–fuel ratios required for combustion of fuels

UNIT - I

Introduction: Thermodynamics, Macroscopic and Microscopic approaches, thermodynamic systems, properties, processes and cycles, thermodynamic equilibrium, quasi – static process, measurement of pressure, Zeroth law of thermodynamics and its significance, measurement of temperature, reference points, ideal gas equation.

UNIT - II

First Law of Thermodynamics: Concept of heat and work, first law of thermodynamics for closed system, energy- a property of the system, application of first law to various thermodynamic processes like isobaric, isochoric, isothermal, adiabatic and polytropic, definition of enthalpy, PMM1, first law

applied to flow processes, application of SFEE to nozzle and diffuser, throttling device, turbine and compressor.

UNIT - III

Second Law of Thermodynamics: Limitations of first law of thermodynamics, Kelvin–Planck and Clausius statements of second law of thermodynamics, PMM2, equivalence of Kelvin-Planck and Clausius statement, reversible and irreversible processes, Carnot theorem, Clausius inequality, calculation of entropy change during various thermodynamic processes, principle of entropy increase, T–S diagrams, application of entropy principle for mixing of two fluids. Helmholtz and Gibb's functions.

UNIT - IV

Thermodynamic Properties of Fluids: Properties of pure substances, p– v diagram, p–T diagram, p–v–T surface, T–s diagram, h–s diagram, dryness fraction, use of steam tables, Maxwell relations.

UNIT - V

Air Standard Cycles: Air standard cycles - Otto, Diesel, Dual Combustion Cycles, working principle, derivation of expression for air standard efficiency, comparison of otto, diesel and dual cycles-for the same compression ratio, for the same maximum pressure and temperature.

Vapour Power Cycles: Vapour power cycles - Carnot cycle, Simple Rankine cycle.

Fuels and Combustion: Characteristics of an ideal fuel, classification of fuels, Stoichiometric air-fuel ratio, equivalence ratio, relation between volumetric and gravimetric analysis.

Text Books:

1. P.K. Nag, "Engineering Thermodynamics", 5/e, Tata McGraw Hill Publishers, 2013.
2. D.S. Kumar, "Thermal science and Engineering", 4/e, S. K.Kataria and Sons, 2013.
3. Y.A. Cengel and M.A. Boles, "Thermodynamics: An Engineering Approach", 7/e, Tata McGraw Hill Publishers, 2014.

Suggested Reading:

1. R.K. Rajput, "Thermal Engineering", 8/e, Laxmi Publications (P) Ltd, 2011.
2. Mahesh M Rathore, "Thermal Engineering", Tata McGraw Hill Publishers, 2013.

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: To make the students to

1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Outcomes: At the end of the course, student will be able to understand

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT - I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT - II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT - III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human

resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT - IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT - V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, "Management", 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education, 2004.

Suggested Reading:

1. P.C. Tripathy & P.N. Reddy, "Principles of Management", Tata McGraw Hill, 1999.
2. Harold Koontz and Cyril O'Donnell "Principles of Management", Tata McGraw Hill, 2017.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C10

FLUID PRINCIPLES AND HYDRAULIC MACHINES

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives: Students will

1. Learn properties of fluids, laws related to fluid flow and their applications.
2. Understand the principles and problems associated with impact force of jet on the vanes
3. Understand various principles and performance characteristics related to Reciprocating pumps.
4. Come to know the working principles and performance characteristics of Centrifugal pumps.
5. Learn the working principle and efficiencies of hydraulic turbines.

Outcomes: At the end of the course, a student will be able to

1. Determine the various properties of fluid and their applications
2. Understand the methodology in calculation of impact force exerted by the jet on the vanes
3. Acquire the knowledge of the functionality and performance of Reciprocating pumps.
4. Understand the working, estimate the performance and testing of Centrifugal pumps.
5. Acquire knowledge in the functionality, performance and testing of hydraulic turbines.

UNIT-I

Properties and Laws of Fluid Flow: Fluids- Fluid properties- Pressure, Density, Specific weight, Specific volume, Dynamic and Kinematic viscosity -Laws of fluid flow-Continuity theorem-Bernoulli's theorem- Venturimeter-Notches-Pitot tube- Darcy's equation - Impulse-momentum equation and applications

UNIT-II

Hydraulic Machines: Classification- Lay-out of hydraulic power plant- working principle- Impact force exerted by a jet striking (i) a fixed flat vertical vane held normal to the jet flow (ii) at the centre of a fixed symmetrical curved vane (iii) at

one end of fixed symmetrical and unsymmetrical curved vanes (iv) flat vertical vane moving in the direction of jet (v) a series of flat vertical moving vanes (vi) at the centre of symmetrical moving curved vanes (vii) symmetrical curved vanes moving in the same direction as that of jet at inlet (viii) at one end of a series of un-symmetrical moving curved vanes. (Numerical problems for above cases only)

UNIT-III

Reciprocating Pumps: Classification- working principle- single and double acting pumps- discharge, work done and power required to drive the pumps- slip, % slip and negative slip- Variation of pressure head in the suction and delivery pipes due to acceleration of piston- Variation of pressure head due to friction in the suction and delivery pipes- Indicator diagrams- Ideal and actual diagrams- Effect of piston acceleration and pipe friction on indicator diagram- Maximum speed at which the pump must run to avoid separation during suction and delivery strokes- Air vessels-Function of air vessels- Work saved by fitting air vessels to single and double acting pumps- Discharge of liquid into and out of air vessels-Performance characteristic curves.

UNIT-IV

Centrifugal Pumps: Classification- Working principle- Comparison over reciprocating pumps-Velocity triangles- Manometric head- work done per second- Head equivalent of work done- Manometric, mechanical and overall efficiencies- Pressure rise in the impeller- Minimum starting speed- Specific speed- Physical significance of specific speed- Model testing- Conditions of similarity of CF pumps- Priming- Performance characteristic curves.

UNIT-V

Hydraulic Turbines: Classification- Impulse and reaction turbines-Construction and working of Pelton wheel, Francis turbine and Kaplan turbine- Velocity triangles- Work done (power developed)- Hydraulic, Mechanical and Overall efficiencies- Maximum efficiency- Specific speed- Physical significance of specific speed-Unit testing -Unit quantities- Model testing of turbines- Conditions for similarity of turbines- Performance characteristic curves.

Text Books:

1. R.K. Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publication (P) Ltd., New Delhi, 2004.
2. R.S. Khurmi and N. Khurmi, "Hydraulics, Fluid Mechanics and Hydraulic Machines", 20/e, S. Chand publishing, 2014

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. P.N. Modi, and. S.M.Seth, "Hydraulics and Fluid Machines", Standard Book House, New Delhi, 2004.
2. S.Ramamrutham, "Hydraulics, Fluid Mechanics and Fluid Machines", Dhanpat Rai and Sons, New Delhi, 2004.
3. Madan Mohan Das., "Fluid Mechanics and Turbomachines", PHI Learning Private Limited, New Delhi, 2009.

18CE M01

ENVIRONMENTAL SCIENCE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	——
Credits	0

Objectives: To enable the student

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental

Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT - I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural Resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT - II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem,

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems

UNIT - III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT – IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT – V

Social Issues and the Environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu,"Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria & Sons, 2009.

Suggested Reading:

1. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006.

18CS C08

BASICS OF DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives:

1. Design and construct simple programs by using the concepts of data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Outcomes: The Student will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs.
4. Implement various kinds of searching, sorting and traversal techniques.
5. Identify the suitable data structure for real world problem.

List of Experiments for Non-CSE/IT:

1. Implementation of operations on arrays
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting Techniques
7. Case study like Banking System, Students Marks Management, Canteen Management etc

Text Books

1. Brian W Kernighan, Dennis Ritchie, "C Programming Language", 2/e, PH PTR.
2. Richard M Reese, "Understanding and Using C Pointers O'Reily", 2013.

Web Links

https://nptel.ac.in/courses/106102064/

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)

18EG C03

SOFT SKILLS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: The course will introduce the students to

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth the practical ability to apply suitable data structure for real time applications.

Outcomes: After successful completion of the course the students will be able to

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1:
Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)

Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2:
Main Topics: Advanced Group Discussion with Case studies : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts

Exercise 3:
Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions & Practice)
Writing Input: Writing to Reflect - Resume Writing

Exercise 4:
Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5:
Main Topic: Mini Project – General/Technical, Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

3. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

18ME C11

FLUID PRINCIPLES AND HYDRAULIC MACHINES LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: Students will

1. Determine discharge of fluid flow.
2. Verify fluid laws like Bernoulli's equation and determine losses through pipes.
3. Determine impact force of jet on the vanes
4. Demonstrate knowledge in evaluating performance characteristics of pumps.
5. Evaluate the performance characteristics of turbines.

Outcomes: On completion of the course, the students will be able to

1. Carry out discharge measurements
2. Determine the energy loss in conduits.
3. Calculate forces and work done by a jet on fixed or moving, flat and curved blades.
4. Evaluate the performance characteristics of pumps.
5. Demonstrate the characteristics curves of turbines.

List of the Experiments:

1. Verification of Bernoulli's equation.
2. Determination of Darcy's friction factor and nature of water flow through pipes.
3. Determination of Cd for V- notch.
4. Determination of Cd for rectangular notch.
5. Determination of Cd for Venturimeter.
6. Determination of Cd for Orifice meter.
7. Determination of impact force of jet on fixed flat and fixed curved vanes.
8. Performance and characteristic curves of Reciprocating pump.
9. Performance and characteristic curves of Centrifugal pump.
10. Performance and characteristic curves of Self-priming pump.
11. Performance and characteristic curves of Gear pump.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

12. Performance and characteristic curves of Pelton wheel.
13. Performance and characteristic curves of Francis Turbine under constant speed and variable speed conditions.
14. Performance and characteristic curves of Kaplan turbine under constant speed and variable speed conditions.

Note: A minimum of 12 Experiments need to be conducted.

Text Books:

1. R.K. Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publication (P) Ltd., New Delhi, 2004.
2. R.S. Khurmi and N. Khurmi, "Hydraulics, Fluid Mechanics and Hydraulic Machines", 20/e, S. Chand publishing, 2014

Suggested Reading:

1. P.N. Modi, and. S.M.Seth, "Hydraulics and Fluid Machines", Standard Book House, New Delhi, 2004.
2. S.Ramamrutham, "Hydraulics, Fluid Mechanics and Fluid Machines", Dhanpat Rai and Sons, New Delhi, 2004.
3. Madan Mohan Das., "Fluid Mechanics and Turbomachines", PHI Learning Private Limited, New Delhi, 2009.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C12

DYNAMICS OF MACHINES

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To understand force analysis of single slider crank mechanism and turning moment Diagrams for Flywheels
2. To understand the Gyroscopic effect and the performances of Governors
3. To know the Balancing of rotating and reciprocating masses.
4. To determine natural frequencies of undamped, damped and forced vibrating systems of single degree freedom systems.
5. To understand the modes of vibrations, Two degree of Freedom and Torsional Vibrations

Outcomes: At the end of the course, the students are able to

1. Determine the fluctuation of energy and decide the cross section of flywheel. (BL-3)
2. Understand the gyroscopic effects in ships, aero planes and road vehicles. (BL-2)
3. Analyze the characteristics of various centrifugal governors. (BL-4)
4. Analyze balancing problems in rotating and reciprocating machinery. (BL-4)
5. Understand free and forced vibrations of single degree freedom systems and two-degree freedom linear systems. (BL-2)

UNIT- I

Force analysis: Dynamic force analysis of single slider crank mechanism, concept of dynamically equivalent link.

Flywheels: Working principle of flywheel, turning moment on the crank shaft, turning moment diagrams, maximum fluctuation of energy and its determination, coefficient of fluctuation of speed, design of flywheels, rim type flywheel versus solid type flywheel.

Gyroscope: Principle of gyroscope, roll, yaw and pitch motions, gyroscopic effect in a two-wheeler, car, ship and aeroplane, practical problems.

UNIT- II

Governors: Necessity of governor, different types of governors, working principle of centrifugal governors, characteristics of Watt governor, Porter governor, Proell governor, Hartnell governor, Hartung governor, hunting of governors, concept of control force, control force diagram, definition of stability of governor, condition for stability, concept of isochronism, sensitivity of governor, energy of governor.

UNIT- III

Balancing of Rotating masses: Balancing and its types, rotor balancing, single plane and two plane balancing, unbalanced forces and couples, static and dynamic balancing, balancing of rotors by analytical and graphical methods.

Balancing of reciprocating machines: Primary and secondary unbalanced forces, balancing of in line and radial engines.

UNIT - IV

Vibrations: Vibrations of single degree freedom system (axial, transverse and torsional), equivalent system of combination of springs, stepped shaft, whirling speed of shafts.

Damped Vibrations: Types of damping, vibrations with viscous damping.

Forced Vibrations: Vibrations with harmonically applied force with viscous damping, dynamic magnifier, resonance, vibration isolation and transmissibility.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

UNIT –V

Two and three degree freedom systems: Natural frequencies of two degree freedom linear systems. Nodes in two and three rotor systems, modes of vibration, determining natural frequencies by Holzer's method for multi-rotor systems. Dunkerley's and Rayleigh's approximate methods.

Text Books:

1. S.S. Rattan, "Theory of Machines", Fourth edition ,Tata-Mc Graw Hill, ,2014
2. John.J.Vicker, Gordon R. Pennock, Joseph E. Shigley, "Theory of Machines & Mechanisms", Oxford University press, 2003.
3. William T.Thomson "Theory of Vibration with Application", 5th edition, Pearson education 2008

Suggested Reading:

1. A. Ghosh and Mallick, "Theory of mechanisms and machines", Affiliated to E-W Press, 1988.
2. J.S. Rao and Gupta, "Theory and Practice of Mechanical Vibrations", PHI, 1984

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C13

APPLIED THERMODYNAMICS AND HEAT TRANSFER

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. The working principles of reciprocating air compressor and its applications in engineering
2. The working principle of diesel and petrol engine, their combustion phenomena and problems pertaining to abnormal combustion
3. Student will understand the features of IC engine like ignition system and injection system
4. The basic modes of heat transfer
5. The classification of heat exchanger, concepts of radiation heat transfer and phase heat transfer

Outcomes: At the end of the course, the students are able to

1. Estimate the power required for reciprocating air compressor using the basic principles of thermodynamics for many engineering applications. (BL-4)
2. Evaluate the performance of C.I. and S.I. engines with appropriate consideration for public health and safety. (BL-5)
3. Understand the functioning of components of I.C. engines and the concept of abnormal combustion with remedial measures. (BL-2)
4. Derive the expressions for the heat transfer in conduction and convection with the basic principles of thermodynamics. (BL-3)
5. Understand the basic principles of heat exchangers, boiling and condensation. (BL-2)

UNIT – I

Reciprocating Air Compressors: Classification of compressors, advantages of reciprocating compressors over rotary compressors, applications of compressed air, working principle of reciprocating compressors - single stage and multi stage compressors with and without clearance, concept of optimum pressure ratio, minimum work input, various efficiencies of multi stage compressors, simple problems on reciprocating compressors.

UNIT - II

Internal Combustion Engines: Classification, working principles of 2 stroke, 4 stroke SI and CI engines, valve and port timing diagrams, performance of IC engines, Morse test, various methods of determining frictional power, various efficiencies, heat balance sheet.

UNIT - III

Combustion Phenomena: Stages of combustion in SI and CI engines, octane and cetane number, factors affecting, normal and abnormal combustion phenomenon in SI and CI engines, methods to control the abnormal combustion, types of combustion chambers, cooling systems, lubrication systems, battery and magneto ignition systems of IC engines, working principle of simple carburetor and fuel injector.

UNIT - IV

Modes of Heat Transfer: General 3-D conduction equation in cartesian and cylindrical coordinates, one dimensional steady state conduction through slabs, hollow cylinders without heat generation, critical radius of insulation for cylinders.

Convection: Free and forced convection, dimensionless numbers and their physical significance.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)

UNIT - V

Radiation: Various laws of radiation, concept of black-body.

Heat Exchangers: Classification, concept of LMTD and simple problems.

Condensation and boiling: Types of condensation, heat transfer coefficient for laminar parallel flow condensation, pool boiling curve, simple problems on condensation and boiling.

Text Books:

1. Mahesh M. Rathore, "Thermal Engineering", TMH, New Delhi, 2010
2. V. Ganeshan, "Internal Combustion Engines", Tata Mcgraw Hill Publishing, New Delhi,2015
3. J.P. Holman, "Heat Transfer", McGraw Hill Publication, New Delhi,

Suggested Reading:

1 R.K. Rajput., "Thermal Engineering", Laxmi Publishers, New Delhi, 2014

2 D.S. Kumar, "Heat Transfer", S K Kataria Publishers, 2015

BReddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C14

DESIGN OF MACHINE ELEMENTS

(Use of data book is permitted)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To understand the principles of machine design and design considerations, types of loads, failure criteria.
2. To design machine members for static, fluctuating loads and impact loads
3. Learn the design principles of shafts, keys, couplings, belt drives and pulleys.
4. Understand the principles of design of permanent joints such as riveted and welded joints.
5. Understand the principles of design of bolted joints, power screws and gasket joints.

Outcomes: At the end of the course, the students are able to

1. Understand the standards, codes, various design considerations and failure criteria of members (BL-2)
2. Analyze and evaluate machine members subjected to static and dynamic loads (BL-4)
3. Recommend suitable shafts, couplings and belt drives for a given application (BL-5)
4. Design permanent joints for a given application (BL-6)
5. Design bolted joints, power screws and screw jack (BL-6)

UNIT – I

Introduction: Materials used in machine design and their specifications to Indian standards, codes and standards used in design, Reliability, principles of Ergonomics and Manufacturing considerations. Preferred numbers, analysis of stress and strain: Types of loading and stresses. Cotter and knuckle joints. Theories of elastic failure, stress concentration factor, factor of safety, Design of components for static loads.

UNIT – II

Design for Fatigue and Impact loads: Importance of fatigue in design, fluctuating stresses, fatigue strength and endurance limit. Factors affecting fatigue strength, S-N Diagram, Soderberg and Modified Goodman's diagrams for fatigue design. Cumulative fatigue, Miner's rule, Design of components for fatigue. Design of components for impact loading.

UNIT – III

Design of shafts, Keys & Couplings: Solid, hollow and splined shafts under torsion and bending loads, types & design of Keys, muff, split muff, flange, marine type and flexible type of couplings.
Design of Belt Drive Systems: selection of belts and design of pulleys.

UNIT – IV

Design of Permanent Joints: Types of Riveted joints, efficiency of the joint. Design of riveted joints subjected to direct and eccentric loads. Types and design of welded joints subjected to direct and eccentric loading.

UNIT – V

Design of Bolted Joints, Power Screws: Design of bolts and nuts, locking devices, bolt of uniform strength, design of gasket joints, design of power screws and screw jack.

Text Books:

1. V.B. Bhandari, "Design Machine Elements", Mc Graw Hill Publication, 2017.
2. J.E. Shigley, C.R. Mischne, "Mechanical Engineering Design", Tata Mc Graw Hill Publications, 2015.
3. R.S.Khurmi and J.K.Gupta, "Machine design", 34/e, S Chand publications, 2018.

Suggested Reading:

1. P. Kannaiah, "Machine Design", Sci-Tech Publications, 2010
2. M.F. Spotts, "Design of Machine Elements", Prentice Hall of India, 2013.

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Machine Design Data Books:

1. K. Mahadevan, K. Balaveera Reddy., "Design Data Hand book for Mechanical Engineers", 3/e, CBS Publisher, 2018
2. PSG College, "Design Data book", 2012

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE C07

METAL CUTTING AND MACHINE TOOL ENGINEERING

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Various cutting tool materials and tool geometry.
2. Factors effecting tool life and thermal aspects of metal cutting.
3. The working principles of various of types of lathes, drilling machine and milling machines ,
4. The working principles of boring machines, grinding machines and thread production
5. Working principles of non-conventional machines and jigs and fixtures

Outcomes: At the end of the course, the students are able to

1. Describe tool geometry, select tool material for machining of various materials and identify the types of chips. (BL-2)
2. Calculate cutting forces, MRR, power consumption under different cutting conditions. (BL-3)
3. Classify the mechanisms of tool wear, estimate tool life using Taylor's equation under various cutting conditions. (BL-4)
4. Identify the basic parts, specifications, operations of various machine tools and understand jigs & fixtures. (BL-2)
5. Classify methods of unconventional machining and identify suitable method for a given component. (BL-3)

UNIT - I

Cutting tool materials: High carbon steel, HSS, Stellite, Carbides, Coated carbides, Diamond.

Tool geometry: Nomenclature of single point cutting tool by ASA and ORS. Geometry of drills, Milling cutters and broaches. Recommended Tool angles. Chip formation: Types of chips, BUE, Chip breakers.

Machining: Orthogonal and oblique cutting, Mechanics of metal cutting, Merchant's analysis, Shear angle Solutions of Merchant and Lee & Shafer.

UNIT - II

Thermal Aspects of Metal Cutting: Sources of heat and heat distribution. Various methods of measurement oftemperature, cutting fluids and applications.

Tool Wear and Tool Life: Criteria for tool wear, flank and crater wear theories, criteria for tool life in roughingand finishing, Measurement of tool wear, Taylor's tool life equation, factors effecting tool life, Machininbility, Economics of machining: Tool life for maximum production, minimum cost.

UNIT-III

Constructional features and specifications of machine tools: Various operations on Lathe, Types of Lathes and special attachments on a Centre Lathe. Drilling, Milling operations. Indexing methods. Shaper, planer and slotter and their differences. Quick return mechanisms, Automatic feed devices. Jig Boring machines-Differences between horizontal and vertical jig boring machines.

UNIT- IV

Grinding machines: Types of grinding, Abrasives and bonds used for grinding wheels. Specification and selection of wheels. Principles of Broaching, Lapping, Honing, Polishing, Buffing, Super finishing and burnishing.

Screws and gear manufacturing: Screw making by tapping, chasers, thread rolling, thread milling, thread grinding. gear shaping, gear hobbing, gear shaving and grinding.

UNIT-V

Jigs and Fixtures: Design principles for location and clamping. Tool holding and work holding devices. Quick clamping devices. Types of Jigs and fixtures.

Unconventional machining: Principles of working and applications of USM, AJM, EDM, ECM, LBM andEBM.

PROFESSOR & HE...
...artment of Mechanical Engine...
...anya Bharathi Institute of Technology (...

Text Books:

1. P N Rao, "Manufacturing Technology – Metal Cutting & Machine Tools", 3/e Tata McGraw-Hill Publishing Company Limited, 2013.
2. B L Juneja and G S Sekhon, "Fundamentals of metal cutting and machine Tools", New Age International publishers, 2001.
3. Kalpakjian S. and Steven R. Schmid, "Manufacturing, Engineering & Technology", Pearson, 2007

Suggested Reading:

1. David A. Stephenson, Johs S. Agapiou, "Metal Cutting Theory and Practice", CRC Press, 3rd Edition, March 2016
2. Amitabha Ghosh and Ashok Kumar Mallik, "Manufacturing Science", Affiliated East-West Press Pvt. Ltd. 2nd Edition, 2010

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E01

REFRIGERATION AND AIR CONDITIONING

(Core Elective-I)

(Use of data book is permitted)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Acquire the basic knowledge about the importance of refrigeration, its applications in aircraft refrigeration.
2. Demonstrate basic knowledge of vapor compression refrigeration system, cascade and compound refrigeration.
3. Understand various types of absorption refrigeration systems like ammonia, Electrolux and lithium bromide refrigeration systems.
4. Acquire the basic knowledge on various psychrometric processes and comfort air conditioning.
5. Acquire knowledge in estimating air conditioning loads.

Outcomes: At the end of the course, the students are able to

1. Evaluate COP of various air craft refrigeration systems using principles of thermodynamics along with necessity of eco-friendly refrigerants for public health and safety. (BL-4)
2. Analyze COP of vapor compression refrigeration system with the appropriate concern for environment. (BL-4)
3. Understand the Vapour absorption, steam jet refrigeration and non-conventional refrigeration in order to provide valid conclusions over simple vapor compression refrigeration system. (BL-2)
4. Understand the working principle of air conditioning system including human comfort and its importance over environment, society with balance of ecological system. (BL-2)
5. Apply the principles of engineering which are complex in nature, having lifelong learning to design air conditioning system for various environments. (BL-3)

UNIT – I

Introduction to Refrigeration: Application of Refrigeration, Definition of COP, Tonne of Refrigeration,Designation, Carnot cycle, Eco-friendly Refrigerants, Properties of Refrigerants.

Air Refrigeration Systems: Analysis of Bell-Coleman Cycle, Application to aircraft refrigeration, Simplecooling system, Bootstrap simple evaporating system, Regenerative cooling system and Reduced ambient cooling system.

UNIT - II

Vapour Compression System: Working principle and analysis of Simple vapor compression Refrigerationcycle. Effect of operating conditions like evaporating pressure, condenser pressure, Liquid sub-cooling and Vapor super heating. Performance of the system. Low temperature refrigeration system (with single load system), Compound compression with water inter cooler and Flash intercooler, Cascade refrigeration system-Analysis and advantages.

UNIT - III

Vapour Absorption Refrigeration System: Simple absorption systems, COP, Practical ammonia absorptionrefrigeration system, Lithium bromide absorption system, Electrolux refrigerator, Common refrigerants and absorbents properties, Comparison with vapor compression refrigeration system.

Steam Jet Refrigeration: Principle of working, Analysis of the system, Advantages, limitations andapplications.

Thermoelectric refrigeration systems: Seebeck effect, Peltier effect and Thompson effect, Analysis of the thermoelectric refrigeration systems using Peltier effect, Expression for COP, Vortex tube refrigeration – principle and working.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)

UNIT - IV

Psychrometry: Psychrometric properties, Psychrometric chart, construction, Representation of variousPsychrometric processes on the chart.

Introduction to Air Conditioning: Requirements of comfort air conditioning, Thermodynamics of humanbody, ASHRE comfort chart, Effective temperature.

UNIT - V

Cooling Load Calculations in Air Conditioning: Concept of bypass factor, Sensible heat factor, ApparatusDew Point, Various Heat Loads.

Design of air conditioning systems: Simple Problems on summer, winter and year Round Air conditioningsystems Energy conservation in air conditioned building.

Air Conditioning Systems: Components of air conditioner equipments, Humidifier, Dehumidifier, Filter.

Text Books:

1. C.P. Arora, "Refrigeration and Air conditioning", Tata McGraw Hill, New Delhi, 2017.
2. Stoecker, W.F., and Jones, J.W., Refrigeration and Air-Conditioning, Mc.Graw Hill, New Delhi, 2014.
3. R.K. Rajput, "Refrigeration and Air Conditioning", Laxmi Publications, New Delhi, 2013.

Suggested Reading:

1. V.K. Jain, "Refrigeration and Air Conditioning", S Chand & Company, New Delhi, 2019.
2. Manohar Prasad, "Refrigeration and Air Conditioning", New Age International, Allahabad, 2015.

Refrigeration and air conditioning data books:

1. Manohar Prasad, "Refrigeration and Airconditioning Data Book", New Age International Publishers, 2010.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E02

VALUES, ETHICS AND SOCIETY

(Core Elective - I)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. Understand the values, the need for value adoption and prepare them meet the challenges
3. Develop the potential to adopt values, develop a good character and personality and lead a happy life
4. Practice the values in life and contribute for the society around them and for the development of the institutions/organization.
5. Understand the professional ethics and their applications to engineering profession

Outcomes: At the end of the course, the students are able to

1. State basic values and the need for value education. (BL -2)
2. Differentiatebetween values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual. (BL-2)
3. Demonstrate the knowledge of ethics at their work place and apply different theoretical approaches to solve ethical dilemmas. (BL-3)
4. Apply risk and safety measures in the engineering practice. (BL-3)
5. Understand the role of a human being in ensuring harmony in society and nature. (BL-2)

UNIT- I

Concepts and Classification of Values –Need and Challenges for Value Adoption: Definition of Values, Concept of Values, Classification of Values, Hierarchy of Values, Types of Values, Espoused and Applied Values, Value judgement based on Culture, Value judgement based on Tradition, Interdependence of Values, Need for value education, Findings of Commissions and Committees, Corruption and illegal practices, Science and Technology without values, Exploitation of nature, Increasing use of violence and intoxicants, Lack of education in values, Implications of education in values, Vision for a better India, Challenges for Value adoption, Cultural, Social, Religious, Intellectual and Personal challenges.

UNIT -II

Process for Value Education: Right Understanding, Relationship and Physical Facilities,basicrequirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and prosperity correctly, a critical appraisal of the current scenario, Method to fulfill the above human aspirations; understanding and living in harmony at various levels.

UNIT-III

Basic Concepts of Professional Ethics: Ethics, Morals and Human life , Types of Ethics, Personal Ethics,Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Professional and Professionalism, Ethical role of a professional Basic ethical principles, Some basic ethical theories, use of ethical theories. Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities.

UNIT- IV

Ethics in Engineering Profession: Engineering profession-Technology and Society-Engineering as SocialExperimentation-Engineering ethics-Ethical obligations of Engineering Professionals, Role of Engineers-Engineers as Managers, Professional responsibilities of Engineers, Engineers Responsibility for Safety, A few Case Studies on Risk management, Conflicts of Interest, Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A
Gandipet, Hyderabad-500 075, Telangana

UNIT - V

Understanding Harmony in the Family and Society: Understanding harmony in the family, the basic unit ofhuman interaction, Understanding values in human relationship; meaning of Nyaya and Program for its fulfillment to ensure Ubhay-tripti, Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.

Text Books:

1. Subramanian R., "Professional Ethics", Oxford University Press , 2017
2. Dinesh Babu S., "Professional Ethics and Human Values", Laxmi Publications , 2016
3. Nagarajan R.S., "A Text Book on Human Values and Professional Ethics", New Age Publications, 2007

Suggested Reading:

1. Santosh Ajmera and Nanda Kishore Reddy, "Ethics, Integrity and Aptitude", Mc Graw Hill Education Private Limited , 2014
2. Govinda Rajan M., Natarajan S., Senthil Kumar V.S., "Professional Ethics and Human Values", Prentice Hall India Private Limited, 2013.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E01

PLASTICS, CERAMICS AND COMPOSITE MATERIALS

(Core Elective-I)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Understand various types of plastics, their properties and uses.
2. Understand various methods of manufacturing plastic components.
3. Understand types of ceramics, refractoriness, and their uses.
4. Understand the manufacturing processes of ceramics.
5. Understand composites and their uses.

Outcomes: At the end of the course, the students are able to

1. Recall the types of plastics, properties and applications. (BL-1)
2. Select the suitable method of manufacturing a plastic component. (BL-5)
3. Describe refractories, their manufacturing methods and applications. (BL-2)
4. Describe the properties, uses and Manufacturing methods of white wares, ceramic coatings and glass. (BL-2)
5. Understand the concept of composites, properties in engineering applications. (BL-2)

UNIT - I
Introduction to Polymers: Plastics and elastomers, polymerization, degree of polymerization, thermoplasticsand thermosetting plastics, properties and applications of various thermoplastic and thermosetting plastics, mechanical properties of plastics and their influencing parameters.

UNIT - II
Processing of Plastics and Elastomers: Constructional features, working principles, advantages, disadvantages and applications of Injection moulding, Extrusion, calendaring, thermoforming, Blowmoulding, compaction moulding, transfer moulding.

UNIT - III
Introduction to Ceramics, Classification of Ceramic Materials, Conventional and Advanced, Refractories: Classification of Refractories, Modern trends and developments, Basic raw materials, Elementary idea of manufacturing process technology, Flow diagram of steps necessary for manufacture, basic properties and areas of application.

UNIT - IV
White Wares: Classification and type of White wares, Elementary idea of manufacturing process technologyincluding body preparation, basic properties and application area.
Ceramic Coatings: Types of glazes and enamels, Elementary ideas on compositions, Process of enameling &glazing and their properties.
Glass: Definition of glass, Basic concepts of glass structure, glass manufacturing processes, Different types of glasses, Application of glasses.

UNIT - V
Fundamentals of Composites: Need for composites–enhancement of properties–classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement–particle reinforced composites, Fiber reinforced composites, Applications of various types of composites, Production techniques for glass fiber, carbon fiber and ceramic fiber, manufacturing methods of composites.

PROFESSOR & HEAD
...artment of Mechanical Enginee...
...ya Bharathi Institute of Technolog...
...Hyderabad-500 075. Telan...

Text Books:

1. Mikell P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", Wiley publications, 6^{th} edition 2015.
2. Kalpakjian, "Manufacturing Engineering and Technology", Pearson publications, 7^{th} edition 2013.
3. P.N. Rao, "Manufacturing Technology", Vol.-1, McGraw Hills Publication, 4^{th} Edition 2016.

Suggested Reading:

1 R.K.Rajput, "A text book of Manufacturing Technology", Vol-I, Laxmi Pub., 2007.

2 P.C. Sharma, "A Text book of Production Technology", 8/e, S. Chand & Co., Pvt. Ltd., 2014.

Reddy

PROFESSOR & HEAD

Department of Mechanical Engineering

Chaitanya Bharathi Institute of Technology (A)

Gandipet, Hyderabad-500 075. Telangana

18PE E02

PRODUCT DESIGN AND PROCESS PLANNING

(Core Elective-I)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. The essence of innovation in product development.
2. The Human Machine Interactions (ergonomics).
3. The various Intellectual Property Rights.
4. The interaction between Design, Manufacturing, Quality and Marketing.
5. The awareness about overall view of Process Planning.

Outcomes: At the end of the course, the students are able to

1. Define the needs of the customer while designing a new product or modifying existing product in the competitive environment. (BL-1)
2. Understand creativity, brainstorming and ergonomic concepts. (BL-2)
3. Apply the concept of design for manufacture, assembly, maintenance, reliability and product life cycle in developing a product. (BL-3)
4. Implement the Intellectual Property Rights to a new product or a process. (BL-3)
5. Evaluate and recommend an effective Process Plan and principles of value engineering to new product development. (BL-5)

UNIT - I
Product Design and Process Design: Functions, Essential factors of product design, Selection of right product,Systematic procedure of product innovation, function of design, value of appearance, colors and laws of appearance.

UNIT - II
Product Selection and Evaluation: Need for creativity and innovation. Techniques of innovation like brainstorming and Delphi techniques, collection of ideas. Selection criteria - screening ideas for new products using evaluation techniques. Principles of ergonomics, Anthropometry, Design with Human Machine Interaction (HMI).

UNIT - III
New Product Planning and Development: Interaction between the functions of design, manufacture, andmarketing, design and material selection, Steps for introducing new products after evaluation, Product life cycle, Research and new product development.

UNIT - IV
Intellectual Property Rights (IPR): Patents, definitions, Types of Patent, Patent search, Patent laws,International code for patents, Trademark, Trade Secret and Copy Rights.
Process Planning: Need and significance of process planning, Process capability studies, Process sheets, Benefits and Types of Computer Aided process planning.

UNIT - V
Process Selection and Planning: Selection of manufacturing process, estimation of machining time in various cutting operations, Estimation of costs for manufacture, value engineering in product design, Group technology, and concepts of concurrent engineering.

Text Books:

1. B.W. Niebel & A.B.Draper, "Production Design & Process Engg", McGraw Hill, 1974.
2. K. G. Swift & J. D. Booker, "Process Selection: From Design to Manufacture", Butterworth-Heinemann Ltd; Revised 2/e, 2003.
3. BhaskaranGopalakrishnan, "Product Design and Process Planning in CE (Design & Manufacturing", Chapman and Hall publishers, 1994.

Suggested Reading:

1. A.K. Chitale& R.C. Gupta, "Product Design & Manufacturing", PHI, 1997.
2. Karl T. Ulrich, Stephen Eppinger, "Product Design and Development", McGrawHill Publication, 2012.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E03

MECHANICAL VIBRATIONS

(Core Elective-I)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To analyze free vibration, damped and un-damped vibrations.
2. The principles of harmonically excited vibrations
3. The principle of damped and un-damped vibrations of two degrees of freedom system
4. To develop the equations of motion for a continuous system in elongation, bending and torsion to find the natural frequencies and mode shapes.
5. The working principles of vibration measurements

Outcomes: At the end of the course, the students are able to

1. Apply Newton's law of motion and energy method to get governing differential equations of vibrating systems. (BL-3)
2. Analyze response of machine members in forced vibration with different excitation frequencies. (BL-4)
3. Recommend suitable Vibration parameters for isolation and compute critical speeds. (BL-5)
4. Predict natural frequency and mode shape for all continuous systems. (BL-3)
5. Understand working principles of vibration measuring instruments. (BL-2)

UNIT - I

Single Degree of Freedom Systems: Undamped, Damped Translational and Torsional Systems, Different methods for equation of motion- Energy method, Rayleigh method, principle of virtual work, principal of conservation energy. Viscously damped free vibration, logarithmic decrement, coulomb damping.

UNIT - II

Harmonically Excited Vibration: Forced harmonic vibration, Rotating unbalance, whirling of rotating shafts, support motion, vibration isolation, energy dissipated by damping. Equivalent viscous damping, structural damping.

UNIT - III

Damped and Undamped Vibrations of Two Degree of Freedom System: Free and forced vibration analysis of two degree of freedom system-different methods for the formulation of equations of motion, natural frequencies, Normal mode vibration, Coordinate coupling and principal coordinates, semi definite systems, influence coefficients-flexibility, stiffness. Eigen values and Eigen vectors, orthogonal properties of Eigen vectors, repeated roots, modal matrix.

UNIT - IV

Vibrations of Continuous Systems: Vibrations of strings, bars and beams, formulation of equations of motion, characteristic equations, identification of nodes and mode shapes.

UNIT - V

Vibration Measurements and Applications: Vibration pickup, Vibrometer, accelerometer. Transducers, piezoelectric transducers, Electrodynamic transducers. Vibration exciters, mechanical and electro dynamic shakers. Frequency measuring instruments.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. J.J. Thomson, "Theory of vibration with Application", 5/e, 2014.
2. S.S. Rao, "Mechanical vibration", 5/e, Pearson, 2011
3. G.S. Grover & Nigam, "Mechanical vibrations", 8/e, New Chand & Bros, 2018

Suggested Reading:

1. V.P. Singh, "Mechanical vibration", 3/e, Dhanpath Rai &Co., 2014.
2. S. Graham Kelley, "Mechanical vibration", Schaums Outline Series, TMH, 2011.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E04

AUTOMOBILE ENGINEERING

(Core Elective-II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. The anatomy of the automobile in general.
2. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels.
3. Suspension, frame, springs and other connections.
4. Ignition, controls, electrical systems and ventilation.
5. Emissions, pollution regulations, EURO and BHARATH stages

Outcomes: At the end of the course, the students are able to

1. Understand the basic layout of automobiles. (BL-2)
2. Understand the various systems in an automobile like engine cooling, lubrication, ignition, electrical and air conditioning systems with the principles of thermodynamics. (BL-2)
3. Describe the principles of suspension and steering system using modern tool usage. (BL-2)
4. Explore therecent systems in Braking and Transmission. (BL-3)
5. Evaluate the effect of automobile pollution on environment and necessity of pollution norms along with trouble shooting (BL-5)

UNIT - I
Types of Automobiles: Normal, Hybrid and Hydrogen Fuel vehicles.
Engine: Engine location and its components, chassis layout - parts of the automobile body, terminology, automobile frames ; crank shaft, firing order, piston and piston rings, cylinder liners, valves and operation mechanism, inlet and exhaust manifolds, carburetion – Zenith carburettor, Fuel injection system, Mechanical Fuel Injection system- MPFI, Electronic Fuel Injection system.

UNIT - II
Lubricating Systems: Wet sump, dry sump and petroil systems
Cooling systems: Water pumps, radiators, thermostat control, anti-freezing compounds
Ignition Systems: Types of Ignition Systems, Modern Ignition systems, Types of Batteries and charging systems- Batteries used in Electric and Hybrid Vehicles, starting motors,
Electrical Systems : Main electrical circuits, generating & starting circuit, lighting system, indicating devices, warning lights, speedometer, automobile air-conditioning.

UNIT - III
Steering Systems: Linkage arrangements and its components, steering gear box types,recent trends, Davis Steering , Modified Ackerman linkage, Steering geometry: caster, camber, King Pin Inclination, Toe in, toe out.
Wheel and tyres: Tyre construction, specification. Tyre wear and causes, wheel balancing, wheel alignment
Suspension systems: Types of Suspension systems, Independent suspension, coil and leaf springs, torsion bar, shock absorbers

UNIT - IV
Power Train: Clutches gear and gearbox manual, semi-automatic and automatic gearboxes. Torque converter,propeller shaft, universal coupling differential, four-wheel drive system
Brakes Systems: Disc and drum types, leading and trailing shoe layout, Description and operation of hydraulic brake, hand brake linkage, Pneumatic, air and vacuum brakes

UNIT – V
Maintenance: Trouble shooting and servicing procedure overhauling, engine tune up, tools and equipment for repair and overhaul testing equipment
Pollution control: Pollution control techniques used for petrol and diesel engines, PCVS, EGR, SCRT, Thermal Reactors, Catalytic converters; Euro norms and Bharat Norms.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)

Text Books:

1. Crouse & Anglin, "Automotive Mechanics", 10/e, TMH. Publishing Co. Ltd., New Delhi, 2006.
2. Kirpalsingh., "Automobile Engineering", Vol. I & II Standard Publishers, Delhi, 2017.
3. Joseph Heitner, "Automotive Mechanics", 2/e, Affiliated East West Pvt. Ltd. 2013.

Suggested Reading:

1. R.K. Rajput, "A Textbook of Automobile Engineering", Laxmi Publications, New Delhi, 2012.
2. D S Kumar, "Automobile engineering", S K Kataria Publications, New Delhi, 2015.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E05

NANO SCIENCE AND TECHNOLOGY

(Core Elective –II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Nanotechnology approach and challenges
2. Materials and characterization procedures
3. Zero and One dimensional Nano structures
4. Various Fabrication Techniques
5. Special nano materials and Nano biomaterials

Outcomes: At the end of the course, the students are able to

1. Understand the basic concepts, developments and challenges in Nano technology. (BL-2)
2. Describe the methods of evaluating magnetic and electronic properties, microstructure by SPM, atomic force microscopy, friction force microscopy. (BL-2)
3. Apply homogenous & heterogeneous methods and characterization techniques of Zero & One dimensional Nano structures. (BL-3)
4. Evaluate various Nano Material Fabrication Techniques. (BL-5)
5. Analyze Nano materials and Nano bio materials for obtaining solutions to societal problems. (BL-4)

UNIT - I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance ofNanotechnology, Bottom-up and Top-down approaches, challenges in nanotechnology, proximal probe technologies.

UNIT - II

Materials of Nanotechnology: Introduction, Si-based materials, Ge-based materials, Ferroelectric materials, Polymer materials, GaAs&InP (III-V) group materials, Nanotribology and materials, characterization using Scanning Probe Microscope, AFM and Friction force microscopy.

UNIT - III

Nano Structures: Zero dimensional Nanostructure, synthesis procedure by heterogeneous method,characterization techniques, properties and applications particles

One dimensional Nanostructures: Nanowires, Nanotubes and its Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires

UNIT - IV

Nano Fabrication: Introduction, Basic fabrication techniques by Lithography, thin film deposition and doping,MEMS fabrication techniques, Nano fabrication techniques by E-beam, Nano-imprint fabrication, Epitaxy and strain engineering

UNIT - V

Special Nano Materials: Introduction, Synthesis procedure by metal-polymer, metal ceramic and polymerceramic, Characterization procedures, applications

Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, applications

BReddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. Dieter Vollath, "Nanomaterials: An introduction to Synthesis, properties and applications", Wiley, 2013
2. Guozhong Cao, "Nanostructures and Nano Materials, Synthesis properties and applications", Imperial College Press, 2004
3. Carl C Koch, "Nano materials Synthesis, Properties and applications", Jaico Publishing House, 2008

Suggested Reading:

1. Willia TIlsey Atkinson, "Nano Technology", Jaico Publishing House, 2009
2. George W. Hanson, "Fundamentals of Nanoelectronics", Pearson Education, 2009

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E06

RIGHTS, DUTIES AND LEGISLATION

(Core Elective - II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Understand the value of human rights
2. Understand the Lawful rights available to him and others
3. Create understanding the rights of under privileged and respect them
4. Understand role of an individual in the Civil Society
5. Understand the safety aspects while using technology and to understand the role of NGO's in protecting human rights and environment.

Outcomes: At the end of the course, the students are able to

1. Recall the human rights in the global and national context. (BL-1)
2. Understand the overall view on working of Indian constitution. (BL-2)
3. Analyse the societal problems in the context of human rights. (BL-4)
4. Evaluate implementation of right to development and right to information. (BL-5)
5. Application of human rights for human safety and clean environment. (BL-3)

UNIT-I

Conceptual Background Of Human Rights And Duties: Rights, inherent, inalienable,universal, indivisible, Values, Dignity, liberty, equality, justice, unity in diversity, Need for balance between Rights and Duties, Freedom and Responsibility, Theories of human rights, History of human rights civilization, Human rights movements, Universal declaration of human rights 1948, classification and three generations of human rights and sarvodaya.

UNIT-II

Human Rights And Duties In India: Evolution, Independence movement, making of theConstitution, Indian Constitution, Fundamental Rights, Directive Principles, Fundamental duties, Their Interrelationship, Enforcement and protection mechanism of human rights in India, Judiciary, Article 32 and 226 of Indian Constitution, National Human Rights Commission and other Commissions and Committees, Non-governmental organizations, Information Media, Education.

UNIT-III

Societal Problems: Core Problems, Poverty, underdevelopment and illiteracy, Women, children andthe disadvantaged groups, National and state commissions of Women/children/minority/SC/ST.

UNIT-IV

Right to Development: Socio-Economic and Cultural Effects of Globalization, Right to Education,Transparency in Governance and Right to Information, Consumer Protection act.

UNIT-V

Environment Rights Such as Right to Clean Environment and Public Safety: Issues of Industrial Pollution,Prevention, and Rehabilitation, Safety aspects of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment.

Sreddy
PROFESSOR & HEAD
Department of Mechanical Engine
Chaitanya Bharathi Institute of Technol
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. Mr. Ishay, "The history of Human rights", Orient Longman, New Delhi, 2004.
2. S.N. Chaudhary, "Human Rights and Poverty in India: Theoretical Issues", Delhi: Concepts, 2005.
3. Anuradha Kumar, "Encyclopedia of Human Rights Development of under Privilege", New Delhi: Sarup, 2002.

Suggested Readings:

1. K.P. Saksena, "Human Rights and the Constitution: Vision and the Reality", New Delhi: Gyan Pub., 2003.
2. Dr.J.N.Pandey, "Constitutional Law of India", Central Law Agency; Central Law Agency; 37th Edition, 2001.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E04

NON DESTRUCTIVE TESTING AND EVALUATION

(Core Elective-II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Need, basic concepts and technologies of Non Destructive Testing (NDT).
2. Security precautions from Radiography, protection from radiation and measurement of radiation received by personnel.
3. Technologies like neutron radiography; laser induced ultrasonics, surface analysis and thermography.
4. Merits and demerits of the different NDT Technologies.
5. Latest research and developments in NDT.

Outcomes: At the end of the course, the students are able to

1. Understand Non Destructive Testing techniques of Dye penetrant inspection andMagnetic particle inspection. (BL-2)
2. Compareeddy current testing with other NDT methods. (BL-2)
3. Identify different types of defects using ultra sonic testing. (BL-2)
4. Analyze the radiograph to detect the defects by using principles of radiography. (BL-4)
5. Interpretlatest techniques of NDT with other methods. (BL-3)

UNIT - I

Dye Penetrant Inspection: Principles of penetrate inspection, characteristics of a penetrate, water washablesystem, post emulsification system, solvent removable system, surface preparation and cleaning, penetrate application, development, advantages limitations, and applications.
Magnetic Particle Inspection: Principle, magnetization methods, continuous and residual methods,sensitivities, demagnetization, magnetic particles, applications, advantages and limitations.

UNIT - II

Eddy Current Testing: Principle, lift-off factor, and edge effect, skin effect, inspection frequency, coilarrangements, inspection probes, types of circuit, reference pieces, phase analysis, display methods and applications.

UNIT - III

Ultrasonic Testing: Generation of ultra sound, characteristics of an ultrasonic beam, sound waves at interfaces,sound attenuation, display systems, probe construction, type of display, inspection techniques, identification of defects, Immersion testing , sensitivity and calibration, reference standards, surface condition, applications.

UNIT - IV

Radiography: Principle and uses of radiography, limitation principle, radiation sources, production of X-Rays,x-ray spectra, attenuation of radiation, radiographic equivalence, shadow formation enlargement and distortion, radio graphic film and paper, Xeroradiography, fluoroscopy, exposure factors, radiographic screens, identification markers and image quality indicators, inspection of simple shapes, inspection of complex shapes, viewing and interpretation of radiographs, radiation hazard, protection against radiation, measurement of radiation received by personnel.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - V

Acoustic Emission: Physical Principles, Sources of emission, instrumentation and applications, Other NDT Techniques: Neuron radiography, Laser induced ultrasonic, surface analysis, and thermography.

Text Books:

1. Barry Hull & Vernon John, "Non Destructive Testing", 1988
2. H J Frissell (Editorial Coordinator), "Non-Destructive Evaluation and quality control", ASM handbook-International Publication USA, 1989.
3. Don.E. Bray, Roderic K. Stanley: Nondestructive Evaluation- A Tool in Design, Manufacturing, and Service, Revised Ed, CRC Press, 1997.

Suggested Reading:

1. Paul E. Mix, "Introduction to Nondestructive Testing- A Training Guide", John Wiley & Sons, 2005.
2. J. Prasad and C. G. K. Nair, "Non-Destructive Test and Evaluation of Materials", Tata McGraw-Hill Education, 2nd edition, 2011.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E07

FUELS AND COMBUSTION

(Core Elective-II)

(Use of combustion tables is permitted)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Different types of solid fuels and gaseous fuels with their properties.
2. The principles of refining liquid fuels, properties & their tests.
3. The thermodynamics of combustion and stoichiometric relations.
4. Features of different types of burners.
5. The importance of control of air pollutants and its effect on human being and environment.

Outcomes: At the end of the course, the students are able to

1. Analyse quality of fuels based on its properties with a special emphasis on environment with merits and demerits. (BL-4)
2. Understand the refining methods of various liquid fuels using the principles of engineering with a special focus on public health and safety and environmental considerations. (BL-2)
3. Estimate the theoretical air fuel ratio for different types of combustion processes using basic laws of thermodynamics in the context of environment. (BL-5)
4. Identify various techniques of utilizing fuels with different combustion appliances for cleaner environment and safety. (BL-3)
5. Understand the impact of pollutants on environment and to demonstrate the knowledge for sustainable development. (BL-2)

UNIT-I

Solid fuels: Origin of coal; analysis of coal-proximate analysis and ultimate analysis; tests on coal-calorific values, caking, fusibility, grindability; coal petrology; classification of coal; other solid fuels-wood, wood charcoal, coke, fuel briquettes.

Gaseous fuels: Natural gas, methane from coal mines, coal gas, blast furnace gas, liquefied petroleum gas (LPG); properties and testing of fuel gases; alcohols and biogas.

UNIT-II

Liquid Fuels: Origin of petroleum-deposition of organisms , reservoir rock; chemistry of petroleum-paraffins, olefins , napthenes, aromatics; refining of petroleum-fractional distillation, cracking, reforming, alkylation, polymerization, isomerisation; properties and tests for petroleum products; important petroleum products-motor gasoline, aviation gasoline, kerosene, jet fuels, diesel oils, fuel oils.

UNIT-III

Combustion of Fuels: Combustion Stoichiometry-- stoichiometric air, excess air, flue gas analysis, dew point of flue gases. Thermodynamics of Combustion--gross calorific value, net calorific value, enthalpy of combustion, enthalpy of formation; adiabatic flame temperature at constant pressure and constant volume.

UNIT-IV

Combustion Appliances: Classification; Coal burning equipment--over feed stokers, chain -grate stokers, under feed stokers, pulverized coal burners, cyclone furnaces. Oil burners--vaporized burners, rotary-cup oil burners, mechanical atomizing burners, high pressure and low pressure atomizing burners .Gas burners--non-aerated burners, aerated burners, surface combustion burners.

UNIT-V

Environmental Considerations: Air pollution types-grit and dust, smoke, gaseous pollutants; combustion generated air pollution and its control-air pollution from combustion of fossil fuels, air pollution from automobiles; effects on environment and human health; emission Standards.

Text Books:

1. Samir Sarkar, "Fuels & Combustion" Orient long man, 1996.
2. S.P. Sharma and Chander Mohan, "Fuels and Combustion", Tata McGraw Hill, 2004.
3. Roger A Strehlow, "Combustion Fundamentals ", Tata McGraw Hill, 1985.

Suggested Reading:

1. Shaha A K,"Combustion Engineering and Fuel Technology ", Oxford and IBH, 1974.
2. Stephen R. Turns,"An introduction to combustion", McGraw Hill International Edition, 2011.

Combustion Data Tables:

1. Combustion enthalpy tables from "Thermodynamics-An engineering approach" by Yunus A. Cengel, Michael A. Boles, McGraw Hill, 9th edition, 2019

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C15

DYNAMICS AND VIBRATIONS LAB

Instruction	2	Hours per week
Duration of SEE	2	Hours
SEE	35	Marks
CIE	15	Marks
Credits	1	

Objectives:

1. To demonstrate basic principle and exposure to evaluate CAM Follower Motion and Gyroscopic effects.
2. The importance of static and dynamic balancing.
3. The methods of controlling speeds of prime movers
4. To acquire the knowledge in evaluating the stability of vehicles
5. Frequency response of spring mass system with damping and without damping - Undamped torsional vibrations of single and double rotor systems

Outcomes: At the end of the course, the students are able to

1. Demonstrate the dynamic behavior of mechanical systems. (BL-3)
2. Analyze the cam profile for different motion characteristics. (BL-4)
3. Examine the performance of governors and the gyroscopic effect on vehicles. (BL-3)
4. Evaluate the static and dynamic balancing masses in a rotating mass system. (BL-5)
5. Determine the natural frequency of different single degree freedom vibrating systems. (BL-3)

List of the Experiments

1. To study the motion of follower with the given profile of the cam. To plot the follower displacement vs angle of rotation curves for different cam follower pairs.
2. To study the gyroscopic effect on a rotating disc.
3. Determination of the frequency of torsional vibrations.
4. Static and Dynamic balancing in a rotating mass system.
5. Study the effect of varying mass on the centre of sleeve in Porter governor.
6. Study the effect of varying the initial spring compression in Hartnell governor.
7. Undamped torsional vibrations of double rotor system.
8. To study the longitudinal vibrations of helical coiled spring.
9. To study the undamped forced vibration of spring mass system.
10. To study the force damped vibration of spring mass system.
11. Determination of critical speed of the given shaft with the given end conditions (Whirling of Shafts).
12. Frequency response of spring mass system with damping.
13. Determine the equivalent link parameters and centre of mass of connecting rod theoretically and validate the result by experiment by choosing suitable methods and devices.

NOTE: Students should complete a minimum of 10 experiments including experiment 13 which is compulsory.

Text Books:

1. S.S. Rattan, "Theory of Machines", Fourth edition Tata-Mc Graw Hill, ,2014
2. John.J.Vicker, Gordon R. Pennock, Joseph E. Shigley, "Theory of Machines & Mechanisms", Oxford University Press, 2003.
3. William T.Thomson "Theory of Vibration with Application", 5th edition, Pearson education 2008

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Robert L. Norton, "Design of Machinery", Tata Mc Graw Hill, 2005.
2. Benson H. Tangue, "Principles of Vibration", 2/e, Oxford University Press, 2007

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C16

APPLIED THERMODYNAMICS AND HEAT TRANSFER LAB

Instruction	2	Hours per week
Duration of SEE	2	Hours
SEE	35	Marks
CIE	15	Marks
Credits	1	

Objectives:

1. To demonstrate basic knowledge and exposure to determine valve and port diagram and also to evaluate the performance of the petrol engine and diesel engine.
2. Student will determine the importance of heat balance sheet of IC engine.
3. Students will acquire knowledge in evaluating the performance of multi-stage reciprocating compressor.
4. To demonstrate knowledge in evaluating thermal conductivity and heat transfer coefficient under natural convection phenomena and forced convection phenomena.
5. Students will understand the basic concepts of radiation heat transfer.

Outcomes: At the end of the course, the students are able to

1. Evaluate the performance of petrol and diesel engines. (BL-5)
2. Evaluate the heat losses in heat balance sheet of IC engine. (BL-5)
3. Determine the performance of multi stage reciprocating air compressor and its importance over single stage air compressor. (BL-3)
4. Estimate the effect of insulation on conduction heat transfer and also estimate the value of convection heat transfer coefficients under different scenario. (BL-5)
5. Determine Stefan - Boltzmann constant, emissivity of grey plate and LMTD of heat exchanger. (BL-3)

List of the Experiments:

Applied Thermodynamics

1. Determination of Valve timing diagram and Port diagram of IC engine.
2. Determination of Performance characteristics of a multi-cylinder petrol engine.
3. To conduct Morse test on multi cylinder petrol engine.
4. To conduct performance test on a variable compression ratio petrol engine.
5. To conduct performance test on single cylinder diesel engine
6. To conduct heat balance test on single cylinder diesel engine.
7. To determine volumetric efficiency, isothermal efficiency of multi -stage reciprocating air compressor.

Heat Transfer

8. Determination of thermal conductivity of composite wall.
9. Determination of convective heat transfer coefficient under Natural and Forced convection phenomena using pin-fin apparatus.
10. Determination of Emissivity of a given plate.
11. Determination of the value of Stefan-Boltzmann constant.
12. Determination of Heat transfer coefficient in parallel and counter flow heat exchanger.
13. Evaluate the performance parameters of an alternative fuel on a vertical stroke single cylinder diesel engine.

Note: Students should complete a minimum of 10 experiments including experiment 13 which is compulsory.

BReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

Text Books:

1. Mahesh M. Rathore, "Thermal Engineering", TMH, New Delhi, 2010
2. V. Ganeshan,"Internal Combustion Engines", Tata Mcgraw Hill Publishing, New Delhi,2015
3. J.P. Holman, "Heat Transfer", McGraw Hill Publication, New Delhi, 2009

Suggested Reading:

1. R.K. Rajput., "Thermal Engineering", Laxmi Publishers, New Delhi, 2014
2. D.S. Kumar," Heat Transfer", S K Kataria Publishers, 2015

PROFESSOR & HEAD
...rtment of Mechanical Engineering
...tanya Bharathi Institute of Technology (A)
...dipet, Hyderabad-500 075. Telangana

18PE C08

METAL CUTTING AND MACHINE TOOL ENGINEERING LAB

Instruction	2	Hours per week
Duration of SEE	2	Hours
SEE	35	Marks
CIE	15	Marks
Credits	1	

Objectives: Students will learn

1. To grind single point cutting tool using HSS as cutting tool
2. To do various operations like plain turning, step turning, knurling
3. Work shop practice on lathe drilling and milling machines
4. Measure cutting forces during machining on Lathe machine, milling
5. Unconventional machining operations like EDM & ECM

Outcomes: At the end of the course, the students are able to

1. Identify tool geometry and grind to a given tool signature. (BL-2)
2. Perform various machining operations to produce components of different shapes and also using jigs &fixtures. (BL-3)
3. Determine the shear angle at various cutting conditions. (BL-4)
4. Evaluate cutting forces using dynamometer, estimate MRR & power consumption under different cutting conditions. (BL-5)
5. Plan and create components of utility using various manufacturing facilities in the laboratory. (BL-6)

List of the Experiments

1. Facing and plain turning operations on lathe.
2. Step turning and knurling on lathe machine.
3. Taper turning on lathe.
4. Drilling and boring on lathe.
5. Thread cutting on lathe.
6. Influence of process parameters on MRR in turning operation.
7. Grinding of single point cutting tool.
8. Gear cutting using (a) Plain Indexing. (b) Compound indexing using universal dividing head.
9. Measurement of cutting forces during machining on lathe machine and milling machine.
10. Finding shear angle experimentally in turning operation.
11. Grinding flat surfaces using surface grinding machine and measurement of surface finish.
12. Process parameters of electro discharge machining (EDM).
13. Design utility component, prepare process sheet for the manufacturing of the same and produce the component in the lab. .

Note: Student should complete a minimum of 10 experiments including experiment number 13 which is compulsory.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. P N Rao, "Manufacturing Technology – Metal Cutting & Machine Tools", 3/e Tata McGraw-Hill Publishing Company Limited, 2013.
2. B L Juneja and G S Sekhon, "Fundamentals of Metal Cutting and Machine Tools", New Age International publishers, 2001.
3. Kalpakjian S. and Steven R. Schmid, "Manufacturing, Engineering & Technology", Pearson Education, 2007

Suggested Reading:

1. David A. Stephenson, Johs S. Agapiou, "Metal Cutting Theory and Practice", CRC Press, 3rd Edition, March 2016
2. Amitabha Ghosh and Ashok Kumar Mallik, "Manufacturing Science", Affiliated East-West Press Pvt. Ltd. 2nd Edition, 2010

PReddy
PROFESSOR & HEAD
...rtment of Mechanical Engineering
...ya Bharathi Institute of Technology (A)
... 1, Hyderabad-500 075. Telangana

18ME C17

CAD/CAM

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To teach the basic design process and the importance and types of geometric modeling techniques
2. To teach the theory for modeling of surface and solid modeling techniques
3. To impart the basic skill in writing CNC part programming
4. To teach basic configurations of robot Manipulator
5. To teach concepts of part classification coding, computer aided process planning, automated inspection methods

Outcomes: At the end of the course, the students are able to

1. Understand the applications of computer in design, manufacturing, and geometric transformation techniques (BL-2)
2. Apply Wireframe, surface, and solid modeling techniques for the generating various parts. (BL-3)
3. Distinguish various NC systems and develop the CNC program. (BL-4)
4. Demonstrate the fundamentals knowledge of robotics (BL-2)
5. Understand automated manufacturing environment. (BL-2)

UNIT-I

Introduction: Introduction to CAD, Product life cycle, Design Process, Design criteria, Alternative solutions, Hardware integration and networking, Graphic Standards and Exchange Formats (IGES, STEP, STL)
Geometric Transformations: Introduction, Translation, Rotation, Scaling, Reflection Transformations, Homogenous Representation, Concatenated Transformation, Transformations about fixed point

UNIT-II

Wire frame Modeling: Wire frame entities and their definition, interpolation and approximation curves. concept of parametric and non-parametric representation of circle and helix curves, properties of splines, synthetic curves: parametric representation of cubic spline, Bezier and B-spline curves, continuity, properties and characteristics, Introduction to non-uniform rational B-splines.
Surface Modeling: Surface representation Analytic surfaces: definition of Plane surface, Ruled surface, Surface of revolution, Tabulated cylinder, Synthetic Surfaces- Hermite cubic and Bezier surfaces.
Solid Modeling: Solid entities, Boolean operations, B – rep and CSG approaches, feature based modeling, assembly modeling and mating conditions

UNIT-III

Numerical Control of Machine Tools: Features and elements of NC, Types of NC systems: PTP, straight Cut and Contouring. definition of axes, definition of interpolation, post-processor, preparatory and miscellaneous functions, canned cycles, tool length and cutter radius compensation. Manual part programming and computer aided part programming for simple components (APT).

UNIT-IV

CNC: Introduction to CNC, Typical configurations, Machining centers, Introduction to FANUC, SINUMERIC controllers
DNC: Typical configurations, CNC vs DNC.
Adaptive Control Systems: ACO and ACC.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Industrial Robots: Robot anatomy, configurations, control systems, drivers, accuracy and repeatability, end effectors, sensors in robotics, programming methods.Robot industrial applications: material handling, processing and assembly and inspection.

UNIT-V

GT: Part families, layout, part classification and coding system- OPITZ, MICLASS.

CAPP: Variant and Generative process planning.

FMS and CIM: FMS equipment, FMS layouts, benefits of FMS, Elements of CIM.

Computer Aided Inspection and QC: Automated inspection- Off-line, On-line, Contact (Co-ordinate measuring machine), Non-contact inspection (Machine Vision, Scanning LASER Beam, Photogrammetry).

Text Books:

1. Ibrahim Zeid, "CAD/ CAM Theory and Practice", McGraw Hill Inc, New York, 2011.
2. Mikell P.Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", Pearson Publication, 4/e, 2016.
3. P.N. Rao, "CAD/CAM - Principles and Applications", 2/e, Tata McGraw Hill, New Delhi, 2004.

Suggested Reading:

1. Yoram koren, "Computer Control of Manufacturing Systems", McGraw Hill Int, New York, 1994.
2. C. Elanchezhian, T. Sunder Selwyn, G. Shanmuga Sunder, "Computer Aided manufacturing", 2/e, Laxmi Publications (P) Ltd, New Delhi 2007.

PReddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C18

MACHINE DESIGN

(Use of data book is permitted)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Design principles of helical coiled and leaf springs. types of materials used for springs
2. The design principles of gears
3. The design principles of sliding contact bearings
4. The Selection of rolling contact bearings and roller chains
5. Design principles of IC engine piston, connecting rod, crank shaft, C-clamp and crane hooks

Outcomes: At the end of the course, the students are able to

1. Understand the stresses in helical, leaf springs under static and fluctuating loads. (BL-2)
2. Design the spur, helical and bevel gears. (BL-6)
3. Demonstrate the ability in designing sliding contact bearings. (BL-3)
4. Selection of rolling contact bearings and roller chains. (BL-4)
5. Design of IC engine piston, connecting rod, crank shaft, C-clamp and crane hooks. (BL-6)

UNIT-I

Mechanical Springs: Introduction, types of springs, Materials used for springs.
Helical Springs: Wahl's factor, calculation of stresses, deflection and energy stored in spring. Design for staticand fluctuating loads.
Leaf Springs: Stresses and deflection, nipping of Leaf springs. Design for static loads.

UNIT-II

Gears: Introduction to gear drives, types of gears, materials used for gears, Standards and specification of gears,Design of Spur, Helical and Bevel gears. Lewis beam strength equation. Dynamic loads on gear tooth. Wear load and design for wear strength.

UNIT-III

Bearings: Introduction, classification of bearings, materials used for bearings, properties and types oflubricants.
Design of Sliding Contact Bearings: Hydrodynamic bearings: journal bearing and thrust bearings.
Selection of Rolling Contact Bearings: Types of rolling elements and their constructional details, Static anddynamic load carrying capacity, Load-life relationship, selection of bearing, for cyclic loads and speeds.

UNIT-IV

I.C. Engine Parts: Introduction, Materials used, Design of piston, connecting rod and overhang crank shaft.

UNIT-V

Design of Curved Beams: Introduction, stresses in curved beams, expression for radius of curvature of neutralaxis for rectangular, circular and trapezoidal sections, Design of C-clamp and crane Hook.
Selection of chain drives: Power rating of roller chains, Strength of roller chains.

Text Books:

1. V.B. Bhandari, "Design Machine Elements", Mc Graw Hill Publication, 2017.
2. J.E. Shigley, C.R. Mischne, "Mechanical Engineering Design", Tata Mc Graw Hill Publications, 2015.
3. R.S.Khurmi and J.K.Gupta, "Machine design", 34th edition, S Chand publications, 2018.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
...bad-500 075, Telangana

Suggested Reading:

1. P. Kannaiah, "Machine Design", Sci-Tech Publications, 2010
2. M.F. Spotts, "Design of Machine Elements", Prentice Hall of India, 2013.

Machine Design Data Books:

1. K.Mahadevan, K.BalaveeraReddy.,"Design Data Hand book for Mechanical Engineers", 3/e, CBS Publisher, 2018
2. PSG College, "Design Data book",2012

Preddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C19

THERMAL TURBO MACHINES

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Student will acquire basic knowledge in designing of nozzles and diffusers used in rockets and aircrafts.
2. Student will come to know the design of ducts, combustion chambers and various types of shocks.
3. Student will come to know the working principles of various rotary compressors like centrifugal compressor and rotary compressor.
4. Student will understand the applications of various steam turbines and velocity triangles in order to calculate power developed by them.
5. Student will demonstrate the basic knowledge in gas turbines and various methods to improve efficiency of gas turbine cycles

Outcomes: At the end of the course, the students are able to

1. Design various configurations of nozzles and diffusers with the principles of Thermodynamics, Fluid mechanics and Heat transfer to meet specified needs. (BL-6)
2. Predict the compressible flow properties behavior with friction, heat transfer and shock waves for complex engineering problems (BL-3)
3. Estimate the power required for various types of rotary compressors using the principles of gas dynamics for engineering problems. (BL-5)
4. Understand the working principle of steam turbines, velocity triangles and performance parameters using principles of turbo machinery. (BL-2)
5. Discuss the working principle of gas turbine, jets and rocket propulsions incorporating methods for efficiency improvement in gas turbine cycles. (BL-2)

UNIT-I

Introduction to Compressible Flows: Speed of propagation of pressure waves, Mach number, Acousticvelocity and Mach cone, limits of compressibility, pressure field due to a moving source of disturbance, one dimensional compressible flow. Isentropic flow with variable area, Mach number variation, Area ratio as function of Mach number, flow through nozzles and diffusers Flow with Shock Waves-Development of Normal Shock waves, governing equations

UNIT-II

Flow in Constant Area Ducts with Friction-Fanno Flow: Variation of flow properties, variation of Machnumber with duct length, isothermal flow with friction, Prandtl – Meyer relation, Rankine-Hugoniot equations and Stagnation pressure ratio across shock.

UNIT-III

Rotodynamic Compressors: Introduction and general classification, Comparison of Reciprocating and Rotarycompressors, Positive displacement Rotary compressors, Flow through rotary compressors. Static and total head quantities. Thermodynamic cycles and work done, calculation of various efficiencies. Velocity diagrams and prewhirl. Euler equation for energy transfer between fluid and rotor, Analysis of Centrifugal compressors and analysis of axial flow compressors, Chocking, Surging and Stalling.

UNIT-IV

Steam Turbines: Introduction to steam nozzles, design for throat area, Classification of steam turbines, Impulseturbine, compounding of steam turbines, Pressure velocity variations across different compounding turbines, blade efficiency and work done by impulse turbine, degree of reaction of reaction turbine, blade efficiency and work done by reaction turbine, stage efficiency and nozzle efficiency and simple problems on impulse and reaction turbines.

PROFESSOR & HEAD
Department of Mechanical Engineering
...ya Bharathi Institute of Technology (A)
...-500 075. Telangana

UNIT-V

Gas Turbines: Applications and classification of Gas Turbines- constant pressure and constant volume gasturbines, Joule cycle-configuration diagram and temp-entropy diagram, Thermal efficiency of Joules cycle, maximum pressure ratio in terms of temperature ratio, optimum pressure ratio for maximum work output with and without considering machine efficiencies, Improvement of gas turbine plant performance- Inter-cooling, Reheating and Regeneration. Simple problems on Joule cycle.

Air Craft Propulsion: Air craft engine types, air craft propulsion theory, Turbo jet engines, Ramjet engines,Pulse jet engines.

Rocket Propulsion: Types of Propellants, types of Rocket engines, Rocket propulsion theory- Rocketapplications.

Text Books:

1. S M Yahya, "Fundamentals of Compressible Flow", New Age International Publishers, 2014.
2. Mahesh M. Rathore, "Thermal Engineering", TMH, New Delhi, 2010
3. M L Mathur & F S Mehta, "Thermal Engineering", Jain Brothers, New Delhi, 2014

Suggested Reading:

1. V. Ganeshan, "Gas Turbines", Tata Mc Graw Hills, New Delhi, 2010.
2. R Yadav, "Steam and Gas Turbines", Central Publishing House Ltd, Allahabad, 2003.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E08

OBJECT ORIENTED PROGRAMMING WITH C++

(Core Elective-III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To understand difference between OOP and structured programming
2. To know classes, objects, constructors and destructors.
3. How to overload operators.
4. To understand inheritance and polymorphism
5. Knowledge about templates and exception handling.

Outcomes: At the end of the course, the students are able to

1. Identify fundamental object oriented concepts of C++ programming Language. (BL-1)
2. Distinguish between object oriented program and structured programming (BL-2)
3. Use operator overloading to give comfort in the programming. (BL-3)
4. Illustrate Exception handling and templates (BL-4)
5. Solve basic mechanical engineering problems by developing programs using object oriented features (BL-5)

UNIT - I

Principles of Object Oriented Programming: Procedure Vs Object Oriented, Paradigm, Basic concepts,benefits, Applications and Object Oriented Languages.

Introduction: Program structure, Creating, Compiling and Linking of C++ program.

Token, Expression and Control Structures: Tokens, Keywords, Identifiers and Constants, Data Types,Operators, Precedence, Type Compatibility, Control Structures, New Features of C++.

Functions: Function Prototype and Parameter Passing, Inline Functions, Default, Constant Arguments,Recursion, Function Overloading

UNIT - II

Classes and Objects: Defining classes and Member functions, creating objects, objects and arrays, objects andfunctions, const with classes, friends to a class, nesting static members of a class.

Constructors and Destructors: Type of Constructors, Dynamic Initialization of Objects, Destructors.

UNIT - III

C++ Operator Overloading and Type Conversions: Fundamentals, restrictions, overloading unary / binaryoperators, overloading ++ and —, overloading special operators, overloading by member functions and friend functions, type conversions.

UNIT - IV

C++ Inheritance: Defining derived classes, Types of Inheritance, Virtual Base class Abstract Class, functionoverriding and containership.

Pointers and Polymorphism: Pointers and Generic pointer, Pointer to Objects and Derived Classes, thispointer, Virtual Functions, Virtual Destructors

UNIT - V

C++ Templates: Introduction, function templates and class templates.

C++ Exception Handling: Conventional error handling mechanism, C++ error handling mechanism, Try,throw, catch, exception handling in classes.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. Rohit Khurana, "Object oriented programming with C++", Vikas publications. 2/e, 2014.
2. Ashok Kamtani, "Object Oriented Programming with ANSI and Turbo C++", Pearson Education, 2017.
3. Somshekara, "Object Oriented Programming with C++", Eastern Economy Edition, 2/e, 2012.

Suggested Reading:

1. E. Balagurusamy, "Object Oriented Programming with C++", McGraw-Hill Education (India), 6/e, 2018.
2. Robert Lafore, "Object-Oriented Programming in C++", 4/e, Sams Publishing, 2016.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E09

MECHANICS OF COMPOSITE MATERIALS

(Core Elective - III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Application and use of composite materials in industry.
2. Types of fibers and matrix materials used in commercial composites.
3. Prediction of the properties of UD lamina based on the constituent materials.
4. Analysis of composite laminates based on classical lamination theory.
5. Method of predicting failure in composite lamina using different theories.

Outcomes: At the end of the course, the students are able to

1. Differentiate between composite materials and conventional materials using basic concepts. (BL-2)
2. Analyze macro and micro mechanical behaviour of a lamina. (BL-4)
3. Determine role of constituent materials in defining the average properties and response of composite materials on macroscopic level. (BL-3)
4. Analyze the laminates for stresses and strains using Classical lamination theory (BL-4)
5. Summarize the various fabrication methods of composite materials and measurements of properties through tests. (BL-2)

UNIT-I

Introduction: Definition, characteristics, overview of advantages and limitations of Composite materials, classification, significance, objectives of composite materials and applications.

UNIT-II

Basic concepts and characteristics: Scale of analysis; Micromechanics, Macromechanics, Macro and micro mechanical behaviour of a lamina: Stress strain relations for anisotropic materials, Restrictions on engineering constants, transformation of stress, Strain and elastic parameters.

UNIT-III

Elastic behaviour of UD Lamina: Elastic constants of a lamina using MOM approach, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation. Tensile and compressive strength of unidirectional fibre composites, Macromechanical failure theories, applicability of various failure theories. Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria.

UNIT-IV

Elastic Behaviour of Laminate: Basic assumptions, Strain-displacement relations, classical Lamination Theory [CLT], Stress-strain relation of layer within a laminate, Force and moment resultant, classification of laminates. Analysis of different types of laminates.

UNIT-V

Manufacturing Processes& Testing: Hand lay-up, bag molding, autoclave processing, RTM, pultrusion, filament winding, gel time test for resins, curing cycle, Testing: Fiber and matrix tests, tensile test, compressive test, in-plane shear test, inter-laminar shear test, flexure test.

Text Books:

1. R. M. Jones, "Mechanics of Composite Materials", Mc Graw Hill Co., 2006.
2. B. D. Agarwal, "Analysis and performance of fiber composites", Wiley & Sons 3/e, 2013.
3. Ronald F Gibson, "Principles of composite material mechanics", CRC press. 4/c, 2016.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Isaac M. Daniels and Ori Ishai, "Engineering Mechaincs of Composite Materials", Oxford University Press, 1994.
2. M.W.Hyer, "Stress Analysis of Fibre Reinforced Composite Materials", McGraw Hill Co., 1998.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E10

ROBOTIC ENGINEERING

(Core Elective–III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Principle of working of a robot, types and specifications,configuration, work envelop and motion controls and applications
2. Transformations, kinematics and dynamics of robots
3. Singularities, Jacobian and trajectory planning of a robot to prepare the robot for various tasks
4. Design of end effectors, drives, working of sensors and controllers for finding position and orientation.
5. Robot vision for image acquisition and processing and plan for various tasks and various Languages and Programming methods of robot.

Outcomes: At the end of the course, the students are able to

1. Understand the basic components and specifications of the Robots (BL-2)
2. Solve the problems of transformations, direct and inverse kinematics of robots (BL-3)
3. Analyze forces in links and joints of a robot and find the singularities, Jacobian and trajectory planning of a robot for various tasks (BL-4)
4. Recommend sensors and controllers for finding position and orientation to take corrective action based on feedback (BL-5)
5. Design an intelligent robot using machine vision and sensors (BL-6)

UNIT - I

Overview of Robots and Subsystems: Brief History, Types of robots, resolution, repeatability and accuracy,degrees of freedom of robots, Robot configurations, Workspace, Mechanisms and transmission, End effectors and Different types of grippers, vacuum and other methods of gripping, Pneumatic, hydraulic and electrical actuators, applications of robots, specifications of different industrial robots.

UNIT – II

Direct Kinematics: Rotation matrices, Euler angle and RPY representation, Homogeneous transformationmatrices, Denavit-Hartenberg notation, representation of absolute position and orientation in terms of joint parameters, direct kinematics.

UNIT - III

Inverse Kinematics: inverse orientation, inverse locations, Singularities, Jacobian, Trajectory Planning: jointinterpolation, task space interpolation, executing user specified tasks, sensor based motion planning.

UNIT - IV

Analysis of RP and RR Type Robots: Static force analysis of RP type and RR type planar robots, Dynamicanalysis using Lagrangean and Newton-Euler formulations of RR and RP type planar robots. Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, force feedback, hybrid control

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - V

Sensors and Controllers: Internal and external sensors, position, velocity and acceleration sensors, proximitysensors, force sensors, laser range finder. Robot vision: image processing fundamentals for robotic applications, image acquisition and preprocessing. Object recognition by image matching and based on features

Text Books:

1. Nagrath and Mittal, "Robotics and Control", Tata McGraw-Hill, 2003.
2. Spong and Vidyasagar, "Robot Dynamics and Control", John Wiley and sons, 2008.
3. Mikell P. Groover " Industrial Robotics", McGraw-Hill, 2008.

Suggested Reading:

1. Fu. K.S, Gonzalez, R.C., Lee, C.S.G, "Robotics, control, sensing, Vision and Intelligence", McGraw Hill International, 1987
2. Steve LaValle, "Planning Algorithms", Cambridge Univ. Press, New York, 2006.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E06

PRODUCTION AND OPERATIONS MANAGEMENT

(Core Elective-III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Understand plant layout design to facilitate material flow and processing of a product in the most efficient manner
2. Gain some ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making on operations management and strategy.
3. Understand how Materials Requirement Planning and MRPII systems are used in managing operations
4. Recognize the importance of Inventory control to ensure their availability with minimum capital lock up.
5. Evaluate the quality processes in manufacturing and service sector to improve the operational performance

Outcomes: At the end of the course, the students are able to

1. Understand the role of production system and its design in Production and Operations Management. (BL-2)
2. Apply forecasting techniques for predicting demand. (BL-3)
3. Use Aggregate Planning, Master Scheduling and Materials Requirement Planning in a production system. (BL-3)
4. Compare various inventory control techniques used in production system. (BL- 4)
5. Apply the quality control tools to improve performance of production system. (BL- 3)

UNIT-I

Introduction: Production systems classification and characterization

Plant Location and Layout: Factors affecting plant location, Objectives of Plant layout, different types of layouts, merits and demerits.

Work Study: Productivity, Introduction to method study and work measurement, standard time calculations, work sampling, wages and incentive plans.

UNIT-II

Forecasting: Introduction, forecasting objectives and uses, demand patterns, qualitative models, market survey,Delphi method, quantitative models, moving average, weighted moving average, simple exponential smoothing, trend adjusted exponential smoothing, simple regression.

Forecast Errors: Mean Absolute Deviation (MAD), Mean Square Error (MSE), Mean Forecast Error (MFE),Mean Absolute Percentage Error (MAPE)

UNIT-III

Aggregate Planning and Master Scheduling: Introduction, objectives of aggregate planning, cost in aggregateplanning, strategies in aggregate planning, master production scheduling

Materials Requirement Planning (MRP): Importance of MRP, MRP system inputs and outputs, bill ofmaterials (BOM).

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
...ndipet, Hyderabad-500 075, Telangana

UNIT-IV

Inventory Control: Importance of Inventory control, Inventory control systems, Types of Inventories, Inventory costs, Deterministic Inventory models - Basic Purchase model, Purchase model with Instantaneous replenishment and with shortages, Basic Production model, Production model with shortages, Inventory model with price breaks.

UNIT-V

Quality Control: Introduction, quality gurus and their contributions, quality tools, process capability, qualitycontrol by control charts, control charts for variables and attributes, sampling plans, operating characteristic curve, introduction to total quality management (TQM).

Text Books:

1. William J. Stevenson, "Operations Management", 8/e, Tata Mc Graw Hill Edition, 2005.
2. Joseph G. Monks, "Operations Management: Theory and Problems", 3/e, McGraw Hill International Edition, 1987.
3. ElwoodS. Buffa, "Modern Production/Operations Management", 5/e, John Wiley Publishers, Singapore, 2002.

Suggested Reading:

1. Everrete E. Adama & Ronald J. Ebert, "Production & Operations Management", 5/e, Prentice Hall of India, 2005.
2. R. Panneerselvam, "Production and Operations Management," 2/e, PHI Learning Pvt. Ltd., New Delhi, 2006.

Preddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

18ME E11

ADVANCED IC ENGINES

(Core Elective-III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Fundamental working principles of diesel/petrol engines.
2. Importance of combustion phenomena in I.C. Engines.
3. Importance of control of pollutants and their remedies and working principles of analyzers for measurements of pollutants.
4. Concept of alternative fuel technology to improve the performance of the engine.
5. Concepts of recent trends in IC engines.

.**Outcomes:** At the end of the course, the students are able to

1. Evaluate the performance of SI/ CI engines with emphasis on environment (BL-5)
2. Understand the combustion phenomenon in IC engines with remedial methods for controlling abnormal combustion. (BL-2)
3. Discuss the need and control of I.C Engine emissions in the context of human health and environment. (BL-2)
4. Understand the need for professional and engineering practices required for identifying alternative fuels in the context of fossil fuels depletion to address health, safety and societal issues. (BL-2)
5. Choose appropriate technologies to improve engine performance with alternative power sources for automobiles. (BL-5)

UNIT - I
Fundamentals of IC Engines: Classification, working principles of 2 stroke, 4 stroke SI and CI engines, performance of IC Engines, heat balance sheet; cooling, lubrication systems, battery and magneto ignition systems of IC engines.working principle of simple carburetor, Zenith carburetor and fuel Injector, injection systems-MPFI and CRDI systems.

UNIT - II
Combustion Phenomena: Stages of combustion in SI and CI engines, normal and abnormal combustion phenomenon in SI and CI engines, remedies. combustion chambers for SI & CI engines; supercharging of IC engines: need of supercharging, advantages, limitations and configurations of supercharging.

UNIT - III
Pollutant Formation And Control: Pollutant– sources – formation of carbon monoxide, unburnthydrocarbon, aldehydes, NOx, smoke and particulate matter – methods of controlling Emissions – thermal and catalytic converters, particulate traps, chemical methods and EGR, SCRT- various methods of measurements like flame ionization detector, Infrared gas analyzer, chemiluminescence method and opacity meters; emission norms.

UNIT - IV
Alternative Fuels: Alcohols, vegetable oils, bio diesel, Hydrogen, natural gas, liquefied petroleum gas and bio gas properties, suitability, merits and demerits as fuels.

UNIT - V
Technological Advances in Vehicles: Lean burn engines, stratified charge engines, homogeneous charge compression ignition (HCCI) engines and GDI concepts.
Electric vehicles: Introduction, limitations of IC engines as prime mover, history of EVs, EV system, components of EV-DC and AC electric machines, Introduction and basic structure, electric vehicle drive train, advantages and limitations.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. Ganeshan, V., "Internal Combustion engines", Tata Mc Graw Hills Publishing Co.Ltd, New Delhi 2015.
2. Gill, P.W. and Smith (Jr), J.H, "Fundamentals of Internal combustion Engines", Oxford & IBH publishing Co.New Delhi, 2007
3. Heywood, J.B, "Internal Combustion engine fundamentals", McGrave Hills, Book Co, New York, 1988

Suggested Reading:

1. M.L. Mathur and R.P. Sharma, "Internal Combustion Engine", DhanpatRai&Sons,New Delhi, 2010.
2. Seth Leitman and Bob Brant "Build your own electric vehicle" McGraw Hill Co. 2nd edition, 2009.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E12

COMPUTATIONAL FLUID DYNAMICS

(Core Elective - IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To understand governing equations of fluid flow
2. To understand turbulence and how to model them.
3. To know how to descretize governing equations of fluid flow by FDM and their stability.
4. To learn various iterative methods to solve N-S equation.
5. To understand FVM to solve fluid flow equations.

.**Outcomes:** At the end of the course, the students are able to

1. Describe and develop mathematical models for flow phenomena. (BL-1)
2. Classify PDE for fluid flow and heat transfer applications. (BL-2)
3. Apply Finite Difference Method for fluid flow and heat transfer problems (BL-3)
4. Test the discretized equations for stability and solve the system of linear equations (BL-4)
5. Formulate numerical equations by Finite Volume Method for fluid flow and heat transfer problems (BL-6)

UNIT-I

Basic Equations: Continuity, momentum and energy equations, Navier-Stokes equations, Heat transferconduction equations for steady and unsteady flows, steady convection-diffusion equation

UNIT-II

Models: Reynolds and Favre averaged N-S equations, mixing length model, k-epsilon turbulence model. **Classifications of Partial Differential Equations:** Elliptic, parabolic and hyperbolic equations, Initial andboundary value problems.

UNIT-III

Finite Difference Method: Forward, backward and central difference.

Parabolic partial differential equations: Euler, implicit and crank Nicholson methods, ADI models, Errors,consistency, stability analysis, Vonnumen analysis, Convergence criteria

UNIT-IV

Elliptic Partial Differential Equations: Jacobi, Gauss Seidel methods, TDMA, Viscous incompressible flow,Vorticity Stream function method.

UNIT-V

Finite Volume Method: Finite volume formulation for diffusion equation, convection diffusion equation,Solution algorithm for pressure velocity coupling in steady flows, staggered grid, SIMPLE algorithm.

Text Books:

1. P.S. Ghoshdastidar, "Computational Fluid Dynamics & Heat Transfer", Cengage Pub., 2018.
2. J.D. Anderson, Jr., "Computational Fluid Dynamics: The Basic with Applications", McGraw Hill, Inc., 2012.
3. H. Versteeg and W. Malalasekra, "An Introduction to Computational Fluid Dynamics : The Finite Volume Method", 3/e ,Pearson, , 2016

Reddy

PROFESSOR & HEAD

Department of Mechanical Engineering

Chaitanya Bharathi Institute of Technology (A)

Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. F. John Wendt (Editor), "Computational Fluid Dynamics - An Introduction", Springer – Verlag, Berlin, 1992.
2. Charles Hirsch, "Numerical Computation of Internal and External Flows", Vols. I and II. John Wiley & Sons, New York, 1988.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E13

PRINCIPLES OF ENTREPRENEURSHIP

(Core Elective - IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Concept and procedure of idea generation
2. The nature of industry and related opportunities and challenges
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

.**Outcomes:** At the end of the course, the students are able to

1. Understand the concept and essence of entrepreneurship. (BL-2)
2. Identify business opportunities and nature of enterprise. (BL-3)
3. Analyze the feasibility of new business plan. (BL-4)
4. Apply project management techniques like PERT and CPM for effective planning and execution of projects. (BL-3)
5. Use behavioral, leadership and time management aspects in entrepreneurial journey. (BL-3)

UNIT-I

Entrepreneurship: Definition, functions of entrepreneurship, qualities of entrepreneurs, Entrepreneur vs intrapreneur, First generation entrepreneurs, women entrepreneurs, innovation and Intellectual property in entrepreneurial journey, conception and evaluation of ideas and their sources, need and importance of startups and incubation centers.

UNIT-II

Indian Industrial Environment: Competence, opportunities and challenges, Entrepreneurship and Economic growth, Entrepreneurship and Engineering, Small Scale Industry in India, objectives, Linkage among small, medium and large scale industries, Types of enterprises, corporate social responsibility.

UNIT-III

Formulation of Business Plan: Introduction, Elements of Business Plan and its salient features, Business model canvas, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary. Choice of Technology and Collaborative interactions, Sources of finance and Incentives for entrepreneurs.

UNIT-IV

Project Management: During construction phase, project organization, project planning, execution and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden, environmental issues.

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, Maslow's Hierarchy of needs, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi, 2012

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Mc Graw Hill Publishing Company Ltd., 2005

2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E08

MODERN MACHINING AND FORMING METHODS

(Core Elective - IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Various non-conventional machining processes and their process parameters.
2. The relative merits, limitations and applications of various non-conventional machining processes.
3. The knowledge regarding working media and its functions of non-conventional machining processes.
4. The concepts of non-conventional forming processes such as rubber pad forming, hydro forming, stretch forming, etc.
5. The concepts of HERF and to provide the description of HERF process

Outcomes: At the end of the course, the students are able to

1. Compare the Traditional and Non Traditional Machining process and recognize the need for Non traditional Machining process. (BL-2)
2. Illustrate constructional features, performance parameters, process characteristics, applications, advantages and limitations of Non Traditional Machining process. (BL-3)
3. Classify mechanisms of material removal of various non traditional machining processes. (BL-4)
4. Describe the principles, characteristics, advantages, limitations and applications of various unconventional methods of forming, HERF. (BL-1)
5. Compare the principles, constructional features and applications among explosive forming, EHF and EMF. i. (BL-4)

UNIT-I

Ultrasonic Machining (USM): Introduction, Process description, abrasive slurry, Abrasive materials and theircharacteristics, Functions of liquid medium in slurry, Types of transducers, effect of process parameters, applications and limitations.

Abrasive Jet Machining (AJM): Principle of operation, process details, process variables and their effect onMRR and accuracy, advantages, disadvantages and applications

Water Jet Machining (WJM): Schematic diagram, equipment used, advantages and applications.

Abrasive Water Jet Machining (AWJM): Process, advantages, limitations and applications

UNIT-II

Electro Discharge Machining (EDM): Process description with schematic diagram, process parameters,functions and characteristics of dielectric medium, dielectric fluids, flushing, mechanism of metal removal, types of power supply circuits, mathematical analysis of metal removal rate (MRR), equations for surface finish, characteristics of spark eroded surfaces, advantages, disadvantages and applications.

Wire EDM: Process description and applications.

Laser Beam Machining (LBM): Principle of LASER beam production, materials used, process parameters,advantages, limitations and applications.

Plasma Arc Machining (PAM): Introduction, equipment used, process description and parameters, types of plasma arc: transferred arc and non transferred arc and process applications.

Electron Beam Machining (EBM): Schematic of the process, process parameters, principle of production ofelectron beam, equipment used, advantages, disadvantages and applications.

UNIT-III

Electro-chemical machining (ECM): Schematic of processparameters, function and characteristics of electrolyte, MRR for pure metal and alloys, electrode feed rate (EFR), advantages, limitations and applications.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Chemical Machining : Chemical blanking and chemical milling, advantages, limitations and applications.**ION Etching**: Process description, merits, limitations and applications.

UNIT-IV

High Energy Rate Forming Processes (HERF): Introduction, applications, advantages

Explosive Forming: Principles, explosive materials, Equipment, types of explosive forming, standoffoperation and contact operation.

Electro Hydraulic Forming (EHF): Schematic of process, description and its applications

Electro Magnetic Forming (EMF): Process description, merits, limitations and applications.

UNIT-V

Flexible Forming: Principle of the process, process details and its types, Guerin, wheelon, Mar formingand Hydro forming processes and applications

Stretch Forming: Introduction, types of stretch forming, stretch draw forming, rotary stretch forming or stretchwrapping, compression forming, radial draw forming.

Tube spinning: Introduction, methods of tube spinning, backward spinning, forward spinning.

Text Books:

1. P.C. Pandey and H.S. Shah, "Modern Machining Process", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1980.
2. J Paulo Davim, "Modern Machining Technology - A Practical Guide", 1/e, Woodhead Publishing in Mechanical Engineering, 1980.
3. Hassan Abdel-Gawad El-Hofy, "Advanced Machining Processes, Nontraditional and Hybrid Machining Processes", McGraw Hill Publishing Co. Ltd., 1984.

Suggested Reading:

1. Davies and Austin, "Developments in High Speed Metal Forming", The Machinery Publishing Co. Ltd., 1985.
2. "Production Technology", HMT, 1984.

SReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E14

HEAT AND MASS TRANSFER

(Core Elective - IV)

(Use of data book is permitted)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To demonstrate basic knowledge by understanding conduction heat Transfer.
2. Students will acquire the basic knowledge in understanding the principles of convection heat transfer.
3. Student will come to know basic principles of radiation heat transfer.
4. Student will come to know the difference of condensation phenomena and boiling phenomena and understand the working principle of heat exchanger and their effectiveness.
5. Student will come to know mass transfer phenomena in gases and liquids.

Outcomes: At the end of the course, the students are able to

1. Apply various laws pertaining to conduction heat transfer using basic principles of thermodynamics.(BL-3)
2. Determine heat transfer coefficient for free and forced convection phenomena along with boundary layer for various complex engineering problems. (BL-5)
3. Understand the concept of radiation phenomena of heat transfer. (BL-2)
4. Design of heat exchangers using the principles of engineering sciences. (BL-6)
5. Understand the concept of mass transfer and co-relate with heat transfer and provide valid conclusions. (BL-2)

UNIT-I

General Heat Conduction Equation: Derivation of the equation in Cartesian and Polar Co-ordinate systems. **Steady-state one-dimensional heat conduction problems in Cartesian and Polar System:** Steady-state 1-D heat conduction problems with and without heat generation and varying thermal conductivity for different boundary conditions, Thermal Resistances in Series and in Parallel. Critical thickness of insulation
Fins: Classification, Rectangular Fins, Fin Efficiency and Fin Effectiveness, Applications,
Transient heat conduction: Lumped heat analysis, Semi-infinite Body, use of Heisler and Grober charts,

UNIT-II

Convection: Boundary Layer Theory, Velocity and Thermal Boundary Layers over a flat plate and through pipes.
Forced convection: Flow over flat plates, cylinders, internal flows -laminar and turbulent flow, Empirical solutions.

Free convection: Flow over vertical Plates, Internal flows-Vertical Tubes and Horizontal Tubes- Laminar and Turbulent flows, Empirical solutions. Dimensional analysis, Buckingham π theorem, Physical significance of different dimensionless numbers.

UNIT-III

Basic Relations: Definition of absorptivity, reflectivity and transmissivity, Concept of black-body and emissivity. Kirchoff's law, Planck's black body spectral distribution, Wien's and Steffan Boltzmann law.
Radiation Heat Exchange between Surfaces: Radiation shape factor, Concept of surface, space resistances, Heat exchange between non-black bodies, Radiation shields.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-IV

Heat Exchangers: Definition, Classification, LMTD method, Effectiveness - NTU method, chart Solution for Heat Exchanger Problem, correction factor charts and Effectiveness-NTU charts.

Boiling: Boiling Heat Transfer Phenomena, Pool boiling Curve

Condensation: Laminar film wise condensation on a vertical plate.

UNIT-V:

Mass Transfer: Applications, concentrations, velocities and fluxes, Fick's law of diffusion, General three dimensional equation for mass transfer in stationary media, diffusion coefficient, steady state molecular diffusion through a plain membrane, equimolal diffusion, evaporation process in atmosphere, significance of dimensionless numbers in mass transfer.

Text Books:

1. Sachdeva, R.C, "Fundamentals of Engineering Heat and Mass Transfer", New Age International Publications, 2014.
2. Holman, J. P., Heat Transfer, Tata McGraw Hill, New Delhi, 2010
3. M. Necati Ozisik, Heat Transfer - A Basic Approach, McGraw Hill, New York, 1985

Suggested Reading:

1. Yunus A Cenegal, Heat Transfer: A Practical Approach, Tata McGrahill, 2nd Edn,2002
2. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, John Wiley and Sons, New York, 2006

Data Book:

1. C. P. Kothandaraman, S. Subramanyan ,"Heat and Mass Transfer Data Book", New Age International Publishers, 2018

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E15

BLOCKCHAIN TECHNOLOGY

(Core Elective -IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Course Objectives:

1. To provide Conceptual understanding of how blockchain technology can be used to improve business processes.
2. To facilitate understanding of bit coin and working with consensus in Bitcoin.
3. To impart knowledge about designing and building Permissioned blockchains.
4. To introduce supply chain management and internet enabled supplychains.
5. To familiarize with blockchain applications.

Course Outcomes: At the end of the course, the students are able to

1. Outline the concepts of blockchain technology. (BL-2)
2. Understand the bit coin, working with consensus in Bitcoin. (BL-2)
3. Develop knowledge about designing and building Permissioned block chains. (BL-3)
4. Explain the concepts of supply chain management and internet enabled supply chains. (BL-2)
5. Make use of blockchain applications involved in various sectors. (BL-3)

UNIT- I

Introduction: History, blockchain Architecture, nodes, crypto currency, tokens, cryptography- private and public keys, hash, ledgers, bitcoin, design Primitives- digital Signature, protocols, security, consensus, understanding Crypto currency.

UNIT- II

Bitcoin and block chain: creation of coins, payments and double spending, bitcoin scripts, bitcoin p2p network, transaction in bitcoin network, block mining, block propagation and block relay.

Working with consensus in bitcoin: distributed consensus in open environments, consensus in a bitcoin network, proof of work (pow) – basic introduction, hashcash pow, bitcoinpow, attacks on pow and the monopoly problem, proof of stake, proof of burn and proof of elapsed time, the life of a bitcoin miner, mining difficulty, mining pool.

UNIT- III

Permissioned Block chain: Definition, merits and demerits, differences between permissioned and permissionless blockchain, overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT, Byzantine fault tolerant (BFT) system, Lamport-Shostak-Pease BFT Algorithm.

Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food security, Mortgage over Blockchain, Blockchain enabled Trade.

UNIT- IV

Blockchain and the world economy: Supply chain industry-past and future, supply chain using blockchain technology, building blocks of a supply chain network, business processes in supply chains, types of supply

Sheddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A
Gandipet, Hyderabad-500 075. Telangana

chains and examples, strategic, tactical, and operational decisions, supply chain performance measures. ERP and automation.

Internet-enabled supply chains: e-marketplaces, e-procurement, e-logistics, e-fulfillment, customer relationship management, web services.

UNIT -V

Applications of blockchain technology: Uses of blockchain in e-governance, land registration, property records, notary, titles, micropayments, medical information systems, next generation of industry 4.0 and additive manufacturing, government identity management, auto executing contracts, three signature escrow, triple entry.

Text Books:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", 1st Edition O'Reilly, 2015.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Crypto currencies", 1st Edition, O'Relly, 2015.
3. Tiana Laurence, "Introduction to blockchain technology", Van Haren Publishing, 's-Hertogenbosch, 2019.

Suggested Reading:

1. Daniel Drescher, "Block Chain Basics", 1st Edition, Apress, 2017.
2. RiteshModi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing, 2018.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E17

RENEWABLE ENERGY SOURCES

(Core Elective - V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Need and importance of non-conventional energy resources
2. Extent of solar energy which can be utilized as energy resource
3. Concept of wind energy and its merits and demerits
4. Operating principles of geothermal energy and bio-energy
5. Merits and demerits of tidal energy, wave energy and OTEC

Outcomes: At the end of the course, the students are able to

1. Understand the need for renewable energy sources in the context of environmental issues. (BL-2)
2. Apply the principles of solar energy for domestic and industrial usages. (BL-3)
3. Understand the working principle of wind power plants along with merits and demerits. (BL-2)
4. Describe the concepts of geothermal energy sources and biomass as a source of energy. (BL-2)
5. Explain the principles and impact of wave, tidal and OTEC plants on the environment. (BL-2)

UNIT-I

Energy Sources: Energy characteristics, forms of energy, energy chain (route), energy sectors, Indian energy scenario, energy pricing in India, energy and environment, energy security, energy conservation and its importance, energy strategy for future, classification of energy sources, availability of conventional and non-conventional (renewable) energy sources, classification of RES - solar, wind, geothermal, bio-mass, ocean tidal, ocean wave and ocean thermal energy conversion (OTEC), advantages and limitations of conventional and renewable energy sources.

UNIT-II

Solar Energy: Solar radiation, solar thermal collectors, working of flat plate and concentrating (focusing) solar collectors and their limitations, comparison of flat plate and focusing collectors, applications of solar collectors - water heating, space heating, low temperature power generation, solar cookers, water pumping, SODIS, solar thermal power plant, advantages and limitations of solar energy systems, PV materials, PV cells and their manufacturing, space based solar power (SBSP), solar satellite system, advantages and disadvantages of SBSP.

UNIT-III

Wind Energy: Sources of wind, merits and demerits of wind energy, site selection for wind energy conversion system, wind turbine (wind mill), classification of wind mills, working principle horizontal axis and vertical axis windmills, horizontal vs vertical axis windmills, power extracted from the wind, effect of velocity on power generation, new developments and problems in operating large wind power generators.

UNIT-IV

Geothermal Energy: Layers in earth, resources of geothermal energy, hydrothermal, petrothermal and geopressure resources, advantages, disadvantages, applications and environmental effects of geothermal energy sources.

Biomass Energy: Resources, biogas and its composition, process of biogas generation, wet process and dry process, raw materials available for biogas fermentation, economical, social, environmental and health benefits of biogas utilization, selection of site and constructional techniques of a biogas plant, working of KVIC, Pragathi

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

design, Janata and Deenbandu biogas plants, common operational problems, causes and remedies relating to a biogas plant.

UNIT V

Tidal power: Tidal systems, site selection for tidal power plant, schematic layout of tidal power house, principle of operation of single basin and double basin tidal plants, advantages and disadvantages of tidal power.

Wave energy - Differences between tides and waves, advantages and disadvantages of wave power, problems associated with wave energy collection, working principle of wave energy conversion devices.

Ocean thermal energy conversion (OTEC) - OTEC power plants, location, open cycle and closed cycle OTEC plants, advantages, limitations and applications of OTEC, environmental impact of OTEC plants.

Text Books:

1. S. Hasan Saeed and D.K. Sharma, "Non Conventional Energy Resources", S.K. Kataria & Sons, New Delhi, 2017.
2. Dr. R.K. Singal, "Non Conventional Energy Resources", S.K. Kataria & Sons, New Delhi, 2005.
3. G.D. Rai, "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.

Suggested Reading:

1. K. M. Mittal, "Non-Conventional Energy Systems", Wheeler Publishing Co. Ltd, New Delhi, 2003.
2. Shali Habibulla, "Non-Conventional Energy Sources", State Institute of Vocational Education, Hyderabad, 2005.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E18

CONTROL SYSTEMS THEORY

(Core Elective - V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To provide with basic knowledge of control systems, associated terminologies, transfer function.
2. Familiar with basic electrical, mechanical & electromechanical system and their representation in Differential Equation /Transfer function form.
3. To make students familiar with system performance analysis in time & frequency domain.
4. To understand different methods of stability analysis
5. To provide basic pathway to space representation and controllability and observability

Outcomes: At the end of the course, the students are able to

1. Understand control system, modeling and transfer functions of different systems. (BL-3)
2. Apply the concept of block diagram and signal flow graphs to different systems. (BL-3)
3. Differentiate between time domain and frequency domain techniques. (BL-2)
4. Examine the stability of a system using different approaches. (BL-3)
5. Analyze the system in state space and to find out the controllability and observability. (BL-4)

UNIT-I

Mathematical Modeling: Introduction to control systems , Open loop & closed loop systems, Mathematicalmodeling & Mechanical systems, Transfer functions from Governing equations, Electrical, hydraulic systems pneumatic, thermal systems, AC,DC servomotors &Electromechanical servo systems

UNIT-II

Components of Control System: Introduction to Block diagrams & Problems, Signal flow graph & mason'sgain formula, Transient response &time domain specifications of 1^{st} order systems, 2^{nd} order systems & time domain specifications, Steady state error, error coefficients, Sensitivity Performance Indices

UNIT-III

Time Domain Analysis: Routh criteria & root locus method, Frequency response, Bode & polar plots,Correlation between Transient & frequency response, Band width, Experimental determination of transfer function

UNIT-IV

Stability Analysis: Nyquist Criteria, Phase & gain margins, Lead, lag compensator design lead-lagcompensator design, PID-controller, linearization of non linear systems

UNIT-V

State Space Representation: State space representation of linear control systems, State transition matrix, **Solution of State Space Equations**: Zero input response and Zero state response, Concept of controllability &observability

Reddy
ROFESSOR & HEAD
...nt of Mechanical Engineering
... Bharathi Institute of Technology (A)
...andipet, Hyderabad-500 075. Telangana

Text Books:

1. K. Ogata, "Modern control Engineering", Prentice Hall, 2015.
2. M. Gopal., "Control Systems", Tata McGraw Hill, 2012.
3. D. Roy Choudhury, "Control System Engineering", PHI, 2005

Suggested Reading:

1. Norman S.Nise., "Control Systems Engineering", John Wiley & sons, Inc., 2018.
2. R.C. Dorf, "Modern Control systems", Addison Wesley, 2011

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E19

ARTIFICIAL INTELLIGENCE

(Core Elective - V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.
4. Familiarize with the types of machine learning.
5. Applications of AI in the field of mechanical engineering.

Outcomes: At the end of the course, the students are able to

1. Differentiate between a rudimentary Problem and an AI problem, its Characteristics and problem solving Techniques. (BL-2)
2. Compare and contrast the various knowledge representation schemes of AI. (BL-4)
3. Analyze various reasoning and planning techniques involved in solving AI problems. (BL-4)
4. Understand the different learning techniques. (BL-2)
5. Apply the AI techniques in the field of mechanical engineering. (BL-3)

UNIT - I
Introduction: Definition, history, applications. Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT - II
Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. Knowledge Representation (Structured): Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III
Reasoning: Probability and Bayes theorem, certainty factors and rule based systems, Bayesian Networks, Dempster-Shafer theory. Planning: components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV
Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: decision tree. Intelligent Agents: classification, working of an agent, single agent and multi agent systems, multi agent application.

UNIT – V
Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. Perception and Action: Real Time Search, Vision, Speech Recognition, Action: Navigation, Manipulation, Robot architectures. Scope and applications of AI in Mechanical Engineering

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence", 3/e, TMH, 2008
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3/e, PearsonEducation, 2010
3. Nilakshi Jain "Artificial Intelligence: Making a System Intelligent", Wiley India, 2019

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012
2. Deepak Khemani, "A First Course in Artificial Intelligence", TMH, 2017

Freddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E20

INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

(Core Elective - V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Various types of business organizations and organization structures and importance of plant location and plant layout
2. Importance of industrial engineering techniques like method study and work measurement.
3. The significance of quality control and production planning and control
4. The importance of project management techniques
5. The total cost of a product based on elements of cost

Outcomes: At the end of the course, the students are able to

1. Understand different types of business organizations, functions of management and importance of various types of plant layouts. (BL-2)
2. Apply techniques of method study and work measurement in organizations to enhance productivity (BL-3)
3. Usequality control charts and tools in industries. (BL-3)
4. Apply various optimization and project management techniques for solving real time problems. (BL-3)
5. Understand basic concepts of Cost accounting and financial management . (BL-2)

UNIT-I

Industrial Organization: Definition of an organization, types of various business organizations, organizationstructures and their relative merits and demerits, functions of management.

Plant location and layouts: Factors affecting the location of plant and layout, types of layouts and their meritsand demerits.

UNIT-II

Work study: Definitions, objectives of method study and time study, steps in conducting method study,symbols and charts used in method study, principles of motion economy, calculation of standard time by time study and work sampling, performance rating factor, types of ratings, job evaluation and performance appraisal, wages and incentive plans.

UNIT-III

Inspection and quality control: Types and objectives of inspection, S.Q.C., its principles. Quality control charts and sampling plans, quality circles, introduction to ISO.

Production planning and control (PPC): Types of production systems, principles of PPC and itsfunctions.

UNIT-IV

Optimization: Introduction to linear programming and graphical solutions, assignment problems.

Project Management: Introduction to CPM and PERT, determination of critical path.

Material Management: Classification of materials, materials planning, duties of purchase manager,determination of economic ordering quantities, types of materials purchase.

UNIT-V

Cost accounting: Elements of cost, various costs, types of overheads, break even analysis and its applications,depreciation, methods of calculating depreciation fund, nature of financial management, time value of money, techniques of capital budgeting and methods, cost of capital, financial leverage.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. O.P. Khanna "Industrial Engineering and Management", Dhanapat Rai & Sons, 2018
2. S.D. Sharma, "Operations Research" , Kedarnat , Ramnath & Co., Meerut,2012
3. Pandey I.M. , " Financial Management", Vikas Publ. House, New Delhi, 2016

Suggested Reading:

1. William J Stevenson, "Operations Management", McGraw Hill, 2018
2. Paneer Selvam, "Production and Operations Management", Pearson Education, 2012.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E11

PRINCIPLES AND APPLICATIONS OF ADDITIVE MANUFACTURING

(Core Elective - V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To introduce students the basics of additive manufacturing, its advantages and limitations and concept of mass customization.
2. To familiarize students with different additive manufacturing techniques.
3. To teach students about STL file issues and familiarize them with various RP softwares.
4. To demonstrate various post processing techniques and rapid tooling concept.
5. To demonstrate the applications of rapid prototyping in various fields

Outcomes: At the end of the course, the students are able to

1. Understand the fundamental concepts of Additive manufacturing, its advantages and Disadvantages (BL-2)
2. Select suitable process and materials used in Additive Manufacturing (BL-5)
3. Analyze pre-processing issues for Additive Manufacturing and related operations for STL file generation. (BL-4)
4. Identify different post processing techniques for enhancing the properties of the 3D printed components (BL-3)
5. Infer the prospects of additive manufacturing in various industrial sectors. (BL-2)

UNIT-I

Introduction: Need for Additive Manufacturing, Generic AM process, Difference between AM and CNC, Classification of Additive Manufacturing processes, Metal systems,Milestones in AM development .Materilas used in Additive Manufacturing Related Technologies-Reverse Engineering.Advantages and Limitations of AM.

UNIT-II

Photo polymerization process: Stereolithography (SL), Materials, SL resin curing process, Process Benefits and Drawbacks, Applications of Photo polymerization Process.

Powder bed fusion process: Introduction, Selective laser Sintering (SLS), Materials, Powder fusion mechanism, Process Benefits and Drawbacks, Applications of Powder Bed Fusion Process.

Extrusion-based systems: Fused Deposition Modelling (FDM), Principles, Materials, Process Benefits and Drawbacks, Applications of Extrusion-Based Process.

Material Jetting Process: Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Process.

UNIT-III

Binder Jetting Process: Materials, Process Benefits and Drawbacks, Technical challenges in printing, Applications of Binder Jetting Process

Sheet Lamination Process: Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM, and UC applications

Breddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Directed Energy Deposition Process: Process Description, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Benefits and drawbacks, Applications of Directed Energy Deposition Process.

UNIT-IV

Pre-processing in Additive Manufacturing: Preparation of 3D-CAD model, Reverse engineering, Reconstruction of 3D-CAD model using reverse engineering, Part orientation and support generation, STL Conversion, STL error diagnostics, Slicing and Generation of codes for tool path.

Post processing in AM: Post processing equipment – support material removal, surface texture improvement, accuracy improvement, aesthetic improvement, preparation for use as a pattern, Property enhancements using non–thermal and thermal techniques.

UNIT-V

Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs Rapid Tooling

AM Applications: Application in Design, Engineering, Analysis & Planning, Application in Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, Biomedical applications.

Text Books:

1. Chua Chee Kai, Leong Kah Fai, "3D Printing and Additive Manufacturing: Principles & Applications", 4th Edition, World Scientific, 2015.
2. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", 2nd Edition, Springer, 2015
3. K. Venuvinod and Weiyin Ma, "Rapid Prototyping: Laser-based and Other Technologies", Springer, 2004.

Suggested Reading:

1. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001.
2. Rafiq Noorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

PReddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C20

CAD/CAM LAB

Instruction	2	Hours per week
Duration of SEE	2	Hours
SEE	35	Marks
CIE	15	Marks
Credits	1	

Objectives:

1. To teach the basic design process and the importance and types of geometric modeling techniques
2. To teach Assembly modeling by applying suitable assembly constraints
3. To generate orthographic views of components and assemblies.
4. To demonstrate the Indication of size, form and positional tolerances on the drawing sheets
5. To demonstrate the working of CNC machines and write part programs for different operations

Outcomes: At the end of the course, the students are able to

1. Model components using CAD software. Select appropriate commands to generate 3D model (BL-3)
2. Select constraints to assemble the components (BL-3)
3. Develop manufacturing drawings from 3D models (BL-3)
4. Analyze the concept CNC part program to generate tool path for different machining operations (BL-4)
5. Develop a product using CAD/CAM technology (BL-6)

List of the Exercises:

1. Introduction to CAD Package, Working with sketch mode and introduction to various Part Features.
2. Part modeling of various machine components
3. Format of drawing sheet, title block, Generating and editing drawings
4. Assembly modeling of Stuffing Box
5. Assembly modeling of Screw Jack
6. Assembly modeling of Crosshead
7. Production drawing of components and indicating tolerances on size and geometrical form, Position; Indicate Surface finish, surface treatments if any and writing process sheet for anyone component
8. Introduction to CNC machines, Working, writing of process sheets, Contouring on CNC Milling Machine.
9. Rectangular & Circular Pocketing on CNC Milling Machine
10. Step Turning and Taper Turning on CNC Lathe Machine
11. Multiple Turning on CNC Lathe Machine
12. Study of 3D printer
13. Design a product and Manufacture / generate CNC Machining tool path for its components

Note: Student should complete a minimum of 10 exercises including exercise number 13 which is compulsory.

Text books:

1. P.N. Rao, "CAD/CAM: Principles and Applications",Tata McGraw-Hill, July 2017
2. N Mehta, "Machine Tool Design and Numerical Control", McGraw Hill Education, 3/e, 2017
3. Dassault Systems, "SOLIDWORKS Essentials: Training", SolidWorks corp., 2011

Suggested Reading:

1. https://my.solidworks.com/solidworks/guide/SOLIDWORKS_Introduction_EN.pdf
2. https://help.solidworks.com

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

18ME C21

THERMAL ENGINEERING LAB

Instruction	2	Hours per week
Duration of SEE	2	Hours
SEE	35	Marks
CIE	15	Marks
Credits	1	

Objectives:

1. To demonstrate knowledge in evaluating thermal conductivity of metal rod.
2. Student will understand how to evaluate critical heat flux.
3. Student will come to know the working principle of axial flow fan and centrifugal blower.
4. Student will understand to evaluate the COP of Refrigeration tutor and AC tutor.
5. Student will come to know to evaluate drag and lift coefficients for contoured bodies.

Outcomes: At the end of the course, the students are able to

1. Determine thermal conductivity of a metal rod and critical heat flux of a copper wire (BL-3)
2. Estimate the convective heat transfer coefficients for phase change heat transfer and effectiveness of cross flow heat exchanger. (BL-3)
3. Evaluate the performance of rotary compressors, refrigeration and air conditioned tutors. (BL-5)
4. Evaluate drag and lift coefficients for different profiles of automobiles. (BL-5)
5. Determine the pressure distribution in a nozzle and around symmetrical bodies. (BL-3)

List of the Experiments

1. Study of Thermal conductivity of metal rod.
2. Determination of critical heat flux for copper wire in water.
3. Evaluate the convective heat transfer coefficient for condensation and boiling equipment.
4. Determination of pressure distribution for convergent and divergent nozzle
5. Study of overall efficiency of axial flow fan
6. Determination of overall efficiency of centrifugal blower
7. Study of COP of refrigerating tutor
8. Study of COP of air conditioning tutor
9. Evaluate the effectiveness of cross flow heat exchanger.
10. Determination of pressure distribution for a cylinder
11. Determination of pressure distribution for an aerofoil.
12. Determination of lift and drag coefficient for different contours
13. Investigation of the wind tunnel performance by using the modeling and simulation

Note: Student should complete a minimum of 10 experiments including experiment number 13 which is compulsory.

Text Books:

1. S M Yahya, "Fundamentals of Compressible Flow", New Age International Publishers, 2014.
2. Mahesh M. Rathore, "Thermal Engineering", TMH, New Delhi, 2010
3. M L Mathur & F S Mehta, "Thermal Engineering", Jain Brothers, New Delhi, 2014

Suggested Reading:

1. V. Ganeshan, "Gas Turbines", Tata Mc Graw Hills, New Delhi, 2010.
2. R.K. Rajput, "Heat Transfer", Laxmi Publication, 2014

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
CHOICE BASED CREDIT SYSTEM
B.E. (MECHANICAL ENGINEERING)

SEMESTER – VII

S. No.	Course Code	Title of the Course	Scheme of instruction Hours per week		Scheme of examination			Credits
					Duration in Hours	Maximum Marks		
			L/T	P/Dg.		CIE	SEE	
THEORY								
1	16ME C33	Metrology and Instrumentation	3	–	3	30	70	3
2	16ME C34	Operations Research	3	–	3	30	70	3
3	16PE C10	Production Drawing	1	2	3	30	70	2
4	16PE C11	Production and Operations Management	3	–	3	30	70	3
5	16ME C35	Finite Element Analysis	3/1	–	3	30	70	4
6		Professional Elective - V	3	–	3	30	70	3
PRACTICALS								
7	16ME C36	Metrology and Instrumentation Lab	–	3	3	25	50	2
8	16ME C37	Computer Aided Engineering Lab	–	3	3	25	50	2
9	16ME C38	Seminar	–	3	–	50	–	2
		TOTAL	17	11		280	520	24

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE – Semester End Examination

Professional Elective-V (3/3)		
SNO	Subj. Code	Name of the Subject
1	16ME E10	Renewable Energy Sources
2	16ME E11	Energy Conservation, Management and Audit
3	16ME E12	Engineering Research Methodology
4	16ME E13	Environmental Pollution

16ME C33

METROLOGY AND INSTRUMENTATION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To familiarize with limits, fits & tolerances and fundamental concepts of linear and angular measurements.
2. To have knowledge of various precision measuring instruments and concept of limit gauges.
3. To learn the importance of Geometric form and how to measure form errors.
4. To have knowledge in the concepts of classification of instrument errors and their characteristics.
5. To understand the working principles of various instruments used for the measurement of displacement, pressure and temperature.

Outcomes: At the end of the course, students are able to

1. Learn and understand the need for measurement and fundamental concepts of measurement.
2. Demonstrate sound knowledge in gauges design and gauge selection for inspection.
3. Demonstrate an ability to select and use the appropriate measuring instruments to measure surface roughness.
4. Recognize the concepts of errors, strain measurement, classification and instrument characteristics.
5. Apply the skills in measuring various quantities like displacement, pressure & temperature.

UNIT-I

Limits, Fits and Tolerances: Interchangeability, nominal size, limits, tolerances, allowance, fundamental deviation, unilateral and bilateral tolerances, Types of fits, alpha numeric designation of limits/fits, hole and shaft basis systems, selective assembly.

Linear and Angular Measurement: line and end standards, Slip gauges, Tomlinson gauges and Sine bar.

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-II

Design of Limit Gauges: Taylor's Principle for plan limit gauges, Design of GO and NO GO gauges, Use of Plug, Ring and Snap gauges.

Comparators: Introduction, Dial indicator, Sigma Mechanical comparator, Back pressure type Pneumatic comparator.

Optical Measuring Instruments: Optical projector principle and its uses, Tool maker's Microscope principle and its uses, interferometry.

UNIT-III

Straightness, Flatness and Roundness Measurement: Definitions, measurement by beam comparator, straight edge, spirit level, and bench centers.

Surface Roughness Measurements: Roughness and waviness, numerical assessment of surface roughness by CLA, RMS, Rz values, Surface roughness measurement by Profilometer, Taylor Hobson Talysurf, ISI symbols for indication of surface finish.

UNIT-IV

Screw Thread Metrology: Basic terminology of screw thread, measurement of effective diameter by 2 wire and 3 wire methods, Best wire size.

Gear Tooth Metrology: Spur Gear nomenclature, Gear tooth thickness measurement by gear tooth vernier.

Instrumentation: Static and Dynamic characteristics of instruments, Types of errors, Strain measurement with strain gauges, gauge factor, Rosette Gauges.

UNIT-V

Transducers: Displacement measurement by L.V.D.T, Pressure measurement by Bourdon pressure gauge, bulk modulus pressure gauge, pirani gauge, Temperature measurement by thermo couples, Laws of thermo electricity, Types of materials used in thermocouples.

Text Books:

1. R.K. Jain, "Engineering Metrology", Khanna Publications, 1996.
2. Doeblin, "Measurement Systems Application and Design", TMH, 5/e., 2004.
3. Beckwith, Buck, Lienhard, "Mechanical Measurements", PEA, 3rd Indian Reprint, 2001.

Suggested Reading:

1. I.C. Gupta., "Engineering Metrology", Dhanpat Rai Pub., New Delhi, 1984.
2. Rega Rajendra," Principles of Engineering Metrology", Jaico Publishing House, Mumbai, 2008.
3. V.S.R. Murti, "Metrology and Surface Engineering", Frontline Publications, 2011.

16ME C34

OPERATIONS RESEARCH

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Students will come to know the formulation of LPP models
2. Students will understand the Algorithms of Graphical and Simplex Methods
3. Students will understand the Transportation and Assignment techniques
4. Students will come to know the procedure of Project Management along with CPM and PERT techniques
5. Students will understand the concepts of sequencing and queuing theory

Outcomes: At the end of the course, the students were able to

1. Formulate a managerial decision problem into a mathematical model;
2. Apply transportation problems in manufacturing industries;
3. Build and solve assignment models and travelling salesmen problems.
4. Apply project management techniques like CPM and PERT to plan and execute project successfully
5. Apply sequencing and queuing theory concepts in industry applications

UNIT-I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, Degeneracy in Simplex, Duality in Simplex.

UNIT-II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-III

Assignment Techniques: Introduction, Hungarian technique of Assignment techniques, unbalanced problems, problems with restrictions, Maximization in Assignment problems, Travelling salesman problems

UNIT-IV

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward path, Determination of critical path, duration of the project, Free float, Independent float and Total float, Crashing of network.

UNIT-V

Sequencing Models: Introduction, General assumptions, processing 'n' jobs through two machines, processing 'n' jobs through three machines.

Queuing Theory: Introduction, Kendal's Notation, single channel - poisson arrivals - exponential service times

Text Books:

1. Hamdy, A. Taha, "Operations Research-An Introduction", 6/e, Prentice Hall of India Pvt. Ltd., 1997.
2. S.D. Sharma, "Operations Research", Kedarnath, Ramnath & Co., Meerut, 2009.
3. V.K. Kapoor, "Operations Research", S. Chand Publishers, New Delhi, 2004.

Suggested Reading:

1. Harvey M. Wagner, "Principles of Operations Research", 2/e, Prentice Hall of India Ltd., 1980.
2. R. Paneer Selvam, "Operations Research", 2/e, PHI Learning Pvt. Ltd., New Delhi, 2008.
3. Nita H. Shah, Ravi M. Gor, Hardik Soni, "Operations Research", PHI Learning Private Limited, 2013.

16PE C10

PRODUCTION DRAWING

Instruction	1 Lecture + 2 Drawing Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	2

Objectives: Students will understand

1. The need and the importance of production drawing
2. How to make part drawing from given assembly drawings and prepare process sheets.
3. Indication of size, form and positional tolerances on the drawing sheets
4. Surface finish and heat treatment process on the drawing sheets.
5. Notations, symbols and abbreviations on production drawings

Outcomes: On completion of the course the students will develop abilities to

1. Draw part drawings from given assembly drawings of machine parts.
2. Indicate tolerance values on the parts drawn on sheet as per alpha numeric codes for given assembly drawings
3. Indicate form tolerances and position tolerances on the parts drawn on the sheet as per universally accepted norms for a given assembly drawing
4. Indicate values of surface finish and heat treatment process on the parts drawn for a given assembly drawings.
5. Write process sheet for the part that is drawn from given assembly drawing and interpret production drawing and process sheet.

UNIT-I

Parts-I: Format of drawing sheet, title block, columns for materials, Processes, parts list, conventional representation of parts: screwed joints, welded joints, springs, gears.

UNIT-II

Parts II: Elements of electrical, hydraulic and pneumatic circuits, machine tool elements, methods of indicating notes on drawing

UNIT-III

Limits and Fits: Basic definition of terms, alpha numeric designation of limits/ fits, types of fits, Interchangeability and selective assembly, Exercises involving selection/interpretation of fits and calculation of limits, dimensional chains.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

UNIT-IV

Production Drawing: Conventional practices of indicating tolerance on size and geometrical form, position, surface finish, surface treatments, part drawing from assembled drawings (Stuffing box, Screw jack, I.C engine connecting rod, Revolving center, Square tool post, Single tool post, Universal coupling, Flange coupling, Steam engine cross head, Drill jig (plate type), Eccentric, Hydraulic cylinder), specification and indication of above features on the drawings, calculation of limits suggesting suitable fits for mating parts

UNIT-V

Assignments: Sketches of conventional representation of parts described with syllabus at (1) process sheets, tolerances and finishes obtainable from different processes. Study of IS 2709 on limits and fits

NOTE: Tolerance charts to be provided in the examination hall for calculation of limits

Text Books:

1. K.L. Naruyana, P. Kannaiah and K. Venkat Reddy, "Production Drawing", New Age Intl., (P) Ltd., Revised Edition, 1997.
2. P. Narasimha Reddy, T.A. Janardhan Reddy and C. Srinivasa Rao, "Production Drawing Practice", Hitech Publishers, 2001.

Suggested Reading:

1. R.L. Murthy, "Precision Engineering in Manufacturing", New Age International Private Ltd., 1996
2. Venkata Reddy, "Production Drawing", New Age International, ISBN 978-81-224-2288-7, 2009
3. Farazdak Haideri, "Machine Drawing & Computer Graphics", Nirali Prakashan, ISBN 978-93-8072-527-7

16PE C11

PRODUCTION AND OPERATIONS MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Understand plant layout design to facilitate material flow and processing of a product in the most efficient manner
2. Gain some ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making on operations management and strategy.
3. Understand how Materials Requirement Planning and MRPII systems are used in managing operations
4. Recognize the importance of Inventory control to ensure their availability with minimum capital lock up.
5. Evaluate the quality processes in manufacturing and service sector to improve the operational performance

Outcomes: At the end of the course, the student will be able to

1. Identify and evaluate the processes, tools and principles of production and operations management to better understand the logistics and supply chain operations
2. Demonstrate the ability to apply mathematical forecasting techniques
3. Identify future challenges and directions that relate to production and operations management to effectively and efficiently respond to market changes
4. Apply the tasks, tools and underlying principles of operations management in the manufacturing and service sectors to improve organizational performance
5. Explain and evaluate the quality process in manufacturing and service sector to improve the operational performance

UNIT-I

Production & Operations Management: Introduction: Types of Production Systems, job shop, batch, flow shop

Plant Location and Layout: Factors affecting plant location, plant layout objectives, types of layouts, merits and demerits.

Work Study: Introduction to method study and work measurement, standard time calculations, work sampling, wages and incentives, types of incentive plans.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-II

Forecasting: Introduction, forecasting objectives and uses, demand patterns, qualitative models, market survey, Delphi method, quantitative models, moving average, weighted moving average, simple exponential smoothing, trend adjusted exponential smoothing, simple regression.

Forecast Errors: Mean Absolute Deviation (MAD), Mean Square Error (MSE), Mean Forecast Error (MFE), Mean Absolute Percentage Error (MAPE)

UNIT-III

Aggregate Planning and Master Scheduling: Introduction, objectives of aggregate planning, cost in aggregate planning, strategies in aggregate planning, master production scheduling

Materials Requirement Planning (MRP): Importance of MRP, MRP system inputs and outputs, bill of materials.

UNIT-IV

Inventory Control: Importance of inventory control, types of inventory models, inventory costs, deterministic inventory models, basic EOQ model, production model without shortages, purchase model with instantaneous replenishment and with shortages, production model with shortages, inventory model with price breaks, fixed order quality system, periodic review system .

UNIT-V

Quality Control: Introduction, quality gurus and their contributions, quality tools, process capability, quality control by control charts, control charts for variables and attributes, sampling plans, operating characteristic curve, introduction to total quality management

Text Books:

1. Stevenson, "Operation Management", Mc-Graw Hill International.
2. Joseph Monks, "Operations Management", TMH Publishers, New Delhi, 2004.
3. S. Buffa Elwood, "Modern Production /Operations Management", John Wiley Publishers, Singapore, 2002.

Suggested Reading:

1. Everrete E. Adama & Ronald J. Ebert, "Production & Operations Management", 5/e, Prentice Hall of India, 2005.
2. R. Panneer Selvam, "Production and Operations Management," 2/e, PHI Learning Pvt. Ltd., New Delhi, 2006.
3. S.N. Chary, "Production and Operations Management", 3/e, Tata McGraw Hill, 2006.

16ME C35

FINITE ELEMENT ANALYSIS

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives:

1. Equip the students with the Finite Element Analysis fundamentals and formulations
2. Enable the students to formulate the axial, truss , beam and circular shaft problems
3. Enable the students to formulate 2D problems with special cases
4. Enable the students to formulate quadrilateral element, use of numerical integration, Gaussian quadrature and one dimensional dynamic problems
5. Enable the students to understand the convergence requirements, heat transfer , formulate 3D problems and perform engineering simulations using Finite Element Analysis software (ANSYS)

Outcomes: At the end of the course a student will be able to

1. Apply FE method for solving field problems using Virtual work and Potential energy formulations
2. Analyze linear problems like axial, trusses , beam problem and circular shaft problems
3. Analyze 2D structural problems using CST element and analyze plane stress, plane strain and axi-symmetric problems with triangular elements.
4. Write shape functions for 4 node quadrilateral isoparametric elements, apply numerical integration, Gaussian quadrature and to estimate natural frequencies for stepped bar
5. Check for convergence requirements, Solve linear 1D and 2D heat conduction and convection heat transfer problems, formulate 3D elements, apply finite element analysis software for engineering solutions

UNIT - I

Fundamental Concepts: Introduction to finite element method, stresses and equilibrium, boundary conditions, strain – displacement and stress – strain relationship

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

One Dimensional Problem: Different co-ordinate systems and shape functions, virtual work and potential energy approach, Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, analysis of axial element and quadratic element

UNIT-II

Analysis of Trusses: Element stiffness matrix for a truss member, Analysis of plane truss with two degrees of freedom at each node,
Analysis of Beams: element stiffness matrix for two nodes (two degrees of freedom per node
Analysis of Frames: Analysis of frames with two translations and rotational degrees of freedom per node, Analysis of circular shaft subjected to torsion

UNIT-III

2D Triangular Elements: Plane stress, plane strain and axisymmetry ,finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Finite element modeling of axisymmetric solids subjected to axisymmetric loading with triangular elements

UNIT-IV

Quadrilateral Elements and Numerical Integration: Two dimensional four noded isoparametric elements, numerical integration and Gauss quadrature
Dynamic Analysis: Formulation of finite element model, element mass matrices, Evaluation of Eigen values and Eigen vectors for a stepped bar and beam

UNIT-V

Heat Transfer Analysis: Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional analysis of thin plate, Formulation of time dependent field problems, application to one dimensional heat flow in a rod
3 D Elements and FEA Software: Introduction to finite element formulation of three dimensional problems in stress analysis, convergence requirements
Introduction to Finite Element analysis Software: Modeling, analysis and post processing

Text Books:

1. G. Ramamurthy, "Applied Finite Element Analysis", I.K. International Publishing House Pvt. Ltd., New Delhi, 2009.
2. Tirupathi R Chandraputla and Ashok D Belagundu, "Introduction to Finite Elements in Engineering", Prentice Hall of India, 1997
3. Daryl L. Logan, "A First Course in the Finite Element Method", Cengage Learning, 2011.

Suggested Reading:

1. S.S. Rao, "The Finite Element Method in Engineering", Pergamon Press, 1989.
2. L. J. Segerlind, "Applied Finite Element Analysis", Wiley Eastern, 1984.
3. J.N. Reddy, "An Introduction to Finite Element Method", McGraw-Hill, 1984.
4. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt., "Concepts and Applications of Finite Element Analysis", 4/e, Wiley.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E10

RENEWABLE ENERGY SOURCES (Professional Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn the

1. Need and importance of non-conventional energy resources
2. Extent of solar energy which can be utilized as energy resource
3. Concept of wind energy and its merits and demerits
4. Operating principles of geothermal energy and bio-energy
5. Merits and demerits of tidal energy, wave energy and OTEC

Outcomes: At the end of the course, the students are able to

1. Understand the depletion and of environmental impact conventional sources of energy and will suggest suitable renewable energies in place of conventional energies
2. Determine the principles of absorption
3. Understand the problems associated with utilizing the wind energy
4. Describe the physics of geothermal resources and describe how biomass is currently used as a source of energy
5. Explain the physical principles of wave energy, tides and the environmental impact of OTEC plants

UNIT-I

Energy Sources: Statistics on conventional energy sources and supply in developing countries - Definition-Concepts of RES - Limitations of RES - Classification of RES-Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources - comparison of these energy sources.

UNIT-II

Solar Energy: Solar Radiation – Solar Thermal Collectors – Flat Plate and Concentrating Collectors and their limitations – Comparison - Solar Applications- Solar thermal power plant – Space based solar power – advantages and limitations of solar thermal energy – PV cells - PV materials - solar satellite system- advantages and disadvantages

UNIT-III

Wind Energy: Merits and demerits-Wind power plant-site selection - Power formula – Bett's limit – Effect of velocity on power generation - classification of wind power plants- Horizontal axis and vertical axis windmills -Working principle - New developments.

UNIT-IV

Geothermal Energy: Layers in earth-Classification of resources of Geothermal Energy – working principle.

Biomass Energy: Biomass-Raw materials-Source, Composition, Conversion technologies – Direct combustion- Pyrolysis—Gasification, Biomass gasifiers – float and fixed dome types-Common operational problems, causes and remedies relating to a biogas plant-Economical, social, environmental and health benefits of bio gas utilization

UNIT V

Wave, Tidal and OTEC Energy: Difference between tidal and wave power generation-Tidal power plant – principle of Operation-single basin and double basin tidal plants- advantages and limitations, OTEC power plants- Open and closed OTEC Cycles- advantages and limitations -Environmental impacts of OTEC.

Text Books:

1. S. Hasan Saeed and D.K. Sharma, "Non Conventional Energy Resources", S.K. Kataria & Sons, New Delhi, 2014.
2. Dr. R.K. Singal, "Non Conventional Energy Resources", S.K. Kataria & Sons, New Delhi, 2005.
3. G.D. Rai, "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.

Suggested Reading:

1. K. M. Mittal, "Non-Conventional Energy Systems", Wheeler Publishing Co. Ltd, New Delhi, 2003.
2. Shali Habibulla, "Non-Conventional Energy Sources", State Institute of Vocational Education, Hyderabad, 2005.
3. Ashok V Desai, "Non-Conventional Energy", Wiley Eastern Ltd, New Delhi, 2003.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E11

ENERGY CONSERVATION, MANAGEMENT AND AUDIT

(Professional Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To make the students to know the importance of energy sector in country's development
2. To identify various auditing services
3. To prepare the organizational structure energy policy
4. To get the concept of management in process industries
5. To explain how to take tax considerations

Outcomes: Students will be able to

1. Know energy scenario both India and world
2. Review and asses the various audit tools
3. Understand energy policy planning and take energy management as a profession
4. Analyze energy security, codes, standards,
5. Arrange the financial arrangements for industries

UNIT-I

Global & Indian Energy Scenario: Basics of Energy and its various forms - Classification of Energy sources- Applications of Non - Conventional and Renewable Energy Sources - Energy needs of growing economy-Energy sector reform, Energy and Environment: Global Environmental Concerns

UNIT-II

Energy Audit: Material and Energy Balance - Energy Action Planning - Energy Monitoring and Targeting - Types of energy audit, Energy Auditing Services Basic Components of an Energy Audit Specialized Audit Tools Industrial Audits Commercial Audits Residential Audits Indoor Air Quality.

Energy Management: Program Organizational Structure Energy Policy Planning Audit Planning Educational Planning Strategic Planning, The Value of Energy Management The Energy Management Profession Some Suggested Principles of Energy Management, Energy Management Systems Justification of EMCSs Systems Integration.

UNIT-III

Energy Efficiency in Thermal Utilities - Fuels and Combustion - Boilers -Steam System - Furnaces - Insulation and Refractory - FBC Boilers -Cogeneration - Waste heat recovery- Compressed Air System. - Diesel Generating System

Energy Efficiency in Electrical Utilities - Electrical Systems -Electric Motors - Lighting System - Energy Efficient Technologies in Electrical Systems

Energy Performance Assessment for Equipment and Utility systems - Turbines (Gas, Steam) - Heat Exchangers - Fans and Blowers - Pumps and Pumping System- Water Pumps - Compressors.

HVAC Systems - Refrigeration System. - Cooling Tower

UNIT-IV

Waste Heat Recovery: Waste Minimization and Resource Conservation - Energy Management in Process Industries, Energy Security, Codes, Standards, Electricity Act, Energy Conservation Act. Economics of Waste-Heat Recovery, Energy management in water and waste water treatment – solid waste treatment- air pollution control systems . Energy Management in Boilers and Fired systems – Steam and condensate systems – cogeneration –

UNIT-V

Performing Financial Analysis: Introduction General Characteristics of Capital Investments Sources of Funds Tax Considerations Time Value of Money Concepts Project Measures of Worth Economic Analysis-Financing Energy Management Projects Introduction Financial Arrangements: A Simple Example Financial Arrangements: Details and Terminology Applying Financial Arrangements: A Case Study "Pros" & "Cons"

Text Books:

1. CB Smith, "Energy Management Principles", Pergamon Press.. New York, 1981
2. W R Murphy, G McKay, "Energy Management", Butterworth Heinemann, 2007.
3. W.C. Turner, "Energy Management Handbook", 5/e, Marcel Dekker, Inc, New York, 2005.
4. W. C. Turner, W. J. Kennedy, "Guide to Energy Management, B. L. Capehart", CRC Press, New York, 2005.

Suggested Reading:

1. Trivedi, PR, Jolka KR, "Energy Managemnent", Con·Lin_onwealth Publication, Nei...Cell·1i, 1997
2. Witte, Larry C, "Industrial Energy Management & Utilization", Hemisphere Publishers, Washington, 1988.
3. Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy efficiencies, 2005.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E12

ENGINEERING RESEARCH METHODOLOGY

(Professional Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. **To make the students to formulate the research problem**
2. **To identify various sources for literature review and data collection.**
3. **To prepare the research design**
4. **To equip the students with good methods to analyze the collected data**
5. **To explain how to interpret the results and report writing**

Outcomes: At the end of the course, the students are able to

1. **Define research problem**
2. **Review and asses the quality of literature from various sources.**
3. **Understand and develop various research designs.**
4. **Analyze problem by statistical techniques: ANOVA, F-test, Chi-square**
5. **Improve the style and format of writing a report for technical paper/ Journal report**

UNIT – I:

Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT-II

Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT – III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT – IV

Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT – V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Text Books:

1. C.R Kothari, "Research Methodology Methods & Technique", New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011

Suggested Reading:

1. Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., New Delhi, 2009.
2. G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, Hyderabad, 2012.
3. Naval Bajjai, "Business Research Methods", Pearson, 2011.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E13

ENVIRONMENTAL POLLUTION (Professional Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectivities: Student will understand

1. the need for control of different types of pollution levels
2. the factors causing water pollution and its remedial methods
3. the importance of disposal of solid waste, related laws and regulations
4. the need for control of air pollution from industry
5. the factors affecting sound pollution

Outcomes: Student will be able to identify

1. factors affecting global warming
2. the method of reducing water contamination
3. the methods of disposal of nuclear waste, related law and regulation
4. the method of reduction of air pollution from industry
5. the methods of controlling sound pollution

Unit-I

Pollution & Environmental Ethics: Environmental ethics, environmental risk analysis, global warming, environmental impact and economic assessment, environmental laws and environmental economics, economic growth versus environment

Unit-II

Water Pollution: Water pollution, Measurement of water quality, water supply, water treatment, collection of waste water, waste water treatment, ground water contamination, treatment, utilization and disposal, water pollution laws and regulations, oil pollution, soil pollution

Unit-III

Solid Waste Management: Solid waste management, solid waste disposal, reuse, recycling and recovery, hazardous waste, nuclear and radioactive waste, hazardous and radioactive waste laws, regulations

Unit-IV

Air Pollution: Air pollution from factories, air pollution from internal combustion engines. Factors affecting air pollution, pollution analyzers, Control, remedies, measurement of air quality, air pollution from thermal power plants, meteorology.

Unit-V

Noise Pollution: Ambient noise levels, noise standards, noise pollution, biological and behavioural effects of noise, magnitude of risk, effect of noise on non-living things, noise pollution control.

Text Books

1. C.S.Rao, "Environmental Pollution Control Engineering", New Age International (P) Limited, Publishers, New Delhi, 2006
2. N.H. Gopal Dutt, "Environmental Pollution and Control", Neelkamal Publishers, New Delhi, 2005

Suggested Reading:

1. Jeremy Colls, "Air Pollution", Span Press, 2002
2. S.K. Agarwal, "Noise Pollution", APH Publishing, New Delhi, 2005
3. R.K. Khitoliya, "Environmental Pollution", Chand Publishers, New Delhi, 2014

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME C36

METROLOGY AND INSTRUMENTATION LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Objectives:

1. To choose the proper measuring instrument for the precise measurement of Length, Height and diameter
2. To select the proper measuring instrument for the angular measurement.
3. To indentify gear & screw thread parameters using optical projector and tool makers microscope.
4. To familiarize with limits, fits and tolerances for gauge selection and design.
5. To understand the working principles in the measurement of Flatness, Roundness and Surface roughness.

Outcomes: At the end of the course, the students were able to

1. Identify methods and devices for measurement of length, height and diameter.
2. Acquire the knowledge about angular measurement and various measuring instruments.
3. Recognize & measure the gear and screw thread parameters using profile projector and tool maker microscope.
4. Demonstrate the sound knowledge in gauges selection, design and measurement.
5. Acquire adequate knowledge in the measurement of flatness, roundness and surface roughness.

Experiments:

1. Measurement with inside, outside and depth micrometers.
2. Measurement with height gauges, height masters.
3. Measurement of Linear and Angular dimensions with Tool Maker's Microscope – Diameter of thin wire and single point cutting tool angle.
4. Measurement with Dial Indicator and its calibration.
5. Measurement of angles with Sine bar and clinometers.

6. Measurement of roundness errors with bench centers.
7. Measurement of flatness errors of a surface plate with precision spirit level.
8. Measurement with optical profile projector.
9. Design of Plug gauge for a given hole.
10. Design of Snap gauge for a given shaft.
11. Surface roughness measurement by Taylor Hobson -Talysurf.
12. Measurement of Gear tooth thickness by gear tooth vernier.
13. Displacement measurement with LVDT.

Note: Student should complete a minimum of 10 experiments.

Suggested Reading:

1. I.C. Gupta, "Engineering Metrology", Dhanpat Rai Pub., New Delhi, 1984.
2. B.C. Nakra & K.K. Chaudhary , "Instrumentation Measurement and Analysis", 3/e, McGrawhill, 2014

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME C37

COMPUTER AIDED ENGINEERING LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Objectives: Study FEA package and model

1. Trusses , Bars of constant cross section area, tapered cross section area and stepped bar
2. Simply supported and clamped beam subjected to UDL, UVL and Point load
3. Stress analysis of a rectangular plate with a circular hole, axisymmetric problems
4. Buckling and Dynamic analysis
5. Steady state and Transient heat transfer analysis

Outcomes: At the end of the course **a student should be able to:**

1. Apply basics of Theory of Elasticity to continuum problems.
2. Formulate finite elements like beam elements for linear static structural analysis.
3. Develop models for 2D and axisymmetric finite elements and 1D heat transfer
4. Solve problems of limited complexity in buckling and dynamic analysis
5. Utilize finite element software to simulate practical problems

List of Excercises:

1. Analysis of plane truss & spatial truss with various cross sections and materials
2. Beam analysis with different sections, different materials for different loads
3. Static analysis of plate with a hole.
4. Plane stress, plane strain and axisymmetric loading on the in plane members.
5. Static analysis of connecting rod with tetrahedron and brick elements.
6. Static analysis of flat and curved shell due to internal pressure.
7. Buckling analysis of plates, shells and beams to estimate BF and modes.

8. Modal analysis of beams, plates and shells for natural frequencies and mode shapes.
9. Harmonic analysis of a shaft and transient analysis of plate.
10. Steady state heat transfer analysis of chimney and transient analysis of castings.
11. Non linear analysis of cantilever beam.
12. Coupled field analysis

Note: 1. Student should complete a minimum of 10 experiments.
2. Any of FEA software ANSYS/ABAQUS/NASTRAN/NISA/ CAEFEM/ADINA may be used.

Suggested Reading:

1. Tadeusz, A. Stolarski, Y. Nakasone, S. Yoshimoto, "Engineering Analysis with ANSYS Software", 1/e, Elsevier Butterworth-Heinemann publications, 2007.
2. ANSYS Inc., "User Manuals for Release 15.0"

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME C38

SEMINAR

Instruction	3 Hours per week
Duration of Semester End Examination	——
SEE	——
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summaryand Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
CHOICE BASED CREDIT SYSTEM
B.E. (MECHANICAL ENGINEERING)

SEMESTER – VIII

S. No.	Course Code	Title of the Course	Scheme of instruction: Hours per week L/T	Scheme of instruction: Hours per week P/Dg.	Scheme of examination: Duration in Hours	Scheme of examination: Maximum Marks CIE	Scheme of examination: Maximum Marks SEE	Credits
THEORY								
1		Professional Elective – VI	3	--	3	30	70	3
2		Open Elective – I	3	--	3	30	70	3
3		Open Elective – II	3	--	3	30	70	3
PRACTICALS								
4	16ME C39	Project Seminar	--	3	--	50	--	2
5	16ME C40	Project	6	--	--	50	100	6
		TOTAL	15	3		190	310	17

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE – Semester End Examination

Professional Elective-VI (3/3)		
SNO	Subj. Code	Name of the Subject
1	16ME E15	Power Plant Engineering
2	16ME E16	Principles of Entrepreneurship
3	16ME E17	Innovations, Protection and Legal Aspects
4	16PE E11	Supply Chain Management
5	16ME E18	Nano Science and Technology

Open Elective – I (3/3)			Open Elective – II (3/3)		
SNO	Subj. Code	Name of the Subject	SNO	Subj. Code	Name of the Subject
1	16CE O02	Disaster Mitigation and Management	1	16IT O01	Object Oriented Programming using JAVA
2	16IT O02	Principles of Internet of Things	2	16PY O01	History of Science and Technology
3	16EE O03	Energy Auditing	3	16ES O05	Waste Management
4	16EC O07	System Automation and Control	4	16EC O05	MEMS and its Applications
5	16CS O08	Basics of Artificial Intelligence	5	16CS O07	Basics of Cyber Security

16ME E15

POWER PLANT ENGINEERING (Professional Elective – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn

1. Different types of power plants and their site selection criteria
2. Operation of thermal power plant
3. About hydraulic power plants, dams and spillways
4. Different types of nuclear power plants including Pressurized water reactor, Boiling water reactor, Liquid metal fast breeder reactor and Gas cooled reactor
5. The power plant economics, environmental and safety aspects of power plant operation.

Outcomes: At the end of the course, the student will be able to

1. Select the suitability of site for a power plant.
2. Propose ash handling, coal handling method in a thermal power plant
3. Understand the water cycle, flow-sheet of hydro-power plant and types of dams and spillways
4. Explain working principle of different types of nuclear power plant.
5. Know the various factors of plant load and economy and safety aspects of power plants

UNIT-I

Introduction: Power plant, classification of power plants, conventional and non-conventional power plants

Steam power plant: Plant Layout, types of coals, coal handling equipment, Ash and Dust handling systems

UNIT II

Steam Power Plant: Combustion Process - Overfeed and Underfeed stokers-traveling grate stokers, spreader stokers, retort stokers- single retort and multi-Retort - Pulverized fuel burning systems – components – burners – Unit and Bin - working

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT III

Hydro Electric Power Plant: Hydrological cycle, flow measurement, Hydrographs – flow/mass duration curve - drainage area characteristics, Types of hydroelectric power plants- working - storage and pondage - classification and working of dams and spill ways.

UNIT - IV

Nuclear Power Plant: Nuclear fuel - breeding and fertile materials - types of reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Gas cooled Reactor-Radioactive waste disposal.

UNIT - V

Power Plant Economics and Environmental Considerations:
Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor - related exercises-Fixed cost and variable cost-methods to find depreciation cost, Effluents from power plants and Impact on environment – pollutants - Pollution control.

Text Books:

1. R.K. Rajput, "A Text Book of Power Plant Engineering", 4/e, Laxmi Publications (P) Ltd., New Delhi, 2015
2. P.K. Nag, "Power Plant Engineering", 4/e, McGraHill Education(India) Private Limited, New Delhi, 2014.
3. S.C. Arora and S. Domukundwar, "A Course in Power Plant Engineering", Dhanpat Rai & Sons, New Delhi, 2005.

Suggested Reading:

1. R. Yadav, "Fundamentals of Power Plant Engineering", Central Publishing House, Allahabad, 2012.
2. R.K. Hegde, "Power Plant Engineering", Pearson Education India, 2015.
3. P.C. Sharma, "A Text Book of Power Plant Engineering", S.K. Kataria & sons, New Delhi, 2016.

16ME E16

'PRINCIPLES OF ENTREPRENEURSHIP (Professional Elective - VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand

1. Concept and procedure of idea generation
2. The nature of industry and related opportunities and challenges
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Outcomes: After completing this course, students will be able to:

1. Analyse ideas for new and innovative products or services
2. Identify opportunities and deciding nature of industry
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioral aspects and use time management matrix

UNIT-I

Entrepreneurship: Definition, functions of entrepreneurship, qualities of entrepreneurs, Entrepreneur vs intrapreneur, First generation entrepreneurs, women entrepreneurs, need of innovation in entrepreneurial journey, Conception and evaluation of ideas and their sources,

UNIT-II

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Entrepreneurship and Engineering, Small Scale Industry in India, Objectives, Linkage among small, medium and large scale industries, Types of enterprises, Corporate Social Responsibility

UNIT-III

Formulation of Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis,

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

Marketing Analysis, Feasibility studies, Executive Summary. Selection of Technology, Collaborative interaction for Technology development

UNIT-IV

Project Management: During construction phase, project organization, project planning, execution and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden, environmental issues.

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, Maslow's Hierarchy of needs, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.
3. G.S. Sudha, "Organizational Behavior", National Publishing House, 1996.

16ME E17

INNOVATIONS, PROTECTION AND LEGAL ASPECTS

(Professional Elective – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn

1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Outcomes: At the end of the course, a student

1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Geographical indications: Introduction, definition, difference between GI and trademark, difference between GI and appellation of origin, GI as factors of rural development, developing a geographical indication and protection

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd , 2006
2. B. L.Wadehra;" Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010

Suggested Reading:

1. Cronish W.R1 "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, .Sweet, Maxwell.

16PE E11

SUPPLY CHAIN MANAGEMENT (Professional Elective – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand

1. The awareness about transportation and warehouse management systems.
2. The designing supply chain networks.
3. The concept of demand and supply and integrating it with supply chain management.
4. The planning and managing inventories.
5. The pricing and revenue management

Outcomes: At the end of the course, the student is able to

1. Plan an effective transportation and warehouse management systems
2. Design an effective supply chain networks
3. Integrate and optimize demand and supply gaps
4. Apply inventory management techniques
5. Understand and design pricing and revenue management systems

UNIT-I

Concept of SCM: Concept of Logistics Management, Supply Chain, Types of supply chain, functions in SCM, Transportation Management, Warehousing Management, Warehouse management systems.

UNIT-II

Designing the Supply Chain Network: Designing the distribution network, Network Design, Network Design in an uncertain environment.

UNIT-III

Planning and Demand: Planning demand & supply in a supply chain, demand forecasting, aggregate planning, planning supply & demand.

UNIT-IV

Planning & Managing Inventories in a Supply Chain: managing economies of scale, cycle inventory, and managing uncertainty safety inventory optimal level of product availability

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-V

Sourcing, Transporting & Pricing Products: sourcing decisions, transportation, pricing & revenue management. Coordination & technology in the supply chains, coordination in supply chain, information technology and supply chain.

Text Books:

1. N. J. Kumar & Mukesh Bhatia, "Supply Chain Management", Neha publishers & Distributors, 2010.
2. Michael H. Hugos, "Essentials of Supply Chain Management", 3/e, John Wiley & Sons, Inc, Hoboken, New Jersy, 2011.
3. Sunil Chopra & Peter Meindl, "Supply Chain Management – Strategy, Planning and Operation", Pearson Education, Inc., Upper Saddle River, New Jersey, 2003.

Suggested Reading:

1. Martin Christopher, "Logistics & Supply Chain Management", 5/e, Financial Times Series, 2010.
2. Dobler Donald. W, David.N.Burt, "Purchasing & supply Management Text & Cases", McGraw-Hill, 1996.
3. A.K. Chitale, R.C, Gupta, "Materials Management-Text and Cases", Prentice-Hall Of India Pvt. Limited, 2007.

16ME E18

NANO SCIENCE AND TECHNOLOGY (Professional Elective – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn

1. Nanotechnology approach and challenges
2. Materials and characterization procedures
3. Zero and One dimensional Nano structures
4. Various Fabrication Techniques
5. Special nano materials and Nano biomaterials

Outcomes: At the end of the course, students will

1. Understand the developments and challenges in nano technology
2. Understand magnetic and electronic properties and its microstructure
3. Learn synthesis and characterization techniques of Zero and One dimensional Nano structures and their applications
4. Study various Nano Material Fabrication Techniques
5. Understand the applications of special nano materials and nano bio materials

UNIT-I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nanotechnology, Bottom-up and Top-down approaches, challenges in nanotechnology, proximal probe technologies

UNIT-II

Materials of Nanotechnology: Introduction, Si-based materials, Ge-based materials, Ferroelectric materials, Polymer materials, GaAs& InP (III-V) group materials, Nanotribology and materials, characterization using Scanning Probe Microscope, AFM and Friction force microscopy

UNIT-III

Nano Structures: Zero dimensional Nanostructure, synthesis procedure by heterogeneous method, characterization techniques, properties and applications particles

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

One dimensional Nanostructures: Nanowires, Nanotubes and its Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires

UNIT - IV

Nano Fabrication: Introduction, Basic fabrication techniques by Lithography , thin film deposition and doping, MEMS fabrication techniques, Nano fabrication techniques by E-beam, Nano-imprint fabrication, Epitaxy and strain engineering

UNIT - V

Special Nano Materials: Introduction, Synthesis procedure by metal-polymer, metal ceramic and polymer ceramic, Characterization procedures, applications
Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, applications

Text Books:

1. Dieter Vollath, "Nanomaterials: An introduction to Synthesis, properties and applications", Wiley, 2013
2. Guozhong Cao, "Nanostructures and Nano Materials, Synthesis properties and applications", Imperial College Press
3. Carl C Koch, "Nano materials Synthesis , Properties and applications", Jaico Publishing House

Suggested Reading:

1. Willia TIlsey Atkinson, "Nano Technology", Jaico Publishing House
2. George W. Hanson, "Fundamentals of Nanoelectronics", Pearson Education, 2009
3. T. Pradeep, "Nano: Essentials-understanding Nano Science and Technology", TMH, 2007

16CE O02

DISASTER MITIGATION AND MANAGEMENT (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Outcomes: At the end of the course the students are able to

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability ~~to~~ understand various

participatory approaches/strategies and their application in disaster management

UNIT-I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III:

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT-IV:

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR

programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh,"Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs, "Government of India, "National disaster management plan, Part I and II"
2. K. K. Ghosh,"Disaster Management", APH Publishing Corporation, 2006.
3. "Hazards, Disasters and your community: A booklet for students and the community", Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

16IT O02

PRINCIPLES OF INTERNET OF THINGS (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To provide an overview of Internet of Things, building blocks of IoT and real-world applications.
2. To explore various IOT enabling technologies.
3. To facilitate students, understand Python scripts for IoT platform.
4. To identify steps in IOT design Methodology.
5. To introduce about the Raspberry Pi device, its interfaces and Django Framework.

Outcomes: Upon completing this course, students will be able to:

1. Comprehend the terminology, protocols and communication models of IoT.
2. Define the various IoT enabling technologies and differentiate between M2M and IoT.
3. Acquire the basics of Python Scripting Language used in developing IoT applications.
4. Describe the steps involved in IoT system design methodology.
5. Design simple IoT systems using Raspberry Pi board and interfacing sensors with Raspberry Pi.

UNIT-I

Introduction & Concepts: Introduction to Internet of Things- Definitions & Characteristics ofIoT, Physical Design of IOT-Physical Layer, Network Layer, Transport Layer, Application Layer, Things in IoT, IoT Protocols, Logical Design of IOT-IoTFunctional Blocks, IoT Communication Models-Request-reponse,Publisher-Subscriber,Push-Pull,Exclusive Pair, IoT Communication APIs-REST API, Websocket API,

UNIT-II

IOT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IOT Levels & Deployment Templates. Differences and similarities between IOT and M2M,

Domain Specific IoT's – IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

UNIT-III

Introduction to Python–Motivation for using Python for designing IoT systems, Language features of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow-if, for, while, range, break/continue, pass, functions, modules, packaging, file handling, data/time operations, classes, Exception handling,

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi about the Raspberry Pi board, Raspberry Pi interfaces-Serial, SPI, I2C, Other IoT Devices pcDuino, BeagleBone Black, Cubieboard. Python Web Application Framework: Django Framework-Roles of Model, Template andView

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach, Universities Press, 2015.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.

Suggested Reading:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Willy Publications.

Reddy

Web Resources:

1. The Internet of Things - Article
https://dl.acm.org/citation.cfm?id=1862541
2. Internet of Things - Tutorial
http://archive.eurescom.eu/~pub/about-eurescoiem/message_2009_02/Eurescom_message_02_2009.pdf
3. Publications on The Internet of Things.
http://www.itu.int/osg/spu/publications/internetofthings/InternetofThings_summary.pdf

16EE O03

ENERGY AUDITING (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To know the concept of Energy auditing
2. To understand the formulation of efficiency for various engineering systems
3. To explore the different ways to design various technologies for efficient engineering systems.

Outcomes: After completion of this course, students will be able to:

1. Know the current energy scenario and importance of energy auditing.
2. Understand the concepts of energy auditing.
3. Evaluate the performance of existing engineering systems
4. Explore the methods of improving energy efficiency in different engineering systems
5. Design different energy efficient devices.

UNIT-I

Basics of Energy and its Various Forms: Overview of engineering, elements Solar energy, electricity generation methods using solar energy, PV cell, elements of wind energy, electricity generation using wind energy, elements of bio energy, bio mass energy conservation, elements of geothermal energy, sources of geothermal energy, sources of chemical energy, fuel cells, Energy Scenario in India

UNIT-II

Energy Auditing-1: Introduction: Need for energy audit, directions for the study of energy auditing, inclusions for energy auditing, types of energy audit: preliminary audit, general/mini audit, investment-grade/ comprehensive audit. Major energy consuming equipments and systems, energy audit team, energy auditing methodology: preliminary and detailed, Process flow diagram, energy audit report format

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-III

Energy Auditing-2: For Buildings: Energy auditing instruments, energy efficiency, energy auditing for buildings: stages in programs, surveying, measurements and model analysis. Energy audit form of commercial buildings, checklist for energy saving measures

UNIT –IV

Energy Efficient Technologies-I: Importance of energy efficiency for engineers, Energy efficient technology in mechanical engineering: Heating, ventilation and air-conditioning, boiler and steam distribution systems Energy efficient technology in civil engineering: future of roads, harnessing road and transport infrastructure;

UNIT-V

Energy Efficient Technologies-II: Energy efficient technology in electrical engineering: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors; Energy efficient technology in chemical engineering: green chemistry, low carbon cements, recycling paper

Text Books:

1. Umesh Rathore, 'energy management', Kataria publications, 2nd ediiton, 2014.
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects
3. Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014) An Overview of Energy Efficiency Opportunities in Mechanical/ civil/electrical/chemical Engineering, The University of Adelaide and Queensland University of Technology.

Suggested reading:

1. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

16EC O07

SYSTEM AUTOMATION AND CONTROL (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: This course aims to

1. Learn the concepts industrial control systems
2. Learn how to measure the physical parameters in industry
3. Learn the applications of Robots in industry.

Outcomes: After completion of this course, students will be able to:

1. Understand various process control systems.
2. Measure the physical parameters in the industry.
3. Design PID controllers
4. Understand the role of digital computers in automation
5. Understand the applications of Robots.

UNIT-I

Introduction to Automatic Control Systems: Purpose of Automatic Control, How an Industrial Control System is implemented, Introduction to Automatic Control theory.

Sensors: Motion, Position, Force, Level sensors and Thermo couples.

UNIT-II

Theory of Measurements: Measurement goals and concepts, Scale factor, Linearity, accuracy, Range, Resolution, Precision and repeatability.

Measurement Techniques and Hardware: Typical Sensor outputs, Bridgemeasurements, Resistance balanced Wheatstone bridge, Variable voltage type measurements, Frequency type measurements.

UNIT-III

Process Controllers: What is a Controller, uses of Controllers, Open loop and closed loop Control, proportional, PD, PI, PID Controllers, Analog and Digital methods of Control.

Controller Hardware: Analog and Digital Controllers.

PROFESSOR & HEAD
...partment of Mechanical Engineering
...anya Bharathi Institute of Technology (A)
...dipet, Hyderabad-500 075. Telangana

UNIT-IV

Digital Computers as Process Controllers: Use by Digital Computer for process control, Information required by the computer, Information required by the process, Computer Interface electronics, Digital Computer input-output, computer processing of data, Digital Process control computer design, Computer programming.

Actuators: Electro mechanical - Linear motion and rotary motion solenoids, DC motors, AC motors and Stepped motors.

UNIT-V

Robots: What are robots, Robots and process Control systems, Degrees of freedom, factories of the future, Delivery, Disposal and transport systems, Sensing elements, Robot Classifications and Applications.

Trouble shooting System failures: Preliminary stepsand other troubleshooting aids.

Text Books:

1. Ronald P. Hunter, "Automated process control systems – concepts and Hardware", 2/e, PHI, 1987.
2. Norman A. Anderson, "Instrumentation for process measurement and Control", 3/e, CRC Press, 2005.

Suggested reading:

1. Kuo BC, "Automatic Control Systems", 9/e
2. AK Sawhney, "A course on Electrical and Electronic Measurements and Instrumentation".

16CS O09

BASICS OF ARTIFICIAL INTELLIGENCE (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: The objectives of this course are

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Outcomes: On Successful completion of this course, student will be able to

1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Understand and analyze the various reasoning and planning techniques involved in solving AI problems.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

UNIT - I

Introduction: Definition, history, applications.

Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate-and-test, Hill Climbing, Constraint Satisfaction.

UNIT - II

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification.

Knowledge Representation (Structured): Declarative representation, Semantic nets, procedural representation, frames.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - III

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory.

Planning: Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree.

Intelligent Agents: Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition.

Perception and Action: Real Time Search, Vision, Speech Recognition, **Action:** Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence", 3/E, 2008
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3/E, 2010.

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.
2. Nelson M. Mattos, "An Approach to Knowledge Base Management", Springer Berlin Heidelberg, 1991.

Online Resources / Weblinks / NPTEL Courses:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

16IT O01

OBJECT ORIENTED PROGRAMMING USING JAVA

(Open Elective – II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To familiarize with fundamentals of object-oriented programming paradigm.
2. To impart the knowledge of string handling, interfaces, packages and inner classes.
3. To facilitate learning Exception handling and Multithreading mechanisms.
4. To gain knowledge on collection framework, stream classes.
5. To familiarize with event driven GUI programming and Database connectivity.

Outcomes: Upon completing this course, students will be able to

1. Understand Object-Oriented concepts.
2. Create Java applications using sound OOP practices e.g. Inheritance, Interfaces, Packages, and Inner classes.
3. Implement Exception Handling and Multithreading concepts in java programs.
4. Develop programs using the Java Collection API and Stream classes.
5. Design and Develop GUI applications with the integration of event handling, JDBC.

UNIT-I

OOP concepts - Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object oriented programming paradigms.

Introduction to Java: Java's Magic: The Byte code, The Java Buzzwords, Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

Reddy

UNIT-II

Inheritance: super and subclasses , Member access rules ,super keyword, Method overriding, Dynamic method dispatch , Abstract classes, using final with inheritance , Introduction to Object class.

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Interfaces : Defining and implementing interfaces, Nested Interfaces.

Strings Handling: String & StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives.

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous inner classes.

UNIT-III

Exception Handling in Java: what are Exceptions? Exception types, Usage of try, catch, throw, throws and finally clauses, writing your own exception classes.

Multithreading in Java: The java Thread Model, How to create threads, Thread class in java, Thread priorities, Thread synchronization.

Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

UNIT-IV

Collections Framework: Overview of Collection Framework, Commonly used Collection classes – ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, Collection Interfaces –Collection, List, Set, SortedSet, Accessing a collection via an Iteration,Storing user-defined classes in collections, Map Interfaces and Classes, Using a comparator. Legacy classes – Vector, Hashtable, The Enumeration interface.

Input/Output : How to read user input (from keyboard) using scanner class,Stream classes, InputStream, OutputStream, FileInputStream, FileOutputStream, Reader and Writer, FileReader, FileWriter cl asses. File class.

UNIT-V

GUI Design and Event Handling: Component, Container, window, Frame classes. Working with Frame window GUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling button click events, Adapter classes. Writing GUI Based applications.

Database Handling in Java: Java Database Connectivity (JDBC) using MySQL.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 8/e, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell, "Core Java, Volume I, Fundamentals", 8/e, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra & Saurabh Choudhary, "Programming in Java", 2/e, Oxford University Press, 2014.
2. C. Thomas Wu, "An introduction to Object-oriented programming with Java", 4/e, Tata McGraw-Hill Publishing company Ltd., 2010.
3. Kathy Sierra, Bert Bates, "Head First Java: A Brain-Friendly Guide" 2/e, O'Reilly, 2005

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PY O01

HISTORY OF SCIENCE AND TECHNOLOGY (Open Elective – II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To enable students to understand science as a socio-cultural product in specific socio-historical contexts.
2. To expose students to philosophical, historical and sociological perspectives to look atscience as a practice deeply embedded in culture and society.
3. To inculcate the scientific culture and ethics in the development of technologies.

Outcomes:

1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

UNIT-I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions,Civilization,Major advances.

Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT-II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT-III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT-IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 AD – 1945 AD): The growth of 20thcentury science, Newphilosophies, Quantum reality, Energy sources, Electricity: a revolution intechnology, Majoradvances.

UNIT-V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 AD – 2015 AD): Information and society, Globalization, The post-industrial society,Problems of the Information age, Major Advances.

Text Books:

1. Bryan Bunch and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company (New York), 2004
2. JD Bernal, "Science in History", 4 Volumes, Eklavya Publishers, 2012

Suggested Readings:

1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010
2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16EE O05

WASTE MANAGEMENT (Open Elective – II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To imbibe the concept of effective utilization of any scrap
2. To Become familiar with the processes of all disciplines of engineering.
3. To learn the technique of connectivity from waste to utility.

Outcomes: After completion of this course, students will be able to

1. Understand the various processes involved in allied disciplines of engineering
2. Infer the regulations of governance in managing the waste
3. Distinguish the nature of waste materials concerned to the particular branch of engineering
4. Explore the ways and means of disposal of waste material
5. Identify the remedies for the disposal of a selected hazardous waste material

UNIT-I

Introduction to Waste Management: Relevant Regulations Municipal solid waste (management and handling) rules; hazardous waste (management and handling) rules; biomedical waste handling rules; fly ash rules; recycled plastics usage rules; batteries (management and handling) rules. Municipal Solid Waste Management – Fundamentals Sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options.

UNIT-II

Hazardous Waste Management : Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects. Radioactive Waste Management – Fundamentals Sources; measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.

UNI-III

Environmental Risk Assessment: Defining risk and environmental risk; methods of risk assessment; case studies, Physicochemical Treatment of Solid and Hazardous Waste Chemical treatment processes for MSW (combustion, stabilization and solidification of hazardous wastes); physicochemical processes for hazardous wastes (soil vapor extraction, air stripping, chemical oxidation); ground water contamination and remediation .

UNIT-IV

Biological Treatment: Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.

UNIT-V

Landfill design aspects: Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration

Text Books:

1. John Pichtel, "Waste Management Practices", CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham, P.L. and Evans, J.C., "Hazardous Waste Management", McGraw Hill International Editions, New York, 1994
3. Richard J. Watts, "Hazardous Wastes - Sources, Pathways, Receptors", John Wiley and Sons, New York, 1997

Suggested Reading:

1. Kanti L.Shah, "Basics of Solid and Hazardous Waste Management Technology", Prentice Hall, 1999.
2. S.C.Bhatia, "Solid and Hazardous Waste Management", Atlantic Publishers & Dist, 2007

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16EC O05

MEMS AND ITS APPLICATIONS (Open Elective – II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: This course aims to:

1. Provide knowledge of semiconductors, various materials used for MEMS.
2. Introduce various Electrostatic and Thermal Sensors and Actuators.
3. Educate on the applications of MEMS to various disciplines.

Outcomes: Upon completion of this course, students will be able to:

1. Select various materials used for MEMS.
2. Design the micro devices and systems using the MEMS fabrication process.
3. Understand the operation of different Sensors and Actuators.
4. Design the micro devices and systems using Polymer MEMs.
5. Apply different MEMS devices in various disciplines.

UNIT-I

Introduction: The History of MEMS Development, The Intrinsic Characteristics of MEMS: Miniaturization, Microelectronics Integration, Parallel Fabrication with Precision, Devices: Sensors and Actuators- Energy Domains and Transducers, Sensors Considerations, Sensor Noise and Design Complexity: Actuators Considerations.

UNIT-II

Introduction to Micro Fabrication: Overview of Micro fabrication, Overview of Frequently used Micro fabrication Processes: Photolithography, Thin Film Decomposition, Thermal Oxidation of Silicon, Wet Etching, Silicon Anisotropic Etching, Plasma Etching and Reactive Etching, Doping, Wafer Dicing, Wafer Bonding, Microelectronics Fabrication Process Flow, Silicon based MEMS Processes, Packaging and Integration, Process Selection and Design.

UNIT-III

Electrostatic Sensing and Actuation: Introduction to Electrostatic Sensors and Actuators, Parallel: Plate Capacitor, Applications of Parallel Plate Capacitors,

Interdigitated Finger Capacitors, Applications of Combo- Drive Devices: Inertia Sensors, Actuators.

Thermal Sensing and Actuation: Introduction to Thermal Sensors, Thermal Actuators, Fundamentals of Thermal Transfer, Sensors and Actuators Based on Thermal Expansion, Thermal Couples, Thermal Resistors, Applications- Inertia Sensors, Flow Sensors, Infrared Sensors.

UNIT-IV

Piezoresistive Sensors: Origin and Expression of Peizoresistivity, Piezoresistive Sensor Materials: Metal Strain Gauges, Single crystal Silicon, Polycrystalline Silicon, Applications of Piezoresistive Sensors:Inertial sensors, Pressure Sensors, Tactile Sensors, flow Sensors.

Piezoelectric Sensors: Introduction, Properties of Piezoelectric Materials, Applications- Inertia Sensors, Acoustic Sensors, Tactile Sensors, Flow Sensors.

UNIT-V

Polymer MEMS: Introduction, Polymers in MEMS- Polyimide, SU-8, Liquid Crystal Polymer(LCP), Representative Applications- Acceleration Sensors, Pressure Sensors, Flow Sensors, Tactile Sensors.

Case Studies of Selected MEMS Products: Blood Pressure (BP) Sensor, Microphone, Acceleration Sensor and Gyros.

Text Books:

1. Chang Liu, "Foudations of MEMS", 2/e, Pearson Education Inc., 2012.
2. Tai Ran Hsu, "MEMS & Micro Systems Design and Manufacture", Tata McGraw Hill, 2002.

Reference Books:

1. P. Rai-Choudary, "MEMS and MOEMS Technology and Applications", PHI publications, 2009.
2. Mohamed Gad-el-Hak, "The MEMS Handbook", CRC press, 2001.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

16CS O07

BASICS OF CYBER SECURITY (Open Elective – II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: The main objectives of this course are:

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Outcomes: On Successful completion of this course, student will be able to:

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector.

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives: Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, "Incident Response and Computer Forensics", Tata McGraw Hill, 2006.

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, "Cyber Security and Cyber Laws", Paperback, 2018.
2. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge University Press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME C39

PROJECT SEMINAR

Instruction	3 Hours per week
Duration of Semester End Examination	——
SEE	——
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks: Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

16ME C40

PROJECT

Instruction	6 Hours per week
Duration of Semester End Examination	——
SEE	100 Marks
CIE	50 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

CIE (Continuous Internal Evaluation) Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Max. Marks: 100

Evaluation by	Max. Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
OPEN ELEECTIVE subjects offered by MED
(to be handled by MED faculty)

S.No.	Semester	Open Elective
UNDER CBCS SCHEME		
1.	SEMESTER – VII & SEMESTER – VIII	16ME O01 : Entrepreneurship 16ME O02 : Robotics 16ME O03 : Human Rights and Legislative Procedure 16ME O04 : Intellectual Property Rights 16ME O05 : Nano Materials and Technology 16ME O06 : Research Methodologies 16ME O07 : Introduction to Operations Research 16ME O08 : Industrial Administration and Financial Management 16ME O09 : Organizational Behaviour 16ME O10 : 3D Printing 16ME O11 : Essentials of Management

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

18MT C05

MATHEMATICS – III

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives:

1. To form PDE and to find its solution.
2. To solve wave and heat equations.
3. To learn the Laplace and Inverse Laplace transforms for solving engineering problems.
4. To learn Fourier transform and Z-transforms for solving engineering problems.
5. Learning the basic concepts of probability and Statistical Analysis.

Outcomes:

On successful completion of this course, the students shall be able to

1. Solve Linear and Non-Linear PDE's.
2. Solve One-Dimension Wave and Heat equations and Two Dimension Laplace equation.
3. Find Laplace transform and inverse Laplace transform and can solve Linear Differential equations.
4. Find the solutions ofvarious Transforms.
5. Find moments of discrete and continuous random variables as well as familiar with distribution.

UNIT - I

Partial Differential Equations: Formation of Partial Differential Equations, Solution of First Order Linear Partial Differential Equations by Lagrange's Method, Solution of First Order Non-linear Partial Differential Equationby Standard types and Charpits Method.

UNIT - II

Applications of Partial Differential Equation: Solution by Method of Separation of Variables, Solution of One dimensional Wave equation, One dimensional Heat equation, Two dimensional Laplace equation and its related problems.

UNIT - III

Laplace Transform: Laplace Transform of standard functions, Linearity property, change of scale property. Shifting theorems, Laplace Transform of Periodic Function, Unit step function and Unit impulse function. Transforms of derivatives, Transforms of integrals, Multiplication by $t^n$and division by t. Inverse Laplace Transform properties, Inverse Laplace Transform by partial fractions and Convolution theorem, Applications of Laplace Transform (Solution of Linear Differential Equations).

UNIT - IV

Fourier Transforms and Z-Transforms:

Fourier Transforms: Fourier integral theorem (statement), Complex form of Fourier integrals. Fourier transforms, Inverse Fourier Transforms, Fourier Sine and Cosine transforms, Inverse Fourier Sine and Cosine Transforms. Properties of Fourier transforms: Linear property, change of scale property, shifting property and Modulation theorem.

Z-Transforms:Z-transforms of standard functions, linearity property, damping rule, shifting theorems, multiplication by 'n', initial and final value theorems. Inverse Z-Transform:Inverse Z-transform by Convolution theorem, partial fractions. Z-transform application to difference equations.

UNIT - V

Basic Statistics: Random variable, discrete probability distribution and continuous probability distribution. Expectation, Addition theorem and Multiplication theorem of expectation, properties of variance, Poisson distribution (Mean, variance, MGF& CGF), Normal distribution (Mean, variance, MGF& CGF), Properties of Normal distribution, Areas of under normal curve. Correlation and regression.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Textbooks:

1. Erwin kreyszig, "Advanced Engineering Mathematics", 9/e, John Wiley & Sons, 2006.
2. B.S. Grewal, "Higher Engineering Mathematics", 35/e, Khanna Publishers, 2000.
3. Sheldon Ross, "A First Course in Probability", 9/e, Pearson publications, 2014.

Suggested Reading:

1. S. J. Farlow, "Partial Differential Equations for Scientists and Engineers", Dover Publications, 1993.
2. Ian Snedon, "Elements of Partial Differential equations", McGraw Hill, 1964.
3. S.C.Gupta, V.K.Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.

Preddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
The objectives of the course are

1. To demonstrate the importance of Managerial Economics in decision making.
2. To understand the importance of project evaluation in achieving a firm's objective.
3. To explain the concept of Accountancy and provided knowledge on preparation and analysis of Final accounts

Outcomes:
At the end of the course a student will be able to

1. Apply fundamental knowledge of Managerial economics concepts and tools.
2. Understand various aspects of demand analysis and forecasting.
3. Analyze production and cost relationships to make best use of resources available.
4. Analyze different opportunities and come out with best feasible capital investment decisions
5. Apply accountancy concepts and conventions and preparation of final accounts

UNIT - I
Introduction to Managerial Economics: Introduction to Economics and its evolution - Managerial Economics - its scope, importance, relationship with other subjects, its usefulness to engineers - Basic concepts of Managerial economics

UNIT - II
Demand and Supply Analysis: Demand Analysis - Concept of demand, determinants, Law of demand, its assumptions, Elasticity of demand, price, income and cross elasticity, Concept of supply, determinants of supply, law of supply, Demand Forecasting – simple numerical problems

UNIT - III
Production and Cost Analysis: Theory of Production, Production function - input-output relations - laws of returns - internal and external economies of scale.
Cost Analysis: Cost concepts - fixed and variable costs - explicit and implicit costs - out of pocket costs and imputed costs - Opportunity cost - Cost output relationship – Firm and industry, types of market structures, Break-even analysis, numerical problems.

UNIT - IV
Accountancy: Book-keeping, principles and significance of double entry book keeping, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments

UNIT - V
Capital Budgeting: Introduction to capital budgeting, Methods: traditional and discounted cash flow methods, Introduction to working capital management, Numerical problems

Text Books:

1. Mehta P.L., "Managerial Economics – Analysis, Problems and Cases", Sultan Chand and Son's Educational publishers, 2016.
2. Maheswari S.N., "Introduction to Accountancy", 11/e, Vikas Publishing House, 2013.
3. Panday I.M., "Financial Management", 11/e, Vikas Publishing House, 2015

Suggested Reading:

1. Varshney and KL Maheswari, "Managerial Economics", Sultan Chand, 2014
2. M.Kasi Reddy and S.Saraswathi, "Managerial Economics and Financial Accounting", PHI Pvt Ltd, 2007.
3. A.R.Aryasri, "Managerial Economics and Financial Analysis", McGraw-Hill, 2013

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C03

MATERIAL SCIENCE AND METALLURGY

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

Student will understand

1. Structure property relations, analyze the failures of metals and their prevention.
2. Fatigue, creep and diffusion mechanisms.
3. Classification of steels and their application .
4. Working principle of various heat treatment operations
5. Principles of extractive metallurgy.

Outcomes:

At the end of the course a student will be able to

1. Understand the imperfections of crystals.
2. Understand crack propagation by fatigue, creep deformation and diffusion theory.
3. Understand the importance of steel in engineering applications.
4. Understand to the methods of improvement of mechanical properties by various heat treatment operations
5. Understand the methods of production of various metals by extractive metallurgy

UNIT - I

Plastic deformation: Imperfections in crystals, dislocation in crystals, types of dislocations, effect of slip and twinning on the plastic deformation, cold and hot working, strain hardening and Bauchinger effect, recovery, recrystallization, grain growth and its effect on mechanical properties of metals.

Fracture: Types of fracture in metals, modes of fracture, Griffith theory of brittle fracture, crack propagation, ductile fracture, fracture under combined stress.

UNIT - II

Fatigue: S–N curve, Structure of fatigue fracture specimen. Fatigue crack propagation, effect of metallurgical variables on fatigue of metal, low cycle fatigue, experimental determination of fatigue strength (RR–Moore Test).

Creep: Creep strength, creep curve, creep deformation mechanisms, creep test.

Diffusion: Fick's law of diffusion, application of diffusion theory in mechanical engineering.

UNIT - III

Structure of Alloys: study of eutectic, eutectoid, peritectic and peritectoid reactions, Iron–Iron Carbide equilibrium diagram, construction and interpretation.

Types of plain carbon steels, cast irons and their properties and characteristics.

UNIT - IV

Heat Treatment: Annealing, normalising, hardening, tempering, Construction and interpretation of T–T–T diagram, austempering and martempering, case hardening, carburizing, nitriding, carbo–nitriding, flame hardening, induction hardening.

UNIT - V

Introduction to Extractive Metallurgy: Method of production of pig iron by blast furnace, cast iron by cupola furnace, Method of production of steel by Bessemer convertor, L.D process and electric arc process.

Alloy Steels: Effects of alloying elements like nickel, chromium, manganese, silicon tungsten, and titanium, Study about stainless steels, HSS, brass, bronze; their composition and properties.

Polymers and Ceramics: Polymerization, thermoplastics and thermosetting plastics, elastomers, resins. Types and applications of ceramics

Text Books:

1. V. Raghavan, "Materials Science and Engineering", 4/e, Prentice Hall of India Ltd., 2005.
2. S.H. Avner, "Introduction to Physical Metallurgy", 2/e, Tata McGraw Hill Publishers, 2005.

Suggested Reading:

1. S.P. Nayak, "Engineering Metallurgy and Material Science", 6/e, Charoter Publishing House, 2005.
2. E. Dieter, "Mechanical Metallurgy", 3/e,Metric Edition, Tata McGraw Hill, 2005.
3. K.L. Kakani, "Material Science", New Age Publications (P) Ltd., 2008.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

With Effect from the Academic Year 2019 – 2020

18ME C04

MECHANICS OF MATERIALS

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives:

1. Student is exposed to the concept of different types of loads, stresses, strains and analysis of members for axial loads.
2. Student will acquire knowledge in drawing bending and shear force diagrams of beams of various loads and configurations.
3. Student becomes familiar with methods of evaluation of deflection of beams of various configurations and stresses that arise due to simple bending.
4. Student is exposed to the concept of shear stresses in beams, principal stresses, strains and phenomenon of torsion.
5. Student will acquire knowledge in estimating stresses for thin, thick cylindrical shells and buckling of columns.

Outcomes:

At the end of the course a student will be able to

1. Determine stresses and strains in members subjected to axial loads and temperature changes.
2. Draw shear force, bending moment diagrams for different types of beams and calculate stresses and strains due to simple bending.
3. Determine slope and deflection for various configurations of beams using different methods. analyze stress, strain and deflection due to torsion in circular members.
4. Analyze shear stress distribution in different sections of beams and find out principal stresses and strains.
5. Find out stresses and strains in thin, thick cylindrical shells and also able to calculate critical buckling loads in columns and struts.

UNIT - I

Stresses and Strains: Definitions, types of stresses and strains, elasticity and plasticity. Hooke's law, stress-strain diagrams for engineering materials, modulus of elasticity. Poisson's ratio, relationship between elastic constants, linear and volumetric strains, bars of uniform strength, temperature stresses, compound bars.

UNIT - II

Beams: Definition of bending moment and shear force; relationship between intensity of loading, shear force and bending moment; bending moment and shear force diagrams for cantilever, simply supported and overhanging beams; simple theory of bending, moment of resistance, modulus of section.

UNIT - III

Slopes and Deflections: Slope and deflection calculations of cantilever, simply supported beams subjected to point loads and uniformly distributed loads with Macaulay's and double integration methods.

Torsion: Derivation of torsion formula for circular sections, power transmission, effect of combined bending and torsion.

UNIT - IV

Shear Stresses in beams: Distribution of shear stresses in rectangular, I-section, T-section, solid and hollow circular sections.

Compound stresses: principal stresses and strains. Mohr's circle of stress.

UNIT - V

Cylinders: Stresses in thin and thick cylinders with internal and external pressures. Stresses in compound cylinders. **Columns and struts**: Euler's and Rankine's formulae for axial load applications. Secant and Perry formulae for eccentrically loaded columns.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. S.S.Rattan, "Strength of Materials", 3/e, Tata Mc-Graw Hill, 2016.
2. S. Ramamrutham, "Strength of Materials", Dhanpatrai and Sons, 1993.
3. G.H.Ryder, "Strength of Materials", 3/e, Macmillan India Limited, Delhi 2002.

Suggested Reading:

1. S.S. Bhavakatti, "Strength of Materials", Vikas Publication, 2003.
2. James M Gere, "Mechanics of materials", 8/e, cengage learning, 2013.
3. R.C. Hibbeler, "Mechanics of Materials", 9/e, Pearson, 2018

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C10

With Effect from the Academic Year 2019 – 2020

FLUID PRINCIPLES AND HYDRAULIC MACHINES

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives: Students will

1. Learn properties of fluids, laws related to fluid flow and their applications.
2. Understand the principles and problems associated with impact force of jet on the vanes
3. Understand various principles and performance characteristics related to Reciprocating pumps.
4. Come to know the working principles and performance characteristics of Centrifugal pumps.
5. Learn the working principle and efficiencies of hydraulic turbines.

Outcomes: At the end of the course, a student will be able to

1. Determine the various properties of fluid and their applications
2. Understand the methodology in calculation of impact force exerted by the jet on the vanes
3. Acquire the knowledge of the functionality and performance of Reciprocating pumps.
4. Understand the working, estimate the performance and testing of Centrifugal pumps.
5. Acquire knowledge in the functionality, performance and testing of hydraulic turbines.

UNIT - I

Properties and Laws of Fluid Flow: Fluids- Fluid properties- Pressure, Density, Specific weight, Specific volume, Dynamic and Kinematic viscosity -Laws of fluid flow-Continuity theorem-Bernoulli's theorem-Venturimeter-Notches-Pitot tube– Darcy's equation - Impulse-momentum equation and applications

UNIT - II

Hydraulic Machines: Classification- Lay-out of hydraulic power plant- working principle- Impact force exerted by a jet striking (i) a fixed flat vertical vane held normal to the jet flow (ii) at the centre of a fixed symmetrical curved vane (iii) at one end of fixed symmetrical and unsymmetrical curved vanes (iv) flat vertical vane moving in the direction of jet (v) a series of flat vertical moving vanes (vi) at the centre of symmetrical moving curved vanes (vii) symmetrical curved vanes moving in the same direction as that of jet at inlet (viii) at one end of a series of un-symmetrical moving curved vanes. (Numerical problems for above cases only)

UNIT - III

Reciprocating Pumps: Classification- working principle- single and double acting pumps- discharge, work done and power required to drive the pumps- slip, % slip and negative slip- Variation of pressure head in the suction and delivery pipes due to acceleration of piston- Variation of pressure head due to friction in the suction and delivery pipes- Indicator diagrams- Ideal and actual diagrams- Effect of piston acceleration and pipe friction on indicator diagram- Maximum speed at which the pump must run to avoid separation during suction and delivery strokes- Air vessels-Function of air vessels- Work saved by fitting air vessels to single and double acting pumps- Discharge of liquid into and out of air vessels-Performance characteristic curves.

UNIT - IV

Centrifugal Pumps: Classification- Working principle- Comparison over reciprocating pumps-Velocity triangles- Manometric head- work done per second- Head equivalent of work done- Manometric, mechanical and overall efficiencies- Pressure rise in the impeller- Minimum starting speed- Specific speed- Physical significance of specific speed- Model testing- Conditions of similarity of CF pumps- Priming- Performance characteristic curves.

UNIT - V

Hydraulic Turbines: Classification- Impulse and reaction turbines-Construction and working of Pelton wheel, Francis turbine and Kaplan turbine- Velocity triangles- Work done (power developed)- Hydraulic, Mechanical and Overall efficiencies- Maximum efficiency- Specific speed- Physical significance of specific speed-Unit testing -Unit quantities- Model testing of turbines- Conditions for similarity of turbines- Performance characteristic curves.

Text Books:

1. R.K. Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publication (P) Ltd., New Delhi, 2004.
2. R.S. Khurmi and N. Khurmi, "Hydraulics, Fluid Mechanics and Hydraulic Machines", 20/e, S. Chand publishing, 2014

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

Suggested Reading:

1. P.N. Modi, and. S.M.Seth, "Hydraulics and Fluid Machines", Standard Book House, New Delhi, 2004.
2. S.Ramamrutham, "Hydraulics, Fluid Mechanics and Fluid Machines", Dhanpat Rai and Sons, New Delhi, 2004.
3. Madan Mohan Das., "Fluid Mechanics and Turbomachines", PHI Learning Private Limited, New Delhi, 2009.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18EG M01

INDIAN CONSTITUTION AND FUNDAMENTAL PRINCIPLES

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	------
Credits	0

Objectives: The course will introduce the students to

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Outcomes: After successful completion of the course the students will be able to

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right To Liberty.

UNIT - I

Constitution of India: Introduction and salient features, Constitutional history, Directive principles of state policy - Its importance and implementation.

UNIT - II

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States, Parliamentary form of government in India. **President**: role, power and position.

UNIT - III

Emergency Provisions in India: National emergency, President rule, Financial emergency

UNIT – IV

Local Self Government: District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

UNIT – V

Scheme Of The Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme of the Fundamental Rights: To Equality, to certain Freedom under Article 19, to Life and Personal Liberty under Article 21.

Text Books:

1. "The Constitution of India", 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1/e, 2015.

Suggested Reading:

1. M. P. Jain, "Indian Constitution Law", 7/e, Lexis Nexis, 2014.
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18EE A01

With Effect from the Academic Year 2019 – 2020

INDIAN TRADITIONAL KNOWLEDGE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	------
Credits	0

Objectives: The course will introduce the students to
1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Outcomes: After successful completion of the course the students will be able to
1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.

UNIT - I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT - II

Indian Languages, Culture and Literature: Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT - III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – IV

Fine Arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT – V

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition",ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre", ISBN 81-7450-494-X, 2006
4. S. Narain, "Examinations in ancient India", Arya Book Depot, 1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
6. M. Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014

Suggested Reading:

1. Kapil Kapoor, "Language, Linguistics and Literature: The Indian Perspective", ISBN-10: 8171880649, 1994
2. Karan Singh, "A Treasury of Indian Wisdom: An Anthology of Spiritual Learn", ISBN: 978-0143426158, 2016.

PReddy

PROFESSOR & HEAD

Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

MATERIAL SCIENCE AND METALLURGY LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: Students will

1. Acquire basic knowledge by understanding iron-carbide diagram and its application in engineering.
2. Expose to Metallographic study and analysis of various metals.
3. Acquire knowledge in determining the hardness of metals before and after various Heattreatment operations.
4. Understand differences between different heat treatment methods.
5. Understand the relation between micro structure and properties.

Outcomes: At the end of the course, a student will be able to

1. Identify crystal structure of various metals.
2. Measure hardness and can correlate with microstructure.
3. Perform a suitable heat treatment operation based on desired properties.
4. Underlines the importance of grain size in evaluating the desired mechanical properties.
5. Correlate the heat treatment methods and the mechanical properties obtained.

.

List of the Experiments

1. Study of: Metallurgical Microscope, Allotropes of Iron, Iron-Iron carbide diagram, Procedure for specimen preparation.
2. Observations for the following specimens - i) Low carbon steels,
   ii) Medium carbon steels, iii) Eutectoid steels, iv) High Carbon steels, v)Stainless steels, vi) Case carburized, vii)HSS, viii) White cast iron, ix) Gray cast iron, x) alleable iron, xi)Spheroidal iron,
   xii) Al–Si alloy and determination of grain size using Image Analyzer.
3. Preparations of the following specimens : i) $\alpha - \beta$ Brass, ii) Normalised steel iii) Medium carbon steel iv) Nodular cast iron v) Grey cast iron.
4. Heat Treatment Processes
   i) Annealing
   ii) Normalizing
   iii) Hardening.

Text Books:

1. V. Raghavan, "Materials Science and Engineering", 4/e, Prentice Hall of India Ltd., 2005.
2. S.H. Avner, "Introduction to Physical Metallurgy", 2/e, Tata McGraw Hill Publishers, 2005.

Suggested Reading:

1. S.P. Nayak, "Engineering Metallurgy and Material Science", 6/e, Charoter Publishing House, 2005.
2. E. Dieter, "Mechanical Metallurgy", 3/e, Metric Edition, Tata McGraw Hill, 2005.
3. K.L. Kakani, "Material Science", New Age Publications (P) Ltd., 2008.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

18ME C06

MECHANICS OF MATERIALS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: Students will

1. Demonstrate an understanding of tension, and the relationship between stress, strain and application of Hooke's law.
2. Demonstrate an understanding of types of beams, deflections and measurement of material property through deflections.
3. Demonstrate an understanding of torsion and deformations resulting from torsion.
4. Demonstrate the understanding of hardness and its measurement using different scales like Brinnel and Rockwell.
5. Demonstrate an understanding of measurement of shear modulus and young's modulus for machine members like helical and leaf springs through loading respectively.

Outcomes: At the end of the course, a student will be able to

1. Draw stress-strain curve for an isotropic material and understand the salient features of it.
2. Determine the Young's modulus of various beam materials by conducting load-deflection test and.

rigidity modulus of a given shaft specimen by torsion test.

3. Able to find out Young's modulus and shear modulus for mechanical components like leaf spring and closely coiled helical spring through load-deflection test respectively.
4. Evaluate hardness of different materials using different scales
5. Find the compressive and crushing strengths of concrete cubes and bricks.

List of the Experiments

1. Uni-axial tension test using UTM.
2. Brinell's and Rockwell's hardness tests.
3. Load-deflection test on a leaf spring to find out the young's modulus of leaf material.
4. Deflection test on a helical spring to determine the rigidity modulus.
5. Torsion of shaft to determine the rigidity modulus of shaft material.
6. Defection test on a cantilever beam to determine the Young's modulus.
7. Deflection test on a simply supported beam to determine the Young's modulus.
8. Deflection test on propped cantilever to determine the Young's modulus.
9. Deflection test on continuous beam to determine the Young's modulus.
10. Crushing and compression test on bricks and concrete cubes.
11. Measuring mechanical strain in a cantilever beam using strain gages and to compare the results with theoretical strain values calculated from an equation derived from solid mechanics.
12. To measure load (tensile/compressive) using load cell on tutor.

Text Books:

1. S.S.Rattan, "Strength of Materials", 3/e, Tata Mc-Graw Hill, 2016.
2. S. Ramamrutham, "Strength of Materials", Dhanpatrai and Sons, 1993.
3. G.H.Ryder, "Strength of Materials", 3/e, Macmillan India Limited, Delhi 2002.

Suggested Reading:

1. S.S. Bhavakatti, "Strength of Materials", Vikas Publication, 2003.
2. James M Gere, "Mechanics of materials", 8/e, cengage learning, 2013.
3. R.C. Hibbeler, "Mechanics of Materials", 9/e, Pearson, 2018.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C11

FLUID PRINCIPLES AND HYDRAULIC MACHINES LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: Students will
1. Determine discharge of fluid flow.
2. Verify fluid laws like Bernoulli's equation and determine losses through pipes.
3. Determine impact force of jet on the vanes
4. Demonstrate knowledge in evaluating performance characteristics of pumps.
5. Evaluate the performance characteristics of turbines.

Outcomes: On completion of the course, the students will be able to
1. Carry out discharge measurements
2. Determine the energy loss in conduits.
3. Calculate forces and work done by a jet on fixed or moving, flat and curved blades.
4. Evaluate the performance characteristics of pumps.
5. Demonstrate the characteristics curves of turbines.

List of the Experiments:
1. Verification of Bernoulli's equation.
2. Determination of Darcy's friction factor and nature of water flow through pipes.
3. Determination of Cd for V- notch.
4. Determination of Cd for rectangular notch.
5. Determination of Cd for Venturimeter.
6. Determination of Cd for Orifice meter.
7. Determination of impact force of jet on fixed flat and fixed curved vanes.
8. Performance and characteristic curves of Reciprocating pump.
9. Performance and characteristic curves of Centrifugal pump.
10. Performance and characteristic curves of Self-priming pump.
11. Performance and characteristic curves of Gear pump.
12. Performance and characteristic curves of Pelton wheel.
13. Performance and characteristic curves of Francis Turbine under constant speed and variable speed conditions.
14. Performance and characteristic curves of Kaplan turbine under constant speed and variable speed conditions.

Note: A minimum 12 Experiments need to be conducted.

Text Books:

1. R.K. Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", Laxmi Publication (P) Ltd., New Delhi, 2004.
2. R.S. Khurmi and N. Khurmi, "Hydraulics, Fluid Mechanics and Hydraulic Machines", 20/e, S. Chand publishing, 2014

Suggested Reading:

1. P.N. Modi, and. S.M.Seth, "Hydraulics and Fluid Machines", Standard Book House, New Delhi, 2004.
2. S.Ramamrutham, "Hydraulics, Fluid Mechanics and Fluid Machines", Dhanpat Rai and Sons, New Delhi, 2004.
3. Madan Mohan Das., "Fluid Mechanics and Turbomachines", PHI Learning Private Limited, New Delhi, 2009.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18CS C05

With effect from academic year 2019-2020

BASICS OF DATA STRUCTURES

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Objectives: To introduce

1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Outcomes: The Student will be able to

1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT - I

Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff.
Recursion: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT - II

Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT - III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT - IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT - V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.
Searching and Sorting: Linear searching, binary Searching, sorting algorithms- bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimhaarumanchi, Data Structures and Algorithms Made Easy, CareerMonk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, Fundamentals of Data structures in C,E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, Data Structures using C, Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, Data structures A Programming Approach with C, PHI.
2. Seymour Lipschutz, Data Structures with C, Schaums Outlines, Kindle Edition

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-1#DS

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

KINEMATICS OF MACHINES

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives:
Students will acquire knowledge in
1. Fundamental definitions of kinematics of mechanism.
2. Drawing velocity and acceleration diagrams for various mechanisms
3. Working principles of brake and dynamometers
4. Drawing displacement diagrams for various types of followers with various types of motions.
5. Estimation of transmission of power by belts and application of various gears and gear trains.

Outcomes:
At the end of the course, student will be able to understand
1. Basic elements of mechanisms and their motion characteristics.
2. Designing a suitable mechanism depending on application.
3. Principles involved in functioning of brake and dynamometer
4. Drawing displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers.
5. Selecting gear and gear train depending on application.

UNIT - I
Introduction: Definition of link, element, pair, kinematic chain, mechanism and machine, Grubler's criterion, single and double slider chains, inversions of quadratic chain, inversions of single and double slider crank chains. Mechanism with lower pairs and straight line motion mechanism, Pantograph and Geneva mechanisms. Ackerman and Davis steering gear mechanisms and Hooke's Joint. Peaucellier, Hart, Scott-Russel, Watt and Tchebicheff mechanisms.

UNIT - II
Analysis of mechanisms: Graphical methods to find velocities of mechanisms, instantaneous centre, body centre and space centre, Kennedy's theorem, graphical determination of acceleration of different mechanisms including Coriolis component of acceleration, analytical method to find the velocity and acceleration, analysis of four bar mechanism with turning pairs, Freudenstein's method for synthesis of four bar linkage.

UNIT - III
Laws of Friction: Friction in screw threads, pivots, collars, Clutches - Single and Multi plate, Cone and centrifugal clutches. Friction circle and friction axis of a link.
Brakes and Dynamometers: Block or shoe, band and block, internal expanding shoe brake, Prony, rope brake, belt transmission, torsion dynamometers.

UNIT - IV
Cams: Types of cams and followers, displacement diagrams for followers, uniform motion, parabolic motion, simple harmonic motion, cycloidal motion, drawing cam profile with knife edge follower, translating roller follower and translating flat follower. Cams of specified contours, tangent cam with roller follower, circular arc (convex) cam with roller follower.

UNIT - V
Gears: Classification of gears, spur gears, nomenclature, law of gear tooth action, involute as gear tooth profile, interference of involute gears, minimum number of teeth to avoid interference, contact ratio, cycloidal tooth profile, comparison of involute and cycliodal tooth profile. **Helical Gears**: Helical gear tooth relations, contact of helical gear teeth,
Gear trains: Gear trains–simple and compound, reverted and epicyclic gear trains. Differential of an Automobile.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. Thomas Bevan, "Theory of Machines", CBS Publishers, 2009.
2. S.S. Rattan, "Theory of Machines", 4/e, Tata McGraw Hill Publishers, 2013.
3. J.E.Shigley, "Theory of Machines", 3/e, Tata Mc.Graw Hill Publishers, New Delhi, 2005.

Suggested Reading:

1. C.S. Sharma and Kamlesh Purohit, "Theory of Mechanisms and Machines", PHI Learning Pvt. Limited, 2006.
2. Amitabh Ghosh and A.K.Mallik, "Theory of Machines", 3/e, East West Publications, 2009.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C08

THERMODYNAMICS

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives:
Students will understand

1. Basic definitions of thermodynamics and significance of Zeroth law of thermodynamics.
2. The importance and application of first law of thermodynamics.
3. The principles associated with second law of thermodynamics.
4. Properties of pure substances and use of Mollier diagram.
5. Various air standard cycles, vapour power cycles and their importance.

Outcomes:
At the end of the course a student will be able to

1. Estimate the temperature of different scales of thermometers.
2. Apply the first law of thermodynamics to various thermodynamic processes.
3. Understand the meaning of perpetual motion of machine of second kind and its significance.
4. Read data from steam tables, Mollier diagram and its applications.
5. Distinguish working principles of various air standard cycles, vapour power cycles and determine air–fuel ratios required for combustion of fuels

UNIT - I
Introduction: Thermodynamics, Macroscopic and Microscopic approaches, thermodynamic systems, properties, processes and cycles, thermodynamic equilibrium, quasi – static process, measurement of pressure, Zeroth law of thermodynamics and its significance, measurement of temperature, reference points, ideal gas equation.

UNIT - II
First Law of Thermodynamics: Concept of heat and work, first law of thermodynamics for closed system, energy- a property of the system, application of first law to various thermodynamic processes like isobaric, isochoric, isothermal, adiabatic and polytropic, definition of enthalpy, PMM1, first law applied to flow processes, application of SFEE to nozzle and diffuser, throttling device, turbine and compressor.

UNIT - III
Second Law of Thermodynamics: Limitations of first law of thermodynamics, Kelvin–Planck and Clausius statements of second law of thermodynamics, PMM2, equivalence of Kelvin-Planck and Clausius statement, reversible and irreversible processes, Carnot theorem, Clausius inequality, calculation of entropy change during various thermodynamic processes, principle of entropy increase, T–S diagrams, application of entropy principle for mixing of two fluids. Helmholtz and Gibb's functions.

UNIT - IV
Thermodynamic Properties of Fluids: Properties of pure substances, p– v diagram, p–T diagram, p–v–T surface, T–s diagram, h–s diagram, dryness fraction, use of steam tables, Maxwell relations.

UNIT - V
Air Standard Cycles: Air standard cycles - Otto, Diesel, Dual Combustion Cycles, working principle, derivation of expression for air standard efficiency, comparison of otto, diesel and dual cycles-for the same compression ratio, for the same maximum pressure and temperature.
Vapour Power Cycles: Vapour power cycles - Carnot cycle, Simple Rankine cycle.
Fuels and Combustion: Characteristics of an ideal fuel, classification of fuels, Stoichiometric air-fuel ratio, equivalence ratio, relation between volumetric and gravimetric analysis.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

Text Books:

1. P.K. Nag, "Engineering Thermodynamics", 5/e, Tata McGraw Hill Publishers, 2013.
2. D.S. Kumar, "Thermal science and Engineering", 4/e, S. K.Kataria and Sons, 2013.
3. D.P.Mishra, "Engineering Thermodynamics", Cengage Learning, 2012.
4. Y.A. Cengel and M.A. Boles, "Thermodynamics: An Engineering Approach", 7/e, Tata McGraw Hill Publishers, 2014.

Suggested Reading:

1. R.K. Rajput, "Thermal Engineering", 8/e, Laxmi Publications (P) Ltd, 2011.
2. Mahesh M Rathore, "Thermal Engineering", Tata McGraw Hill Publishers, 2013.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
To make the students to
1. Understand basic fundamentals and insights of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work of organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

Outcomes:
At the end of the course, student will be able to understand
1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT - I
Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills;. Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT - II
Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT - III
Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT - IV
Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT - V
Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:
1. S.P. Robins and M. Couiter, "Management", 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, "Management", 6/e., Pearson Education, 2004.

Suggested Reading:
1. P.C. Tripathy & P.N. Reddy, "Principles of Management", Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O'Donnell "Principles of Management", Tata McGraw Hill, 2017

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE C03

METAL CASTING AND WELDING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
To enable the students to

1. Impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting
2. Provide adequate knowledge of molding sand properties, melting furnaces , defects and quality test methods conducted on casted components
3. Provide knowledge of various special casting processes
4. Impart knowledge of various arc welding processes
5. Provide knowledge about other welding processes, weldability and defects in welding

Outcomes:
At the end of the course a student will be able to

1. Design the pattern, gating system and riser for a simple casting.
2. Understand various properties of molding sand, furnaces used in foundry, and defects in casting
3. Describe various special casting processes
4. Describe various arc welding processes.
5. Compare various arc, resistance, solid state and other welding processes.

UNIT - I
Pattern design and Methoding: Introduction, classification, pattern design: types of patterns, pattern materials, pattern allowances, gating system, purpose, elements, requirements, types of gates, choke, gating ratio, types of gating systems, gating system design, Risering: purpose, requirements, chvorinov's rule, optimum shape and dimensions of riser, riser design by Caine's method, modulus method and NRL method.

UNIT - II
Moulding, Melting, Defect Analysis and Inspection Techniques: Moulding sand: ingredients, types of sand clays, additives, moulding sand preparation, required properties, Core: purpose, core prints, core sand preparation, core preparation, chaplets, types of cores, net force on the core Melting furnaces: Cupola, Induction and Arc furnace, casting defects and remedies, inspection and testing of castings

UNIT - III
Special Casting Processes: Gravity die casting pressure die casting, centrifugal casting, shell moulding, investment casing, continuous casting, slush casting, lost foam process, squeeze casting, vacuum moulding ,CO_2 moulding and ceramic moulding

UNIT - IV
Arc Welding: Introduction, classification of welding processes, physics of arc, DCSP, DCRP, AC, arc initiation, arc stability, parts of arc, arc length characteristics, static V-I characteristics of power sources, duty cycle, shielded metal arc welding, submerged arc welding, Gas tungsten arc welding, Plasma arc welding, Atomic Hydrogen welding.

UNIT - V
Other Welding Processes: Resistance welding: spot, projection, seam, butt and percussion welding, Oxy-Acetylene welding, Thermit welding, laser beam welding, electron beam welding, Soldering and Brazing, weld defects, solid state welding, forge welding, friction welding, ultrasonic welding, explosive welding, weldability, effect of various parameters on weldability and weld defects

Text Books:

1. P.N. Rao, "Manufacturing Technology", 3/e, Vol. 1, Tata McGraw Hill Publishers, 2011.
2. Amitabh Ghosh and Mallick, "Manufacturing science", 4/e, Assoc. East West Press Pvt. Ltd., 2011.
3. Schey, "Introduction to Manufacturing Processes", 2/e, McGraw Hill Education

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Roy A. Lindberg, "Materials and Process of Manufacturing", 5/e, Prentice Hall of India, 1992.
2. Serope Kalpak Jian, "Manufacturing Engineering and Technology", Addition, Wesley Publishing company, 2006.
3. Mikeli P. Grover, "Fundamentals of Modern Manufacturing Materials", 3/e, Processes and Systems, Wiley A.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18CE M01

ENVIRONMENTAL SCIENCE

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	50 Marks
CIE	------
Credits	0

Objectives: To enable the student

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental

Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT - I

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural Resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT - II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems

UNIT - III

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT – IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT – V

Social Issues and the Environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu,"Introduction to Environmental Science", B S Publications, 2004.
2. Suresh K. Dhameja, "Environmental Studies", S. K. Kataria & Sons, 2009.

Suggested Reading:

1. C. S. Rao," Environmental Pollution Control Engineering", Wiley, 1991.
2. S. S. Dara, "A Text Book of Environmental Chemistry &Pollution Control", S. Chand Limited, 2006.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18CS C08

BASICS OF DATA STRUCTURES LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives:

1. Design and construct simple programs by using the concepts of data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Outcomes: The Student will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs.
4. Implement various kinds of searching, sorting and traversal techniques.
5. Identify the suitable data structure for real world problem.

List of Experiments for Non-CSE/IT:

1. Implementation of operations on arrays
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List .
5. Implementation of Searching techniques.
6. Implementation of Sorting Techniques
7. Case study like Banking System, Students Marks Management, Canteen Management etc

Text Books

1. Brian W Kernighan, Dennis Ritchie, "C Programming Language", 2/e, PH PTR.
2. Richard M Reese, "Understanding and Using C Pointers O'Reily", 2013.

WebLinks

https://nptel.ac.in/courses/106102064/

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18EG C03

SOFT SKILLS LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: The course will introduce the students to

1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth the practical ability to apply suitable data structure for real time applications.

Outcomes: After successful completion of the course the students will be able to

1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise 1:
Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise 2:
Main Topics: Advanced Group Discussion with Case studies : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts

Exercise 3:
Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions & Practice)
Writing Input: Writing to Reflect - Resume Writing

Exercise 4:
Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.

Exercise 5:
Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:

1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE C04

METAL CASTING AND WELDING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives:

To enable the students to

1. Deploy the knowledge to prepare the mould for a single piece and split patterns.
2. Impart the knowledge of properties of the moulding sand and analyze the same.
3. Develop knowledge of the bead geometry and study effect of the input parameters.
4. Identify and distinguish the types of the flame in gas welding and applications
5. Develop knowledge to use TIG, MIG and Spot welding machines and experiment with them.

Outcomes:

Students will be able to

1. Prepare the mould for a single piece and split patterns.
2. Test the moulding sand and analyze the same.
3. Test the bead geometry and correlate the results to the input parameters.
4. Distinguish the type of the flame and recommend for different materials.
5. Use TIG, MIG and Spot welding machines and experiment with them.

List of the Experiments:

Casting

1. Design and manufacturing of a simple pattern with various allowances.
2. Green sand moulding practice for a single piece pattern.
3. Green sand moulding practice for a split pattern with a horizontal core.
4. Moulding sand testing: GCS, GSS, DCS and DSS Permeability and shatter index.
5. Finding out the GFN, Moisture content and clay content for a given sand sample.
6. Melting and Pouring of Aluminum.
7. Dimensional inspection and visual inspection of the casting and analysis of dimensional variation and defects.

Welding

1. Study of gas welding equipment and process. Identification of flames, making Butt joint with gas welding.
2. Study of Arc welding process, comparison of the bead geometry with DCSP, DCRP and A.C.
3. Study of resistance welding process and plot the variation of spot area with time and current variation.
4. Study of TIG welding process and plotting cooling curve in TIG welding process.
5. Study of SAW Welding process and finding out deposition efficiency of the process.
6. Study of MIG welding process and testing of weld bead formed by MIG welding.

Note: Minimum 10 Experiments need to be conducted by choosing any 5 from each section.

Text Books:

1. P.N.Rao, "Manufacturing Technology", 3/e, Vol.1, Tata McGraw Hill Publ., 2011.
2. Amitabh Ghosh and Mallick, "Manufacturing Science", 4/e, Assoc. East West Press Pvt. Ltd., 2011.

Suggested Reading:

1. Schey, "Introduction To Manufacturing Processes" , 2/e, McGraw -Hill Education.
2. Serope Kalpakjian, "Manufacturing Engineering and Technology", Addition, Wesley Publishing Company, 2006.
3. Mikell P.Grover, "Fundamentals of Modern Manufacturing Materials", 3/e, Processes and Systems, Willey A.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

18ME C12

DYNAMICS OF MACHINES

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To understand static and dynamic forces on planar mechanisms and turning moment Diagrams for Flywheels
2. To understand the Gyroscopic effect and the performances of Governors
3. To know the Balancing of rotating and reciprocating masses
4. To determine natural frequencies of undamped, damped and forced vibrating systems of single degree freedom systems.
5. To understand the modes of vibrations, Two degree of Freedom and Torsion Vibrations

Outcomes: At the end of the course, the students are able to

1. Determine the fluctuation of energy and decide the cross section of flywheel. (BL-3)
2. Understand the gyroscopic effects in ships, aero planes and road vehicles. (BL-2)
3. Analyze the characteristics of various centrifugal governors. (BL-4)
4. Analyze balancing problems in rotating and reciprocating machinery. (BL-4)
5. Understand free and forced vibrations of single degree freedom systems and two-degree freedom linear systems. (BL-2)

UNIT- I

Force analysis: Dynamic force analysis of single slider crank mechanism, concept of dynamically equivalent link.

Flywheels: Working principle of flywheel, turning moment on the crank shaft, turning moment diagrams, maximum fluctuation of energy and its determination, coefficient of fluctuation of speed, design of flywheels, rim type flywheel versus solid type flywheel.

Gyroscope: Principle of gyroscope, roll, yaw and pitch motions, gyroscopic effect in a two-wheeler, car, ship and aeroplane, practical problems.

UNIT- II

Governors: Necessity of governor, different types of governors, working principle of centrifugal governors, characteristics of Watt governor, Porter governor, Proell governor, Hartnell governor, Hartung governor, hunting of governors, concept of control force, control force diagram, definition of stability of governor, condition for stability, concept of isochronism, sensitivity of governor, energy of governor.

UNIT- III

Balancing of Rotating masses: Balancing and its types, rotor balancing, single plane and two plane balancing, unbalanced forces and couples, static and dynamic balancing, balancing of rotors by analytical and graphical methods.

Balancing of reciprocating machines: Primary and secondary unbalanced forces, balancing of in line and radial engines.

UNIT - IV

Vibrations: Vibrations of single degree freedom system (axial, transverse and torsional), equivalent system of combination of springs, stepped shaft, whirling speed of shafts.

Damped Vibrations: Types of damping, vibrations with viscous damping,

Forced Vibrations: Vibrations with harmonically applied force with viscous damping, dynamic magnifier, resonance, vibration isolation and transmissibility.

UNIT –V

Two and three degree freedom systems: Natural frequencies of two degree freedom linear systems. Nodes in two and three rotor systems, modes of vibration, determining natural frequencies by Holzer's method for multi-rotor systems. Dunkerley's and Rayleigh's approximate methods.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

Text Books:

1. S.S. Rattan, "Theory of Machines", Fourth edition ,Tata-Mc Graw Hill, ,2014
2. John.J.Vicker, Gordon R. Pennock, Joseph E. Shigley, "Theory of Machines & Mechanisms", Oxford University press, 2003.
3. William T.Thomson "Theory of Vibration with Application", 5^{th} edition, Pearson education 2008

Suggested Reading:

1. A. Ghosh and Mallick, "Theory of mechanisms and machines", Affiliated to E-W Press, 1988.
2. J.S. Rao and Gupta, "Theory and Practice of Mechanical Vibrations", PHI, 1984

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

18ME C13

APPLIED THERMODYNAMICS AND HEAT TRANSFER

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
Student will understand

1. the working principles of reciprocating air compressor and its applications in engineering
2. the working principle of diesel and petrol engine, their combustion phenomena and problems pertaining to abnormal combustion
3. Student will understand the features of IC engine like ignition system and injection system
4. the basic modes of heat transfer
5. the classification of heat exchanger, concepts of radiation heat transfer and phase heat transfer

Outcomes: At the end of the course, the students are able to

1. Estimate the power required for reciprocating air compressor using the basic principles of thermodynamics for many engineering applications. (BL-4)
2. Evaluate the performance of C.I. and S.I. engines with appropriate consideration for public health and safety. (BL-5)
3. Understand the functioning of components of I.C. engines and the concept of abnormal combustion with remedial measures. (BL-2)
4. Derive the expressions for the heat transfer in conduction and convection with the basic principles of thermodynamics. (BL-3)
5. Understand the basic principles of heat exchangers, boiling and condensation. (BL-2)

UNIT – I
Reciprocating Air Compressors: Classification of compressors, advantages of reciprocating compressors over rotary compressors, applications of compressed air, working principle of reciprocating compressors - single stage and multi stage compressors with and without clearance, concept of optimum pressure ratio, minimum work input, various efficiencies of multi stage compressors, simple problems on reciprocating compressors.

UNIT - II
Internal Combustion Engines: Classification, working principles of 2 stroke, 4 stroke SI and CI engines, valve and port timing diagrams, performance of IC engines, Morse test, various methods of determining frictional power, various efficiencies, heat balance sheet.

UNIT - III
Combustion Phenomena: Stages of combustion in SI and CI engines, octane and cetane number, factors affecting, normal and abnormal combustion phenomenon in SI and CI engines, methods to control the abnormal combustion, types of combustion chambers, cooling systems, lubrication systems, battery and magneto ignition systems of IC engines, working principle of simple carburetor and fuel injector.

UNIT - IV
Modes of Heat Transfer: General 3-D conduction equation in cartesian and cylindrical coordinates, one dimensional steady state conduction through slabs, hollow cylinders without heat generation, critical radius of insulation for cylinders.
Convection: Free and forced convection, dimensionless numbers and their physical significance.

UNIT - V
Radiation: Various laws of radiation, concept of black-body.
Heat Exchangers: Classification, concept of LMTD and simple problems.
Condensation and boiling: Types of condensation, heat transfer coefficient for laminar parallel flow condensation, pool boiling curve, simple problems on condensation and boiling.

Text Books:

1. Mahesh M. Rathore, "Thermal Engineering", TMH, New Delhi, 2010
2. V. Ganeshan, "Internal Combustion Engines", Tata Mcgraw Hill Publishing, New Delhi, 2015
3. J.P. Holman, "Heat Transfer", McGraw Hill Publication, New Delhi,

Suggested Reading:

1 R.K. Rajput., "Thermal Engineering", Laxmi Publishers, New Delhi, 2014
2 D.S. Kumar, "Heat Transfer", S K Kataria Publishers, 2015

18ME C14

DESIGN OF MACHINE ELEMENTS

(Use of data book is permited)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To understand the principles of machine design and design considerations, types of loads, failure criteria.
2. To design machine members for static, fluctuating loads and impact loads
3. Learn the design principles of shafts, keys, couplings, belt drives and pulleys.
4. Understand the principles of design of permanent joints such as riveted and welded joints.
5. Understand the principles of design of bolted joints, power screws and gasket joints.

Outcomes: At the end of the course, the students are able to

1. Understand the standards, codes, various design considerations and failure criteria of members (BL-2)
2. Analyze and evaluate machine members subjected to static and dynamic loads (BL-4)
3. Recommend suitable shafts, couplings and belt drives for a given application (BL-5)
4. Design permanent joints for a given application (BL-6)
5. Design bolted joints, power screws and screw jack (BL-6)

UNIT – I

Introduction: Materials used in machine design and their specifications to Indian standards, codes and standards used in design. Reliability, principles of Ergonomics and Manufacturing considerations. Preferred numbers, analysis of stress and strain: Types of loading and stresses. Cotter and knuckle joints. Theories of elastic failure, stress concentration factor, factor of safety, Design of components for static loads.

UNIT – II

Design for Fatigue and Impact loads: Importance of fatigue in design, fluctuating stresses, fatigue strength and endurance limit. Factors affecting fatigue strength, S-N Diagram, Soderberg and Modified Goodman's diagrams for fatigue design. Cumulative fatigue, Miner's rule, Design of components for fatigue. Design of components for impact loading.

UNIT – III

Design of shafts, Keys & Couplings: Solid, hollow and splined shafts under torsion and bending loads, types & design of Keys, muff , split muff , flange, marine type and flexible type of couplings.
Design of Belt Drive Systems: selection of belts and design of pulleys.

UNIT – IV

Design of Permanent Joints: Types of Riveted joints, efficiency of the joint. Design of riveted joints subjected to direct and eccentric loads. Types and design of welded joints subjected to direct and eccentric loading.

UNIT – V

Design of Bolted Joints, Power Screws: Design of bolts and nuts, locking devices, bolt of uniform strength, design of gasket joints, design of power screws and screw jack.

Text Books:

1. V.B. Bhandari, "Design Machine Elements", Mc Graw Hill Publication, 2017.
2. J.E. Shigley, C.R. Mischne, "Mechanical Engineering Design", Tata Mc Graw Hill Publications, 2015.
3. R.S.Khurmi and J.K.Gupta, "Machine design", 34/e, S Chand publications, 2018.

Suggested Reading:

1. P. Kannaiah, "Machine Design", Sci-Tech Publications, 2010
2. M.F. Spotts, "Design of Machine Elements", Prentice Hall of India, 2013.

Machine Design Data Books:

1. K. Mahadevan, K. Balaveera Reddy., "Design Data Hand book for Mechanical Engineers", 3/e, CBS Publisher, 2018
2. PSG College, "Design Data book", 2012

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075. Telangana

18PE C05

METAL FORMING TECHNOLOGY

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To introduce students to metal forming technology while understanding the fundamentals of theory of plastic deformation and stress strain relations.
2. To explain the working principle of various operations like sheet metal operations, extrusion, drawing, rolling, forging etc with their applications, merits and demerits.
3. To explain different deformation mechanisms and effect of the process variables on different process and product quality.
4. To enable the students to determine loading and energy required for metal forming tools and machines.
5. To enable the students to understand different defects that occurring forming operations with remedial measures.

Outcomes:

At the end of the course, student will be able to

1. Apply theory of plasticity to analyze metal forming processes.
2. Understand the basic principles and practical aspects of metal forming operations.
3. Understand various process parameters that affect product quality in various processes under different conditions.
4. Determine load, energy and power required for various processes and machines.
5. Propose suitable metal forming processes for making different products.

UNIT - I

Theory of Plasticity: Plastic deformation, work hardening, cold, warm and hot working with their advantages and disadvantages, true stress and true strain, flow curve, effect of strain-rate and temperature on flow stress, yield criterion: von-Mises and Tresca

UNIT - II

Forging: Open and closed die forging, Drop, Press and Machine forging operations, types of hammers and presses, their principles of operation and applications, Forging load calculation with slab method and empirical methods, forge ability , forging defects, Methods of heating and types of furnaces, Isothermal forging Hot Isostatic Pressing.

UNIT - III

Extrusion and Drawing: Types of extrusion, Tube extrusion Rod/wire/tube drawing ,load calculation of extrusion and drawing using uniform deformation energy method and slab method, maximum reduction in drawing, effect of friction, die angles, deformation speeds on extrusion/drawing forces, die materials and lubrication in these operations, extrusion and drawing defects.

UNIT - IV

Rolling: Principles of Metal rolling, roll load, torque and mill power calculation for homogenous deformation, classification and description of rolling mills, their applications, rolling defects, shape rolling, ring rolling thread rolling, roll bending and powder rolling.

UNIT - V

Sheet Metal Working: Sheet Metal working operations-shearing, blanking, piercing, bending, drawing and squeezing operations, estimation of loads and energy required for these operations, Formability, FLD, types of presses, specifications and their applications, comparison of simple, compound, progressive and combination dies. Other sheet metal forming operations like Embossing, Stretch forming, Spinning and Flow forming.

Text Books:

1. Serope Kalpakjian, "Manufacturing Engineering and Technology", 4/e, Pearson education INC., 2015.
2. George.E. Dieter, "Mechanical Metallurgy", SI Metric Edition, McGraw –Hill, 1988.
3. P.N. Rao, "Manufacturing Technology", 4/e, TMH, 2015.

Suggested Reading:

1. R.K. Jain, S.C. Gupta, "Production Technology", 17/e, Khanna Publications, 2012.
2. Roy A lindberg, "Materials and Process of manufacturing", 4/e, PHI, 2004.
3. John A Schey, "Introduction To Manufacturing Processes", 3/e, McGraw Hill education, 2012.

18ME E01

REFIGRERATION AND AIR CONDITIONING
(Core Elective-I)
(Use of data book is permitted)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Acquire the basic knowledge about the importance of refrigeration, its applications in aircraft refrigeration.
2. Demonstrate basic knowledge of vapor compression refrigeration system, cascade and compound refrigeration.
3. Understand various types of absorption refrigeration systems like ammonia, Electrolux and lithium bromide refrigeration systems.
4. Acquire the basic knowledge on various psychrometric processes and comfort air conditioning.
5. Acquire knowledge in estimating air conditioning loads.

Outcomes: At the end of the course, the students are able to

1. Evaluate COP of various air craft refrigeration systems using principles of thermodynamics along with necessity of eco-friendly refrigerants for public health and safety. (BL-4)
2. Analyze COP of vapor compression refrigeration system with the appropriate concern for environment. (BL-4)
3. Understand the Vapour absorption, steam jet refrigeration and non-conventional refrigeration in order to provide valid conclusions over simple vapor compression refrigeration system. (BL-2)
4. Understand the working principle of air conditioning system including human comfort and its importance over environment, society with balance of ecological system. (BL-2)
5. Apply the principles of engineering which are complex in nature, having lifelong learning to design air conditioning system for various environments. (BL-3)

UNIT – I

Introduction to Refrigeration: Application of Refrigeration, Definition of COP, Tonne of Refrigeration,Designation, Carnot cycle, Eco-friendly Refrigerants, Properties of Refrigerants.

Air Refrigeration Systems: Analysis of Bell-Coleman Cycle, Application to aircraft refrigeration, Simplecooling system, Bootstrap simple evaporating system, Regenerative cooling system and Reduced ambient cooling system.

UNIT - II

Vapour Compression System: Working principle and analysis of Simple vapor compression Refrigerationcycle. Effect of operating conditions like evaporating pressure, condenser pressure, Liquid sub-cooling and Vapor super heating, Performance of the system. Low temperature refrigeration system (with single load system), Compound compression with water inter cooler and Flash intercooler, Cascade refrigeration system-Analysis and advantages.

UNIT - III

Vapour Absorption Refrigeration System: Simple absorption systems, COP, Practical ammonia absorptionrefrigeration system, Lithium bromide absorption system, Electrolux refrigerator, Common refrigerants and absorbents properties, Comparison with vapor compression refrigeration system.

Steam Jet Refrigeration: Principle of working, Analysis of the system, Advantages, limitations andapplications.

Thermoelectric refrigeration systems: Seebeck effect, Peltier effect and Thompson effect, Analysis of the thermoelectric refrigeration systems using Peltier effect, Expression for COP, Vortex tube refrigeration – principle and working.

UNIT - IV

Psychrometry: Psychrometric properties, Psychrometric chart, construction, Representation of variousPsychrometric processes on the chart.

Introduction to Air Conditioning: Requirements of comfort air conditioning, Thermodynamics of humanbody, ASHRE comfort chart, Effective temperature.

UNIT - V

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

Cooling Load Calculations in Air Conditioning: Concept of bypass factor, Sensible heat factor, ApparatusDew Point, Various Heat Loads.
Design of air conditioning systems: Simple Problems on summer, winter and year Round Air conditioningsystems Energy conservation in air conditioned building.
Air Conditioning Systems: Components of air conditioner equipments, Humidifier, Dehumidifier, Filter.

Text Books:

1. C.P. Arora, "Refrigeration and Air conditioning", Tata McGraw Hill, New Delhi, 2017.
2. Stoecker, W.F., and Jones, J.W., Refrigeration and Air-Conditioning, Mc.Graw Hill, New Delhi, 2014.
3. R.K. Rajput, "Refrigeration and Air Conditioning", Laxmi Publications, New Delhi, 2013.

Suggested Reading:

1. V.K. Jain, "Refrigeration and Air Conditioning", S Chand & Company, New Delhi, 2019.
2. Manohar Prasad, "Refrigeration and Air Conditioning", New Age International, Allahabad, 2015.

Refrigeration and air conditioning data books:

1. Manohar Prasad, "Refrigeration and Airconditioning Data Book", New Age International Publishers, 2010.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E02

VALUES, ETHICS AND SOCIETY

(Core Elective - I)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. Understand the values, the need for value adoption and prepare them meet the challenges
3. Develop the potential to adopt values, develop a good character and personality and lead a happy life
4. Practice the values in life and contribute for the society around them and for the development of the institutions/organization.
5. Understand the professional ethics and their applications to engineering profession

Outcomes: At the end of the course, the students are able to

1. State basic values and the need for value education. (BL-2)
2. Differentiatebetween values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual. (BL-2)
3. Demonstrate the knowledge of ethics at their work place and apply different theoretical approaches to solve ethical dilemmas. (BL-3)
4. Apply risk and safety measures in the engineering practice. (BL-3)
5. Understand the role of a human being in ensuring harmony in society and nature. (BL-2)

UNIT- I

Concepts and Classification of Values –Need and Challenges for Value Adoption: Definition of Values, Concept of Values, Classification of Values, Hierarchy of Values, Types of Values, Espoused and Applied Values, Value judgement based on Culture, Value judgement based on Tradition, Interdependence of Values, Need for value education, Findings of Commissions and Committees, Corruption and illegal practices, Science and Technology without values, Exploitation of nature, Increasing use of violence and intoxicants, Lack of education in values, Implications of education in values, Vision for a better India, Challenges for Value adoption, Cultural, Social, Religious, Intellectual and Personal challenges.

UNIT -II

Process for Value Education: Right Understanding, Relationship and Physical Facilities,basicrequirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and prosperity correctly, a critical appraisal of the current scenario, Method to fulfill the above human aspirations; understanding and living in harmony at various levels.

UNIT-III

Basic Concepts of Professional Ethics: Ethics, Morals and Human life , Types of Ethics, Personal Ethics,Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Professional and Professionalism, Ethical role of a professional Basic ethical principles, Some basic ethical theories, use of ethical theories, Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities.

UNIT- IV

Ethics in Engineering Profession: Engineering profession-Technology and Society-Engineering as SocialExperimentation-Engineering ethics-Ethical obligations of Engineering Professionals, Role of Engineers-Engineers as Managers, Professional responsibilities of Engineers, Engineers Responsibility for Safety, A few Case Studies on Risk management, Conflicts of Interest, Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking.

UNIT - V

Understanding Harmony in the Family and Society: Understanding harmony in the family, the basic unit ofhuman interaction, Understanding values in human relationship; meaning of Nyaya and Program for its fulfillment to ensure Ubhay-tripti, Trust (Vishwas) and Respect (Samman) as the foundational values of relationship.

Text Books:

1. Subramanian R., "Professional Ethics", Oxford University Press , 2017

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

2. Dinesh Babu S., "Professional Ethics and Human Values", Laxmi Publications , 2016
3. Nagarajan R.S., "A Text Book on Human Values and Professional Ethics", New Age Publications, 2007

Suggested Reading:

1. Santosh Ajmera and Nanda Kishore Reddy, "Ethics, Integrity and Aptitude", Mc Graw Hill Education Private Limited , 2014
2. Govinda Rajan M., Natarajan S., Senthil Kumar V.S., "Professional Ethics and Human Values", Prentice Hall India Private Limited, 2013.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E01

PLASTICS, CERAMICS AND COMPOSITE MATERIALS
(Core Elective-I)

Instruction week	3	Hours per
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:
1. Understand various types of plastics, their properties and uses.
2. Understand various methods of manufacturing plastic components.
3. Understand types of ceramics, refractoriness, and their uses.
4. Understand the manufacturing processes of ceramics.
5. Understand composites and their uses.

Outcomes: At the end of the course, the students are able to
1. Recall the types of plastics, properties and applications. (BL-1)
2. Select the suitable method of manufacturing a plastic component. (BL-5)
3. Describe refractories, their manufacturing methods and applications. (BL-2)
4. Describe the properties, uses and Manufacturing methods of white wares, ceramic coatings and glass. (BL-2)
5. Understand the concept of composites, properties in engineering applications. (BL-2)

UNIT - I

Introduction to Polymers: Plastics and elastomers, polymerization, degree of polymerization, thermoplasticsand thermosetting plastics, properties and applications of various thermoplastic and thermosetting plastics, mechanical properties of plastics and their influencing parameters.

UNIT - II

Processing of Plastics and Elastomers: Constructional features, working principles, advantages, disadvantages and applications of Injection moulding, Extrusion, calendaring, thermoforming, Blowmoulding, compaction moulding, transfer moulding.

UNIT - III

Introduction to Ceramics, Classification of Ceramic Materials, Conventional and Advanced, Refractories:Classification of Refractories, Modern trends and developments, Basic raw materials, Elementary idea of manufacturing process technology, Flow diagram of steps necessary for manufacture, basic properties and areas of application.

UNIT - IV

White Wares: Classification and type of White wares, Elementary idea of manufacturing process technologyincluding body preparation, basic properties and application area.

Ceramic Coatings: Types of glazes and enamels, Elementary ideas on compositions, Process of enameling &glazing and their properties.

Glass: Definition of glass, Basic concepts of glass structure, glass manufacturing processes, Different types of glasses, Application of glasses.

UNIT - V

Fundamentals of Composites: Need for composites–enhancement of properties–classification of composites
– Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement–particle reinforced composites, Fiber reinforced composites, Applications of various types of composites, Production techniques for glass fiber, carbon fiber and ceramic fiber, manufacturing methods of composites.

Text Books:

1. Mikell P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", Wiley publications, 6th edition 2015.
2. Kalpakjian, "Manufacturing Engineering and Technology", Pearson publications, 7th edition 2013.
3. P.N. Rao, "Manufacturing Technology", Vol.-1, McGraw Hills Publication, 4th Edition 2016.

Reddy

Suggested Reading:

1 R.K.Rajput, "A text book of Manufacturing Technology", Vol-I, Laxmi Pub., 2007.
2 P.C. Sharma, "A Text book of Production Technology", 8/e, S. Chand & Co., Pvt. Ltd., 2014.

18PE E02

PRODUCT DESIGN AND PROCESS PLANNING
(Core Elective-I)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:
1. The essence of innovation in product development.
2. The Human Machine Interactions (ergonomics).
3. The various Intellectual Property Rights.
4. The interaction between Design, Manufacturing, Quality and Marketing.
5. The awareness about overall view of Process Planning.

Outcomes: At the end of the course, the students are able to
1. Define the needs of the customer while designing a new product or modifying existing product in the competitive environment. (BL-1)
2. Understand creativity, brainstorming and ergonomic concepts. (BL-2)
3. Apply the concept of design for manufacture, assembly, maintenance, reliability and product life cycle in developing a product. (BL-3)
4. Implement the Intellectual Property Rights to a new product or a process. (BL-3)
5. Evaluate and recommend an effective Process Plan and principles of value engineering to new product development. (BL-5)

UNIT - I
Product Design and Process Design: Functions, Essential factors of product design, Selection of right product,Systematic procedure of product innovation, function of design, value of appearance, colors and laws of appearance.

UNIT - II
Product Selection and Evaluation: Need for creativity and innovation. Techniques of innovation like brainstorming and Delphi techniques, collection of ideas. Selection criteria - screening ideas for new products using evaluation techniques. Principles of ergonomics, Anthropometry, Design with Human Machine Interaction (HMI).

UNIT - III
New Product Planning and Development: Interaction between the functions of design, manufacture, andmarketing, design and material selection, Steps for introducing new products after evaluation, Product life cycle, Research and new product development.

UNIT - IV
Intellectual Property Rights (IPR): Patents, definitions, Types of Patent, Patent search, Patent laws,International code for patents, Trademark, Trade Secret and Copy Rights.
Process Planning: Need and significance of process planning, Process capability studies, Process sheets, Benefits and Types of Computer Aided process planning.

UNIT - V
Process Selection and Planning: Selection of manufacturing process, estimation of machining time in various cutting operations, Estimation of costs for manufacture, value engineering in product design, Group technology, and concepts of concurrent engineering.

Text Books:

1. B.W. Niebel & A.B.Draper, "Production Design & Process Engg", McGraw Hill, 1974.
2. K. G. Swift & J. D. Booker, "Process Selection: From Design to Manufacture", Butterworth-Heinemann Ltd; Revised 2/e, 2003.
3. BhaskaranGopalakrishnan, "Product Design and Process Planning in CE (Design & Manufacturing", Chapman and Hall publishers, 1994.

Suggested Reading:

1. A.K. Chitale& R.C. Gupta, "Product Design & Manufacturing", PHI, 1997.
2. Karl T. Ulrich, Stephen Eppinger, "Product Design and Development", McGrawHill Publications.

18PE E03

POWDER PROCESSING (Core Elective-I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
To make the students to understand the different
1. Powder properties & characteristics.
2. Powder mixing & compaction methods.
3. Powder Sintering methods.
4. Post Sintering processes.
5. Testing's of sintered parts.

Outcomes:
At the end of the course, the students are able to
1. Characterize the Powders in different techniques.
2. Suggest appropriate compaction technique for a particular powder.
3. Suggest appropriate sintering technique for a particular powder.
4. Choose correct post sintering processes.
5. Have ability to choose the appropriate testing for sintered parts.

UNIT - I
Introduction: Importance and advantages of powder processing.
Powder Manufacture: Comminution, solid state reduction, electrolysis, thermal decomposition, and Atomization (water atomization, oil atomization, gas atomization, centrifugal atomization).

UNIT - II
Powder Properties, Characterization and Mixing: Chemical composition, particle shape, powder density, particle size, size distribution compressibility, green strength. Blending and mixing. Compaction: Compact size, tool materials, design of sintered part, Olivetti process hot pressing, injection moulding, cold iso-static pressing, and hot iso-static pressing.

UNIT - III
Sintering: Theory of sintering, Sintering practice – furnace design, furnace atmospheres, vacuum sintering, control of shrinkage, liquid phase sintering, activated sintering, and loose powder sintering.

UNIT - IV
Post-Sintering Operations: Re-press and re-enter, hot re-press, hot forge in a closed die, sizing, coining, HIP, steam treatment, infiltration, and impregnation. Heat treatment, hardening, and tempering, surface hardening, electro-plating, and other coatings. Deburring, machining and joining. Sinter forging.

UNIT - V
Testing of Sintered Parts and Applications: Porous bearings, filters Magnetic Materials, super alloys, High speed steels, Stainless steels, ODS materials, Production of Near-net shapes, rapidly solidified powders, and spray forming. Manufacturing of Cutting tools, forming dies using powder metallurgy.

Text Books:

1. J. S. Hirsch horn: "Introduction to Powder Metallurgy", American Powder Metallurgy Institute, Princeton, NJ, 1976.
2. P. C. Angelo and R. Subramanian: "Powder Metallurgy- Science, Technology and Applications", PHI, New Delhi, 2008.

Suggested Reading:

1. G.S.Upadhya, "Powder Metallurgy Technology", Cambridge international Science publishing,1997.
2. B.K Dutta, "Powder Metallurgy: An advanced technique and processing of engineering materials", PHI Publications , 2011.
3. Clark Frances Hurd, "Advanced Techniques in Powder Metallurgy", Literary Licensing,2017.

18ME E04

AUTOMOBILE ENGINEERING

(Core Elective-II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. The anatomy of the automobile in general.
2. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels.
3. Suspension, frame, springs and other connections.
4. Ignition, controls, electrical systems and ventilation.
5. Emissions, pollution regulations, EURO and BHARATH stages

Outcomes: At the end of the course, the students are able to

1. Understand the basic layout of automobiles. (BL-2)
2. Understand the various systems in an automobile like engine cooling, lubrication, ignition, electrical and air conditioning systems with the principles of thermodynamics. (BL-2)
3. Describe the principles of suspension and steering system using modern tool usage. (BL-2)
4. Explore therecent systems in Braking and Transmission. (BL-3)
5. Evaluate the effect of automobile pollution on environment and necessity of pollution norms along with trouble shooting (BL-5)

UNIT - I

Types of Automobiles: Normal, Hybrid and Hydrogen Fuel vehicles.

Engine: Engine location and its components, chassis layout - parts of the automobile body, terminology, automobile frames ; crank shaft, firing order, piston and piston rings, cylinder liners, valves and operation mechanism, inlet and exhaust manifolds, carburetion – Zenith carburettor, Fuel injection system, Mechanical Fuel Injection system- MPFI, Electronic Fuel Injection system.

UNIT - II

Lubricating Systems: Wet sump, dry sump and petroil systems

Cooling systems: Water pumps, radiators, thermostat control, anti-freezing compounds

Ignition Systems: Types of Ignition Systems, Modern Ignition systems, Types of Batteries and charging systems- Batteries used in Electric and Hybrid Vehicles, starting motors,

Electrical Systems : Main electrical circuits, generating & starting circuit, lighting system, indicating devices, warning lights, speedometer, automobile air-conditioning.

UNIT - III

Steering Systems: Linkage arrangements and its components, steering gear box types,recent trends, Davis Steering , Modified Ackerman linkage, Steering geometry: caster, camber, King Pin Inclination, Toe in, toe out.

Wheel and tyres: Tyre construction, specification. Tyre wear and causes, wheel balancing, wheel alignment

Suspension systems: Types of Suspension systems, Independent suspension, coil and leaf springs, torsion bar, shock absorbers

UNIT - IV

Power Train: Clutches gear and gearbox manual, semi-automatic and automatic gearboxes. Torque converter,propeller shaft, universal coupling differential, four-wheel drive system

Brakes Systems: Disc and drum types, leading and trailing shoe layout, Description and operation of hydraulic brake, hand brake linkage, Pneumatic, air and vacuum brakes

UNIT – V

Maintenance: Trouble shooting and servicing procedure overhauling, engine tune up, tools and equipment for repair and overhaul testing equipment

Pollution control: Pollution control techniques used for petrol and diesel engines, PCVS, EGR, SCRT, Thermal Reactors, Catalytic converters; Euro norms and Bharat Norms.

Text Books:

1. Crouse & Anglin, "Automotive Mechanics", 10/e, TMH. Publishing Co. Ltd., New Delhi, 2006.
2. Kirpalsingh., "Automobile Engineering", Vol. I & II Standard Publishers, Delhi, 2017.
3. Joseph Heitner, "Automotive Mechanics", 2/e, Affiliated East West Pvt. Ltd. 2013.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. R.K. Rajput, "A Textbook of Automobile Engineering", Laxmi Publications, New Delhi, 2012.
2. D S Kumar, "Automobile engineering", S K Kataria Publications, New Delhi, 2015.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E05

NANO SCIENCE AND TECHNOLOGY

(Core Elective –II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Nanotechnology approach and challenges
2. Materials and characterization procedures
3. Zero and One dimensional Nano structures
4. Various Fabrication Techniques
5. Special nano materials and Nano biomaterials

Outcomes: At the end of the course, the students are able to

1. Understand the basic concepts, developments and challenges in Nano technology. (BL-2)
2. Describe the methods of evaluating magnetic and electronic properties, microstructure by SPM, atomic force microscopy, friction force microscopy. (BL-2)
3. Apply homogenous & heterogeneous methods and characterization techniques of Zero & One dimensional Nano structures. (BL-3)
4. Evaluate various Nano Material Fabrication Techniques. (BL-5)
5. Analyze Nano materials and Nano bio materials for obtaining solutions to societal problems. (BL-4)

UNIT - I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance ofNanotechnology, Bottom-up and Top-down approaches, challenges in nanotechnology, proximal probe technologies.

UNIT - II

Materials of Nanotechnology: Introduction, Si-based materials, Ge-based materials, Ferroelectric materials, Polymer materials, GaAs&InP (HI-V) group materials, Nanotribology and materials, characterization using Scanning Probe Microscope, AFM and Friction force microscopy.

UNIT - III

Nano Structures: Zero dimensional Nanostructure, synthesis procedure by heterogeneous method,characterization techniques, properties and applications particles

One dimensional Nanostructures: Nanowires, Nanotubes and its Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires

UNIT - IV

Nano Fabrication: Introduction, Basic fabrication techniques by Lithography, thin film deposition and doping,MEMS fabrication techniques, Nano fabrication techniques by E-beam, Nano-imprint fabrication, Epitaxy and strain engineering

UNIT - V

Special Nano Materials: Introduction, Synthesis procedure by metal-polymer, metal ceramic and polymerceramic, Characterization procedures, applications

Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, applications

Text Books:

1. Dieter Vollath, "Nanomaterials: An introduction to Synthesis, properties and applications", Wiley, 2013
2. Guozhong Cao, "Nanostructures and Nano Materials, Synthesis properties and applications", Imperial College Press, 2004
3. Carl C Koch, "Nano materials Synthesis, Properties and applications", Jaico Publishing House, 2008

Suggested Reading:

1. Willia Tllsey Atkinson, "Nano Technology", Jaico Publishing House, 2009
2. George W. Hanson, "Fundamentals of Nanoelectronics", Pearson Education, 2009

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E06

RIGHTS, DUTIES AND LEGISLATION
(Core Elective - II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:
1. Understand the value of human rights
2. Understand the Lawful rights available to him and others
3. Create understanding the rights of under privileged and respect them
4. Understand role of an individual in the Civil Society
5. Understand the safety aspects while using technology and to understand the role of NGO's in protecting human rights and environment.

Outcomes: At the end of the course, the students are able to

1.	Recall the human rights in the global and national context.	(BL-1)
2.	Understand the overall view on working of Indian constitution.	(BL-2)
3.	Analyse the societal problems in the context of human rights.	(BL-4)
4.	Evaluate implementation of right to development and right to information.	(BL-5)
5.	Application of human rights for human safety and clean environment.	(BL-3)

UNIT-I

Conceptual Background Of Human Rights And Duties: Rights, inherent, inalienable,universal, indivisible, Values, Dignity, liberty, equality, justice, unity in diversity, Need for balance between Rights and Duties, Freedom and Responsibility, Theories of human rights, History of human rights civilization, Human rights movements, Universal declaration of human rights 1948, classification and three generations of human rights and sarvodaya.

UNIT-II

Human Rights And Duties In India: Evolution, Independence movement, making of theConstitution, Indian Constitution, Fundamental Rights, Directive Principles, Fundamental duties, Their Interrelationship, Enforcement and protection mechanism of human rights in India, Judiciary, Article 32 and 226 of Indian Constitution, National Human Rights Commission and other Commissions and Committees, Non-governmental organizations, Information Media, Education.

UNIT-III

Societal Problems: Core Problems, Poverty, underdevelopment and illiteracy, Women, children andthe disadvantaged groups, National and state commissions of Women/children/minority/SC/ST.

UNIT-IV

Right to Development: Socio-Economic and Cultural Effects of Globalization, Right to Education,Transparency in Governance and Right to Information, Consumer Protection act.

UNIT-V

Environment Rights Such as Right to Clean Environment and Public Safety: Issues of Industrial Pollution,Prevention, and Rehabilitation, Safety aspects of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment.

Text Books:

1. Mr. Ishay, "The history of Human rights", Orient Longman, New Delhi, 2004.
2. S.N. Chaudhary, "Human Rights and Poverty in India: Theoretical Issues", Delhi: Concepts, 2005.
3. Anuradha Kumar, "Encyclopedia of Human Rights Development of under Privilege", New Delhi: Sarup, 2002.

Suggested Readings:

1. K.P. Saksena, "Human Rights and the Constitution: Vision and the Reality", New Delhi: Gyan Pub., 2003.
2. Dr.J.N.Pandey, "Constitutional Law of India", Central Law Agency; Central Law Agency, 2001.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E04

NON DESTRUCTIVE TESTING AND EVALUATION

(Core Elective-II)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Need, basic concepts and technologies of Non Destructive Testing (NDT).
2. Security precautions from Radiography, protection from radiation and measurement of radiation received by personnel.
3. Technologies like neutron radiography; laser induced ultrasonics, surface analysis and thermography.
4. Merits and demerits of the different NDT Technologies.
5. Latest research and developments in NDT.

Outcomes: At the end of the course, the students are able to

1. Understand Non Destructive Testing techniques of Dye penetrant inspection andMagnetic particle inspection. (BL-2)
2. Compareeddy current testing with other NDT methods. (BL-2)
3. Identify different types of defects using ultra sonic testing. (BL-2)
4. Analyze the radiograph to detect the defects by using principles of radiography. (BL-4)
5. Interpretlatest techniques of NDT with other methods. (BL-3)

UNIT - I

Dye Penetrant Inspection: Principles of penetrate inspection, characteristics of a penetrate, water washablesystem, post emulsification system, solvent removable system, surface preparation and cleaning, penetrate application, development, advantages limitations, and applications.

Magnetic Particle Inspection: Principle, magnetization methods, continuous and residual methods,sensitivities, demagnetization, magnetic particles, applications, advantages and limitations.

UNIT - II

Eddy Current Testing: Principle, lift-off factor, and edge effect, skin effect, inspection frequency, coilarrangements, inspection probes, types of circuit, reference pieces, phase analysis, display methods and applications.

UNIT - III

Ultrasonic Testing: Generation of ultra sound, characteristics of an ultrasonic beam, sound waves at interfaces,sound attenuation, display systems, probe construction, type of display, inspection techniques, identification of defects, Immersion testing , sensitivity and calibration, reference standards, surface condition, applications.

UNIT - IV

Radiography: Principle and uses of radiography, limitation principle, radiation sources, production of X-Rays,x-ray spectra, attenuation of radiation, radiographic equivalence, shadow formation enlargement and distortion, radio graphic film and paper, Xeroradiography, fluoroscopy, exposure factors, radiographic screens, identification markers and image quality indicators, inspection of simple shapes, inspection of complex shapes, viewing and interpretation of radiographs, radiation hazard, protection against radiation, measurement of radiation received by personnel.

UNIT - V

Acoustic Emission: Physical Principles, Sources of emission, instrumentation and applications, Other NDT Techniques: Neuron radiography, Laser induced ultrasonic, surface analysis, and thermography.

Text Books:

1. Barry Hull & Vernon John, "Non Destructive Testing", 1988
2. H J Frissell (Editorial Coordinator), "Non-Destructive Evaluation and quality control", ASM handbook-International Publication USA, 1989.
3. Don.E. Bray, Roderic K. Stanley: Nondestructive Evaluation- A Tool in Design, Manufacturing, and Service, Revised Ed, CRC Press, 1997.

Suggested Reading:

1. Paul E. Mix, "Introduction to Nondestructive Testing- A Training Guide", John Wiley & Sons, 2005.

2. J. Prasad and C. G. K. Nair, "Non-Destructive Test and Evaluation of Materials", Tata McGraw-Hill Education, 2nd edition, 2011.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E05

SURFACE ENGINEERING (Core Elective - II)

Instruction	3 Theory Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To impart knowledge on surface engineering and surface modification methods that will come in handy to solve the industrial problems.
2. This will also serve as a precursor for future research in the same field.
3. Student will understand the basic principles of corrosion and know the methods to reduce the corrosion on mechanical components.
4. Student will understand the role of wear and wear measurement techniques on engineering components.
5. Student will identify the suitable surface processing method from various methods to create surface engineering solutions for specific materials, specific environments and specific applications in modern engineering practice.

Outcomes: At the end of the course, the students are able to

1. Demonstrate basic understanding of friction, and be familiar with adhesion theories and the effect of adhesion on friction.
2. Demonstrate basic understanding of wear processes, and able to describe wear mechanisms on engineering components.
3. Demonstrate basic understanding of corrosion and know the methods to reduce the corrosion on engineering components.
4. Design a tribological system for optimal performance, and Justify, critical analysis on surface engineering techniques and surface design for relevant applications.
5. Apply surface engineering principles and methods to modify and improve the properties of surfaces for structural and functional applications.

UNIT – I:

Friction: Topography of Surfaces – Surface features – Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction – Rolling Friction – Friction properties of metallic and non metallic materials – Friction in extreme conditions – Thermal considerations in sliding contact.

UNIT–II

Wear: Introduction – Abrasive wear, Erosive, Cavitation, Adhesion, Fatigue wear and Fretting Wear- Laws of wear – Theoretical wear models – Wear of metals and non metals - International standards in friction and wear measurements.

UNIT – III

Corrosion: Introduction – Principle of corrosion – Classification of corrosion – Types of corrosion – Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated service, Laboratory testing – Evaluation of corrosion – Prevention of Corrosion – Material selection, Alteration of environment, Design, Cathodic and Anodic Protection, Corrosion inhibitors.

UNIT – IV

Surface Treatments: Introduction – Surface properties, Superficial layer – Changing surface metallurgy – Wear resistant coatings and Surface treatments – Techniques – PVD – CVD – Physical CVD – Ion implantation – Surface welding – Thermal spraying – Laser surface hardening and alloying, Applications of coatings and surface treatments in wear and friction control – Characteristics of Wear resistant coatings – New trends in coating technology – DLC – CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant coatings.

UNIT – V

Engineering Materials: Introduction – Advanced alloys – Super alloys, Titanium alloys, Magnesium alloys, Aluminium alloys, and Nickel based alloys – Ceramics – Polymers – Biomaterials – Applications – Bio Tribology, Nano Tribology.

Text Books:

1. G.W.Stachowiak & A.W. Batchelor, "Engineering Tribology", Butterworth-Heinemann, UK, 2005.
2. E. Rabinowicz, "Friction and Wear of materials", John Willey & Sons, UK,1995.
3. J. Halling, (Editor), "Principles of Tribology", Macmillian – 1984.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. J.A. Williams, "Engineering Tribology", Oxford Univ. Press, 1994.
2. S.K. Basu, S.N. Sengupta & B.B.Ahuja, "Fundamentals of Tribology", Prentice –Hall of India Pvt Ltd , New Delhi, 2005.
3. G. Fontana, "Corrosion Engineering", McGraw Hill, 1985.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C15

DYNAMICS AND VIBRATIONS LAB

Instruction	2	Hours per week
Duration of SEE	2	Hours
SEE	35	Marks
CIE	15	Marks
Credits	1	

Objectives:

1. To demonstrate basic principle and exposure to evaluate CAM Follower Motion and Gyroscopic effects.
2. The importance of static and dynamic balancing.
3. The methods of controlling speeds of prime movers
4. To acquire the knowledge in evaluating the stability of vehicles
5. Frequency response of spring mass system with damping and without damping - Undamped torsional vibrations of single and double rotor systems

Outcomes: At the end of the course, the students are able to

1. Demonstrate the dynamic behavior of mechanical systems. (BL-3)
2. Analyze the cam profile for different motion characteristics. (BL-4)
3. Examine the performance of governors and the gyroscopic effect on vehicles. (BL-3)
4. Evaluate the static and dynamic balancing masses in a rotating mass system. (BL-5)
5. Determine the natural frequency of different single degree freedom vibrating systems. (BL-3)

List of the Experiments

1. To study the motion of follower with the given profile of the cam. To plot the follower displacement vs angle of rotation curves for different cam follower pairs.
2. To study the gyroscopic effect on a rotating disc.
3. Determination of the frequency of torsional vibrations.
4. Static and Dynamic balancing in a rotating mass system.
5. Study the effect of varying mass on the centre of sleeve in Porter governor.
6. Study the effect of varying the initial spring compression in Hartnell governor.
7. Undamped torsional vibrations of double rotor system.
8. To study the longitudinal vibrations of helical coiled spring.
9. To study the undamped forced vibration of spring mass system.
10. To study the force damped vibration of spring mass system.
11. Determination of critical speed of the given shaft with the given end conditions (Whirling of Shafts).
12. Frequency response of spring mass system with damping.
13. Determine the equivalent link parameters and centre of mass of connecting rod theoretically and validate the result by experiment by choosing suitable methods and devices.

NOTE: Students should complete a minimum of 10 experiments including experiment 13 which is compulsory.

Text Books:

1. S.S. Rattan, "Theory of Machines", Fourth edition Tata-Mc Graw Hill, ,2014
2. John.J.Vicker, Gordon R. Pennock, Joseph E. Shigley, "Theory of Machines & Mechanisms", Oxford University Press, 2003.
3. William T.Thomson "Theory of Vibration with Application", 5th edition, Pearson education 2008

Suggested Reading:

1. Robert L. Norton, "Design of Machinery", Tata Mc Graw Hill, 2005.
2. Benson H. Tangue, "Principles of Vibration", 2/e, Oxford University Press, 2007

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

18ME C16

APPLIED THERMODYNAMICS AND HEAT TRANSFER LAB

Instruction	2	Hours per week
Duration of SEE	2	Hours
SEE	35	Marks
CIE	15	Marks
Credits	1	

Objectives:

1. To demonstrate basic knowledge and exposure to determine valve and port diagram and also to evaluate the performance of the petrol engine and diesel engine.
2. Student will determine the importance of heat balance sheet of IC engine.
3. Students will acquire knowledge in evaluating the performance of multi-stage reciprocating compressor.
4. To demonstrate knowledge in evaluating thermal conductivity and heat transfer coefficient under natural convection phenomena and forced convection phenomena.
5. Students will understand the basic concepts of radiation heat transfer.

Outcomes: At the end of the course, the students are able to

1. Evaluate the performance of petrol and diesel engines. (BL-5)
2. Evaluate the heat losses in heat balance sheet of IC engine. (BL-5)
3. Determine the performance of multi stage reciprocating air compressor and its importance over single stage air compressor. (BL-3)
4. Estimate the effect of insulation on conduction heat transfer and also estimate the value of convection heat transfer coefficients under different scenario. (BL-5)
5. Determine Stefan - Boltzmann constant, emissivity of grey plate and LMTD of heat exchanger. (BL-3)

List of the Experiments:

Applied Thermodynamics

1. Determination of Valve timing diagram and Port diagram of IC engine.
2. Determination of Performance characteristics of a multi-cylinder petrol engine.
3. To conduct Morse test on multi cylinder petrol engine.
4. To conduct performance test on a variable compression ratio petrol engine.
5. To conduct performance test on single cylinder diesel engine
6. To conduct heat balance test on single cylinder diesel engine.
7. To determine volumetric efficiency, isothermal efficiency of multi -stage reciprocating air compressor.

Heat Transfer

8. Determination of thermal conductivity of composite wall.
9. Determination of convective heat transfer coefficient under Natural and Forced convection phenomena using pin-fin apparatus.
10. Determination of Emissivity of a given plate.
11. Determination of the value of Stefan-Boltzmann constant.
12. Determination of Heat transfer coefficient in parallel and counter flow heat exchanger.
13. Evaluate the performance parameters of an alternative fuel on a vertical stroke single cylinder diesel engine.

Note: Students should complete a minimum of 10 experiments including experiment 13 which is compulsory.

Text Books:

1. Mahesh M. Rathore, "Thermal Engineering", TMH, New Delhi, 2010
2. V. Ganeshan,"Internal Combustion Engines", Tata Mcgraw Hill Publishing, New Delhi,2015
3. J.P. Holman, "Heat Transfer", McGraw Hill Publication, New Delhi, 2009

Suggested Reading:

1. R.K. Rajput., "Thermal Engineering", Laxmi Publishers, New Delhi, 2014

D.S. Kumar," Heat Transfer", S K Kataria Publishers, 2015With Effect from the Academic Year 2020 – 2021

Reddy

18PE C06

METAL FORMING TECHNOLOGY LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives:

Students will learn

1. To demonstrate various operations like sheet metal operations-blanking, punching, deep drawing, extrusion etc with their applications, merits and demerits.
2. To enable the students to determine loading and energy required for metal forming tools and machines.
3. To enable the students to understand different defects that occurring forming operations with remedial measures.
4. To make the students understand working principle, types, and applications of forging process.
5. To make students understand working principle, parameters, types and applications of extrusion 1process.

Outcomes:

At the end of the course, a student will be able to

1. Understand the practical aspects of metal forming operations.
2. Understand various process parameters that affect product quality under different conditions.
3. Determine load, energy and power required for various processes and machines.
4. Propose suitable metal forming processes for making different products.
5. Design and fabricate various types of dies for sheets metal operations.

List of the Experiments

1. Evaluation of Formability of a given sheet material using Erichsen cupping test.
2. Study of Simple Die design for Blanking/ Piercing operations in sheet metal forming and manufacturing of circular blanks using a mechanical press (capacity30Tons) and measurement of forces and comparing with theoretical loads.
3. Study of Progressive die design and manufacturing of washer components using the same on a fly press (capacity6Tons) and estimation of forces.
4. Study of Compound die design and manufacturing of washer components using the same on double body fly press (capacity8 Tons) and estimation of forces.
5. Study of Combination die design and manufacturing of cylindrical cups using the same on a Hydraulic power press (capacity 50Tons) and estimation of drawing force.
6. Study of deep drawing die design and measuring forces with/without blank holder for cylindrical/square cups using 10 T load cell on a Hydraulic power Press and comparing them with theoretical values.
7. Measurement of cutting force or Blanking operation using 10T load cell on Mechanical power Press for different materials and comparing theoretical and practical values.
8. Estimation of True stress and True strain for ferrous/ non-ferrous materials encountered in metal forming operations using Universal Testing Machine.
9. Study of extrusion dies and demonstration of extruding lead material.
10. Demonstration of Simulation software for metal forming operations.

Text Books:

1. Serope Kalpakjian, "Manufacturing Engineering and Technology", 4/e, Pearson education INC., 2015.
2. George.E. Dieter, "Mechanical Metallurgy", SI Metric Edition, McGraw –Hill, 1988.
3. P.N. Rao, "Manufacturing Technology", 4/e, TMH, 2015.

Suggested Reading:

1. R.K. Jain, S.C. Gupta, "Production Technology", 17/e, Khanna Publications, 2012.
2. Roy A lindberg, "Materials and Process of manufacturing", 4/e, PHI, 2004.
3. John A Schey, "Introduction To Manufacturing Processes", 3/e, Mcgraw Hill education, 2012.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C17

CAD/CAM

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To teach the basic design process and the importance and types of geometric modeling techniques
2. To teach the theory for modeling of surface and solid modeling techniques
3. To impart the basic skill in writing CNC part programming
4. To teach basic configurations of robot Manipulator
5. To teach concepts of part classification coding, computer aided process planning, automated inspection methods

Outcomes: At the end of the course, the students are able to

1. Understand the applications of computer in design, manufacturing, and geometric transformation techniques (BL-2)
2. Apply Wireframe, surface, and solid modeling techniques for the generating various parts. (BL-3)
3. Distinguish various NC systems and develop the CNC program. (BL-4)
4. Demonstrate the fundamentals knowledge of robotics (BL-2)
5. Understand automated manufacturing environment. (BL-2)

UNIT-I

Introduction: Introduction to CAD, Product life cycle, Design Process, Design criteria, Alternative solutions, Hardware integration and networking, Graphic Standards and Exchange Formats (IGES, STEP, STL)
Geometric Transformations: Introduction, Translation, Rotation, Scaling, Reflection Transformations, Homogenous Representation, Concatenated Transformation, Transformations about fixed point

UNIT-II

Wire frame Modeling: Wire frame entities and their definition, interpolation and approximation curves. concept of parametric and non-parametric representation of circle and helix curves, properties of splines, synthetic curves: parametric representation of cubic spline, Bezier and B-spline curves, continuity, properties and characteristics, Introduction to non-uniform rational B-splines.
Surface Modeling: Surface representation Analytic surfaces: definition of Plane surface, Ruled surface, Surface of revolution, Tabulated cylinder, Synthetic Surfaces- Hermite cubic and Bezier surfaces.
Solid Modeling: Solid entities, Boolean operations, B – rep and CSG approaches, feature based modeling, assembly modeling and mating conditions

UNIT-III

Numerical Control of Machine Tools: Features and elements of NC, Types of NC systems: PTP, straight Cut and Contouring. definition of axes, definition of interpolation, post-processor, preparatory and miscellaneous functions, canned cycles, tool length and cutter radius compensation. Manual part programming and computer aided part programming for simple components (APT).

UNIT-IV

CNC: Introduction to CNC, Typical configurations, Machining centers, Introduction to FANUC, SINUMERIC controllers
DNC: Typical configurations, CNC vs DNC.
Adaptive Control Systems: ACO and ACC.
Industrial Robots: Robot anatomy, configurations, control systems, drivers, accuracy and repeatability, end effectors, sensors in robotics, programming methods.Robot industrial applications: material handling, processing and assembly and inspection.

UNIT-V

GT: Part families, layout, part classification and coding system- OPITZ, MICLASS.
CAPP: Variant and Generative process planning.
FMS and CIM: FMS equipment, FMS layouts, benefits of FMS, Elements of CIM.
Computer Aided Inspection and QC: Automated inspection- Off-line, On-line, Contact (Co-ordinate measuring machine), Non-contact inspection (Machine Vision, Scanning LASER Beam, Photogrammetry).

Text Books:

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
... Bharathi Institute of Technology (A)
Hyderabad-500 075, Telangana

1. Ibrahim Zeid, "CAD/ CAM Theory and Practice", McGraw Hill Inc, New York, 2011.
2. Mikell P.Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", Pearson Publication, 4/e, 2016.
3. P.N. Rao, "CAD/CAM - Principles and Applications", 2/e, Tata McGraw Hill, New Delhi, 2004.

Suggested Reading:

1. Yoram koren, "Computer Control of Manufacturing Systems", McGraw Hill Int, New York, 1994.
2. C. Elanchezhian, T. Sunder Selwyn, G. Shanmuga Sunder, "Computer Aided manufacturing", 2/e, Laxmi Publications (P) Ltd, New Delhi 2007.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

18ME C18

MACHINE DESIGN

(Use of data book is permitted)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Design principles of helical coiled and leaf springs. types of materials used for springs
2. The design principles of gears
3. The design principles of sliding contact bearings
4. The Selection of rolling contact bearings and roller chains
5. Design principles of IC engine piston, connecting rod, crank shaft, C-clamp and crane hooks

Outcomes: At the end of the course, the students are able to

1. Understand the stresses in helical, leaf springs under static and fluctuating loads. (BL-2)
2. Design the spur, helical and bevel gears. (BL-6)
3. Demonstrate the ability in designing sliding contact bearings. (BL-3)
4. Selection of rolling contact bearings and roller chains. (BL-4)
5. Design of IC engine piston, connecting rod, crank shaft, C-clamp and crane hooks. (BL-6)

UNIT-I

Mechanical Springs: Introduction, types of springs, Materials used for springs.
Helical Springs: Wahl's factor, calculation of stresses, deflection and energy stored in spring. Design for staticand fluctuating loads.
Leaf Springs: Stresses and deflection, nipping of Leaf springs. Design for static loads.

UNIT-II

Gears: Introduction to gear drives, types of gears, materials used for gears, Standards and specification of gears,Design of Spur, Helical and Bevel gears. Lewis beam strength equation. Dynamic loads on gear tooth. Wear load and design for wear strength.

UNIT-III

Bearings: Introduction, classification of bearings, materials used for bearings, properties and types oflubricants.
Design of Sliding Contact Bearings: Hydrodynamic bearings: journal bearing and thrust bearings.
Selection of Rolling Contact Bearings: Types of rolling elements and their constructional details, Static anddynamic load carrying capacity, Load-life relationship, selection of bearing, for cyclic loads and speeds.

UNIT-IV

I.C. Engine Parts: Introduction, Materials used, Design of piston, connecting rod and overhang crank shaft.

UNIT-V

Design of Curved Beams: Introduction, stresses in curved beams, expression for radius of curvature of neutralaxis for rectangular, circular and trapezoidal sections, Design of C-clamp and crane Hook.
Selection of chain drives: Power rating of roller chains, Strength of roller chains.

Text Books:

1. V.B. Bhandari, "Design Machine Elements", Mc Graw Hill Publication, 2017.
2. J.E. Shigley, C.R. Mischne, "Mechanical Engineering Design", Tata Mc Graw Hill Publications, 2015.
3. R.S.Khurmi and J.K.Gupta, "Machine design", 34th edition, S Chand publications, 2018.

Suggested Reading:

1. P. Kannaiah, "Machine Design", Sci-Tech Publications, 2010
2. M.F. Spotts, "Design of Machine Elements", Prentice Hall of India, 2013.

Machine Design Data Books:

1. K.Mahadevan, K.BalaveeraReddy.,"Design Data Hand book for Mechanical Engineers", 3/e, CBS Publisher, 2018
2. PSG College, "Design Data book",2012

Reddy
PROFESSOR & HEAD
...ent of Mechanical Engineeri...
...harathi Institute of Technolog...
Hyderabad-500 075. Telan...

18PE C09

MACHINE TOOL ENGINEERING

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
Student will learn
1. To provide the basic understanding of cutting tools, geometry in machining process.
2. The concepts of tool wear
3. Different operations performed on lathe machine.
4. To make the students to understand various machine tools, like drilling, milling and boring machines
5. To make knowledge of Thread manufacturing and gear manufacturing.

Outcomes:
Students will be able to
1. Select tool geometry for various materials.
2. Estimate the tool wear
3. Identify the machine tools for manufacturing various components.
4. Select grinding wheel and Automats.
5. Work on shaper, planner and grinding machines.

UNIT - I
Orthogonal and Oblique Cutting: Cutting forces in turning, drilling milling and grinding, Merchant's analysis, Shear angle, friction angles. Experimental methods for estimation of shear angle, cutting forces and power, types of chips. Built up edge phenomena and its effects. Chip breakers. Sources of heat, its distribution and measurement. Different types of cutting fluids.

UNIT - II
Tool Wear and Tool Life: Criteria for tool wear, flank and crater wear theories, criteria for tool life in roughing and finishing, Measurement of tool wear, Taylor's tool life equation, factors effecting tool life, Machiniability. Single point cutting tool design; Geometry, tool nomenclature, American, DIN, max. rake system. Interrelation between normal rake and orthogonal rake, tool signature, effect of basic tool angles on its performance. Selection of size and angles of S.I. Tools, from tools. Design feature of multipoint cutting tools

UNIT - III
Lathe: Types constructional features, size of lathe, various operations that can be performed on lathes types of lathes, capstan and turret lathes, bar work and chuck work and tool holding devices. Taper turning methods. Thread cutting and accessories of lathe.
Automats: Single spindle and multiple spindle automats, Swiss type of automats, constructions and features of these machines.

UNIT - IV
Drilling Machines: Types and constructional features and applications, Radial drilling machine, drilling operations.
Milling Machines: Classifications and types various operations on milling machines, Up and down milling, Types of milling cutters and bars. Dividing head, plain, compound and differential indexing.
Boring Machines: Horizontal, Vertical and Jig boring machines and constructional features.
Thread Production: Thread rolling, thread chasing , thread milling and thread grinding.

UNIT - V
Shaping, Planing & Slotting Machines: Types, Constructional features, Types of work done on it. Quick return motion, manipulation of cutting speeds and feeds, work and tool holding devices, comparison of these machines.
Gear Cutting Machines: Methods of gear cutting, types and classification of gear hobbing, gear shaping machines Bevel gear cutting.
Grinding Machines: Types, Classification Abrasives and bonds used for grinding wheel, Selection of grinding wheel, cylindrical grinding and center less grinding.

Text Books:

1. B.L. JuneJa and Shekon, Fundamentals of "Metal Cutting & Machines Tools", Wiley Eastern Ltd. 1987.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineerin
Chaitanya Bharathi Institute of Technology (

2. P.N. Rao, "Manufacturing Technology – Metal Cutting & Machine Tools", Vol. 2, Tata McGraw Hill Education Pvt. Ltd, 2010.
3. M.C. Shaw, "Metal Cutting Principles", Clarendon Press, Oxford 1984.

Suggested Reading:

1. Hazra Choudary, "Workshop Technology", Vol. II, Media Pub., New Delhi.
2. Kibbe Richand R, Meyer, R.D, Neely etal, "Machine Tool Practices", 9/e, PHI, 2014.
3. Jain & Chitale, "Text Book of Production Engineering", 2/e, PHI, 2014.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E08

OBJECT ORIENTED PROGRAMMING WITH C++

(Core Elective-III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To understand difference between OOP and structured programming
2. To know classes, objects, constructors and destructors.
3. How to overload operators.
4. To understand inheritance and polymorphism
5. Knowledge about templates and exception handling.

Outcomes: At the end of the course, the students are able to

1. Identify fundamental object oriented concepts of C++ programming Language. (BL-1)
2. Distinguish between object oriented program and structured programming (BL-2)
3. Use operator overloading to give comfort in the programming. (BL-3)
4. Illustrate Exception handling and templates (BL-4)
5. Solve basic mechanical engineering problems by developing programs using object oriented features (BL-5)

UNIT - I

Principles of Object Oriented Programming: Procedure Vs Object Oriented, Paradigm, Basic concepts,benefits, Applications and Object Oriented Languages.

Introduction: Program structure, Creating, Compiling and Linking of C++ program.

Token, Expression and Control Structures: Tokens, Keywords, Identifiers and Constants, Data Types,Operators, Precedence, Type Compatibility, Control Structures, New Features of C++.

Functions: Function Prototype and Parameter Passing, Inline Functions, Default, Constant Arguments,Recursion, Function Overloading

UNIT - II

Classes and Objects: Defining classes and Member functions, creating objects, objects and arrays, objects andfunctions, const with classes, friends to a class, nesting static members of a class.

Constructors and Destructors: Type of Constructors, Dynamic Initialization of Objects, Destructors.

UNIT - III

C++ Operator Overloading and Type Conversions: Fundamentals, restrictions, overloading unary / binaryoperators, overloading ++ and —, overloading special operators, overloading by member functions and friend functions, type conversions.

UNIT - IV

C++ Inheritance: Defining derived classes, Types of Inheritance, Virtual Base class Abstract Class, functionoverriding and containership.

Pointers and Polymorphism: Pointers and Generic pointer, Pointer to Objects and Derived Classes, thispointer, Virtual Functions, Virtual Destructors

UNIT - V

C++ Templates: Introduction, function templates and class templates.

C++ Exception Handling: Conventional error handling mechanism, C++ error handling mechanism, Try,throw, catch, exception handling in classes.

Text Books:

1. Rohit Khurana, "Object oriented programming with C++", Vikas publications. 2/e, 2014.
2. Ashok Kamtani, "Object Oriented Programming with ANSI and Turbo C++", Pearson Education, 2017.
3. Somshekara, "Object Oriented Programming with C++", Eastern Economy Edition, 2/e, 2012.

Suggested Reading:

1. E. Balagurusamy, "Object Oriented Programming with C++", McGraw-Hill Education (India), 6/e, 2018.
2. Robert Lafore, "Object-Oriented Programming in C++", 4/e, Sams Publishing, 2016.

18ME E09

MECHANICS OF COMPOSITE MATERIALS

(Core Elective - III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Application and use of composite materials in industry.
2. Types of fibers and matrix materials used in commercial composites.
3. Prediction of the properties of UD lamina based on the constituent materials.
4. Analysis of composite laminates based on classical lamination theory.
5. Method of predicting failure in composite lamina using different theories.

Outcomes: At the end of the course, the students are able to

1. Differentiate between composite materials and conventional materials using basic concepts. (BL-2)
2. Analyze macro and micro mechanical behaviour of a lamina. (BL-4)
3. Determine role of constituent materials in defining the average properties and response of composite materials on macroscopic level. (BL-3)
4. Analyze the laminates for stresses and strains using Classical lamination theory (BL-4)
5. Summarize the various fabrication methods of composite materials and measurements of properties through tests. (BL-2)

UNIT-I

Introduction: Definition, characteristics, overview of advantages and limitations of Composite materials, classification, significance, objectives of composite materials and applications.

UNIT-II

Basic concepts and characteristics: Scale of analysis; Micromechanics, Macromechanics, Macro and micro mechanical behaviour of a lamina: Stress strain relations for anisotropic materials, Restrictions on engineering constants, transformation of stress, Strain and elastic parameters.

UNIT-III

Elastic behaviour of UD Lamina: Elastic constants of a lamina using MOM approach, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation. Tensile and compressive strength of unidirectional fibre composites, Macromechanical failure theories, applicability of various failure theories. Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria.

UNIT-IV

Elastic Behaviour of Laminate: Basic assumptions, Strain-displacement relations, classical Lamination Theory [CLT], Stress-strain relation of layer within a laminate, Force and moment resultant, classification of laminates. Analysis of different types of laminates.

UNIT-V

Manufacturing Processes& Testing: Hand lay-up, bag molding, autoclave processing, RTM, pultrusion, filament winding, gel time test for resins, curing cycle, Testing: Fiber and matrix tests, tensile test, compressive test, in-plane shear test, inter-laminar shear test, flexure test.

Text Books:

1. R. M. Jones, "Mechanics of Composite Materials", Mc Graw Hill Co., 2006.
2. B. D. Agarwal, "Analysis and performance of fiber composites", Wiley & Sons 3/e, 2013.
3. Ronald F Gibson, "Principles of composite material mechanics", CRC press. 4/e, 2016.

Suggested Reading:

1. Isaac M. Daniels and Ori Ishai, "Engineering Mechaincs of Composite Materials", Oxford University Press, 1994.
2. M.W.Hyer, "Stress Analysis of Fibre Reinforced Composite Materials", McGraw Hill Co., 1998.

18ME E10

ROBOTIC ENGINEERING
(Core Elective–III)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:
1. Principle of working of a robot, types and specifications,configuration, work envelop and motion controls and applications
2. Transformations, kinematics and dynamics of robots
3. Singularities, Jacobian and trajectory planning of a robot to prepare the robot for various tasks
4. Design of end effectors, drives, working of sensors and controllers for finding position and orientation.
5. Robot vision for image acquisition and processing and plan for various tasks and various Languages and Programming methods of robot.

Outcomes: At the end of the course, the students are able to
1. Understand the basic components and specifications of the Robots (BL-2)
2. Solve the problems of transformations, direct and inverse kinematics of robots (BL-3)
3. Analyze forces in links and joints of a robot and find the singularities, Jacobian and trajectory planning of a robot for various tasks (BL-4)
4. Recommend sensors and controllers for finding position and orientation to take corrective action based on feedback (BL-5)
5. Design an intelligent robot using machine vision and sensors (BL-6)

UNIT - I
Overview of Robots and Subsystems: Brief History, Types of robots, resolution, repeatability and accuracy,degrees of freedom of robots, Robot configurations, Workspace, Mechanisms and transmission, End effectors and Different types of grippers, vacuum and other methods of gripping, Pneumatic, hydraulic and electrical actuators, applications of robots, specifications of different industrial robots.

UNIT – II
Direct Kinematics: Rotation matrices, Euler angle and RPY representation, Homogeneous transformationmatrices, Denavit-Hartenberg notation, representation of absolute position and orientation in terms of joint parameters, direct kinematics.

UNIT - III
Inverse Kinematics: inverse orientation, inverse locations, Singularities, Jacobian, Trajectory Planning: jointinterpolation, task space interpolation, executing user specified tasks, sensor based motion planning.

UNIT - IV
Analysis of RP and RR Type Robots: Static force analysis of RP type and RR type planar robots, Dynamicanalysis using Lagrangean and Newton-Euler formulations of RR and RP type planar robots. Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, force feedback, hybrid control

UNIT - V
Sensors and Controllers: Internal and external sensors, position, velocity and acceleration sensors, proximitysensors, force sensors, laser range finder. Robot vision: image processing fundamentals for robotic applications, image acquisition and preprocessing. Object recognition by image matching and based on features

Text Books:

1. Nagrath and Mittal, "Robotics and Control", Tata McGraw-Hill, 2003.
2. Spong and Vidyasagar, "Robot Dynamics and Control", John Wiley and sons, 2008.
3. Mikell P. Groover " Industrial Robotics", McGraw-Hill, 2008.

Suggested Reading:

1. Fu. K.S, Gonzalez, R.C., Lee, C.S.G, "Robotics, control, sensing, Vision and Intelligence", McGraw Hill International, 1987
2. Steve LaValle, "Planning Algorithms", Cambridge Univ. Press, New York, 2006.

18PE E06

PRODUCTION AND OPERATIONS MANAGEMENT

(Core Elective-III)

Instruction week	3	Hours per
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Understand plant layout design to facilitate material flow and processing of a product in the most efficient manner
2. Gain some ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making on operations management and strategy.
3. Understand how Materials Requirement Planning and MRPII systems are used in managing operations
4. Recognize the importance of Inventory control to ensure their availability with minimum capital lock up.
5. Evaluate the quality processes in manufacturing and service sector to improve the operational performance

Outcomes: At the end of the course, the students are able to

1. Understand the role of production system and its design in Production and Operations Management. (BL-2)
2. Apply forecasting techniques for predicting demand. (BL-3)
3. Use Aggregate Planning, Master Scheduling and Materials Requirement Planning in a production system. (BL-3)
4. Compare various inventory control techniques used in production system. (BL-4)
5. Apply the quality control tools to improve performance of production system. (BL-3)

UNIT-I

Introduction: Production systems classification and characterization

Plant Location and Layout: Factors affecting plant location, Objectives of Plant layout, different types of layouts, merits and demerits.

Work Study: Productivity, Introduction to method study and work measurement, standard time calculations, work sampling, wages and incentive plans.

UNIT-II

Forecasting: Introduction, forecasting objectives and uses, demand patterns, qualitative models, market survey,Delphi method, quantitative models, moving average, weighted moving average, simple exponential smoothing, trend adjusted exponential smoothing, simple regression.

Forecast Errors: Mean Absolute Deviation (MAD), Mean Square Error (MSE), Mean Forecast Error (MFE),Mean Absolute Percentage Error (MAPE)

UNIT-III

Aggregate Planning and Master Scheduling: Introduction, objectives of aggregate planning, cost in aggregateplanning, strategies in aggregate planning, master production scheduling

Materials Requirement Planning (MRP): Importance of MRP, MRP system inputs and outputs, bill ofmaterials (BOM).

UNIT-IV

Inventory Control: Importance of Inventory control, Inventory control systems, Types of Inventories, Inventory costs, Deterministic Inventory models - Basic Purchase model, Purchase model with Instantaneous replenishment and with shortages, Basic Production model, Production model with shortages, Inventory model with price breaks.

UNIT-V

Quality Control: Introduction, quality gurus and their contributions, quality tools, process capability, qualitycontrol by control charts, control charts for variables and attributes, sampling plans, operating characteristic curve, introduction to total quality management (TQM).

Rreddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. William J. Stevenson, "Operations Management", 8/e, Tata Mc Graw Hill Edition, 2005.
2. Joseph G. Monks, "Operations Management: Theory and Problems", 3/e, McGraw Hill International Edition, 1987.
3. ElwoodS. Buffa, "Modern Production/Operations Management", 5/e, John Wiley Publishers, Singapore, 2002.

Suggested Reading:

1. Everrete E. Adama & Ronald J. Ebert, "Production & Operations Management", 5/e, Prentice Hall of India, 2005.
2. R. Panneerselvam, "Production and Operations Management," 2/e, PHI Learning Pvt. Ltd., New Delhi, 2006.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E07

PRINCIPLES OF INDUSTRIAL ENGINEERING (Core Elective-III)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn the
1. Basic principles of industrial engineering along with work study techniques.
2. Significance of production planning & control.
3. Necessity of inventory control techniques.
4. Essence of quality engineering.
5. Productivity improvement tools and techniques.

Outcomes: At the end of the course, the students are able to
1. Conceptualize the essence of industrial engineering techniques.
2. Plan, execute and control production related issues.
3. Analyze and choose right inventory control techniques.
4. Plot control charts and apply quality control tools.
5. Apply productivity improvement techniques.

UNIT - I

Concepts of Industrial Engineering: Productivity-concepts, Principles and Techniques, Production Vs Productivity, Productivity Improvement Methods. Work Study: Method Study and Work Measurement steps involved in method study and work measurement, Recording Techniques-Flow Process Charts, multiple activity chart, two handed process chart, SIMO Chart. Various techniques of work measurement-Time Study, Work Sampling, PMTS etc, Standard time computation.

UNIT - II

Plant Location and Layout: Factors for Plant Locations, Types of production - Mass, batch, job. Types of plant layout - product, process and fixed position layouts, cellular layouts.

UNIT - III

Production Planning and Control: Elements of PPC-Planning, Routing, Scheduling, Dispatching., Materials Requirement Planning (MRP), Manufacturing Resource Planning (MRP II).JIT and KANBAN system.

UNIT - IV

Inventory Control: ABC analysis, FSN analysis, VED Analysis, P System, Q System. Economic order quantity, Lead time, Buffer Stock, ASRS, Stores management.

UNIT - V

Quality Engineering: Control Charts-X, R, P, C charts. OC Curve, Acceptance Sampling, Kaizen, ISO-9000, Quality Concepts by Deming, Juran, Philip Crosby. Taguchi ' loss function.

Text Books:
1. SK Hajra Choudhury, Nirjhar Roy, AK Hajra Choudhury, "Industrial Engineering & Management", Media Promoters & Pub. Pvt. Ltd.,
2. Banga and Sharma, "Industrial Engineering and Management", Khanna Publishers, 2008.
3. O.P. Khanna, "Industrial Engineering and Management", Dhanpat Rai Pub.,
4. M.S. Mahajan, "Industrial Organization & Management", Nirali Prakashan Pub.

Suggested Reading:
1. K.K.Ahuja, "Industrial Management", Khanna Publishers, 5/e, 1993.
2. James L. Riggs,"Production Systems - Planning Analysis And Control" Wiley Publishers, 1992.
3. Elwood S Buff Rakesh K Sarin, "Modern Production Operations Management", John Wiley & Sons (Asia) Pte Ltd. 1983.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E12

With Effect from the Academic Year 2020 – 2021

COMPUTATIONAL FLUID DYNAMICS
(Core Elective - IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:
1. To understand governing equations of fluid flow
2. To understand turbulence and how to model them.
3. To know how to descretize governing equations of fluid flow by FDM and their stability.
4. To learn various iterative methods to solve N-S equation.
5. To understand FVM to solve fluid flow equations.

.**Outcomes:** At the end of the course, the students are able to
1. Describe and develop mathematical models for flow phenomena. (BL-1)
2. Classify PDE for fluid flow and heat transfer applications. (BL-2)
3. Apply Finite Difference Method for fluid flow and heat transfer problems (BL-3)
4. Test the discretized equations for stability and solve the system of linear equations (BL-4)
5. Formulate numerical equations by Finite Volume Method for fluid flow and heat transfer problems (BL-6)

UNIT-I

Basic Equations: Continuity, momentum and energy equations, Navier-Stokes equations, Heat transferconduction equations for steady and unsteady flows, steady convection-diffusion equation

UNIT-II

Models: Reynolds and Favre averaged N-S equations, mixing length model, k-epsilon turbulence model. **Classifications of Partial Differential Equations:** Elliptic, parabolic and hyperbolic equations, Initial andboundary value problems.

UNIT-III

Finite Difference Method: Forward, backward and central difference.

Parabolic partial differential equations: Euler, implicit and crank Nicholson methods, ADI models, Errors,consistency, stability analysis, Vonnumen analysis, Convergence criteria

UNIT-IV

Elliptic Partial Differential Equations: Jacobi, Gauss Seidel methods, TDMA, Viscous incompressible flow,Vorticity Stream function method.

UNIT-V

Finite Volume Method: Finite volume formulation for diffusion equation, convection diffusion equation,Solution algorithm for pressure velocity coupling in steady flows, staggered grid, SIMPLE algorithm.

Text Books:

1. P.S. Ghoshdastidar, "Computational Fluid Dynamics & Heat Transfer", Cengage Pub., 2018.
2. J.D. Anderson, Jr., "Computational Fluid Dynamics: The Basic with Applications", McGraw Hill, Inc., 2012.
3. H. Versteeg and W. Malalasekra, "An Introduction to Computational Fluid Dynamics : The Finite Volume Method", 3/e ,Pearson, , 2016

Suggested Reading:

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

1. F. John Wendt (Editor), "Computational Fluid Dynamics - An Introduction", Springer – Verlag, Berlin, 1992.
2. Charles Hirsch, "Numerical Computation of Internal and External Flows", Vols. I and II. John Wiley & Sons, New York, 1988.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E13

PRINCIPLES OF ENTREPRENEURSHIP

(Core Elective - IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Concept and procedure of idea generation
2. The nature of industry and related opportunities and challenges
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Outcomes: At the end of the course, the students are able to

1. Understand the concept and essence of entrepreneurship. (BL-2)
2. Identify business opportunities and nature of enterprise. (BL-3)
3. Analyze the feasibility of new business plan. (BL-4)
4. Apply project management techniques like PERT and CPM for effective planning and execution of projects. (BL-3)
5. Use behavioral, leadership and time management aspects in entrepreneurial journey. (BL-3)

UNIT-I

Entrepreneurship: Definition, functions of entrepreneurship, qualities of entrepreneurs, Entrepreneur vs intrapreneur, First generation entrepreneurs, women entrepreneurs, innovation and Intellectual property in entrepreneurial journey, conception and evaluation of ideas and their sources, need and importance of startups and incubation centers.

UNIT-II

Indian Industrial Environment: Competence, opportunities and challenges, Entrepreneurship and Economic growth, Entrepreneurship and Engineering, Small Scale Industry in India, objectives, Linkage among small, medium and large scale industries, Types of enterprises, corporate social responsibility.

UNIT-III

Formulation of Business Plan: Introduction, Elements of Business Plan and its salient features, Business model canvas, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary. Choice of Technology and Collaborative interactions, Sources of finance and Incentives for entrepreneurs.

UNIT-IV

Project Management: During construction phase, project organization, project planning, execution and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden, environmental issues.

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, Maslow's Hierarchy of needs, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi, 2012

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Mc Graw Hill Publishing Company Ltd., 2005
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E08

MODERN MACHINING AND FORMING METHODS

(Core Elective - IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Various non-conventional machining processes and their process parameters.
2. The relative merits, limitations and applications of various non-conventional machining processes.
3. The knowledge regarding working media and its functions of non-conventional machining processes.
4. The concepts of non-conventional forming processes such as rubber pad forming, hydro forming, stretch forming, etc.
5. The concepts of HERF and to provide the description of HERF process

Outcomes: At the end of the course, the students are able to

1. Compare the Traditional and Non Traditional Machining process and recognize the need for Non traditional Machining process. (BL-2)
2. Illustrate constructional features, performance parameters, process characteristics, applications, advantages and limitations of Non Traditional Machining process. (BL-3)
3. Classify mechanisms of material removal of various non traditional machining processes. (BL-4)
4. Describe the principles, characteristics, advantages, limitations and applications of various unconventional methods of forming, HERF. (BL-1)
5. Compare the principles, constructional features and applications among explosive forming, EHF and EMF.
   i. (BL-4)

UNIT-I

Ultrasonic Machining (USM):Introduction, Process description, abrasive slurry, Abrasive materials and theircharacteristics, Functions of liquid medium in slurry, Types of transducers, effect of process parameters, applications and limitations.

Abrasive Jet Machining (AJM): Principle of operation, process details, process variables and their effect onMRR and accuracy, advantages, disadvantages and applications

Water Jet Machining (WJM): Schematic diagram, equipment used, advantages and applications.

Abrasive Water Jet Machining (AWJM): Process, advantages, limitations and applications

UNIT-II

Electro Discharge Machining (EDM): Process description with schematic diagram, process parameters,functions and characteristics of dielectric medium, dielectric fluids, flushing, mechanism of metal removal, types of power supply circuits, mathematical analysis of metal removal rate (MRR), equations for surface finish, characteristics of spark eroded surfaces, advantages, disadvantages and applications.

Wire EDM: Process description and applications.

Laser Beam Machining (LBM): Principle of LASER beam production, materials used, process parameters,advantages, limitations and applications.

Plasma Arc Machining (PAM): Introduction, equipment used, process description and parameters, types of plasma arc: transferred arc and non transferred arc and process applications.

Electron Beam Machining (EBM): Schematic of the process, process parameters, principle of production ofelectron beam, equipment used, advantages, disadvantages and applications.

UNIT-III

Electro-chemical machining (ECM): Schematic of processparameters, function and characteristics of electrolyte, MRR for pure metal and alloys, electrode feed rate (EFR), advantages, limitations and applications.

Chemical Machining : Chemical blanking and chemical milling, advantages, limitations and applications.**ION Etching**: Process description, merits, limitations and applications.

PReddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

UNIT-IV

High Energy Rate Forming Processes (HERF): Introduction, applications, advantages
Explosive Forming: Principles, explosive materials, Equipment, types of explosive forming, standoffoperation and contact operation.
Electro Hydraulic Forming (EHF): Schematic of process, description and its applications
Electro Magnetic Forming (EMF): Process description, merits, limitations and applications.

UNIT-V

Flexible Forming: Principle of the process, process details and its types, Guerin, wheelon, Mar formingand Hydro forming processes and applications
Stretch Forming: Introduction, types of stretch forming, stretch draw forming, rotary stretch forming or stretchwrapping, compression forming, radial draw forming.
Tube spinning: Introduction, methods of tube spinning, backward spinning, forward spinning.

Text Books:

1. P.C. Pandey and H.S. Shah, "Modern Machining Process", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1980.
2. J Paulo Davim, "Modern Machining Technology - A Practical Guide", 1/e, Woodhead Publishing in Mechanical Engineering, 1980.
3. Hassan Abdel-Gawad El-Hofy, "Advanced Machining Processes, Nontraditional and Hybrid Machining Processes", McGraw Hill Publishing Co. Ltd., 1984.

Suggested Reading:

1. Davies and Austin, "Developments in High Speed Metal Forming", The Machinery Publishing Co. Ltd., 1985.
2. "Production Technology", HMT, 1984.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E16

FINITE ELEMENT METHODS (Core Elective - IV)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Equip the students with the Finite Element Analysis fundamentals and formulations
2. Enable the students to formulate the axial, truss and beam problems
3. Enable the students to formulate 2D problems with special cases
4. Enable the students to formulate quadrilateral element, use of numerical integration, Gaussian quadrature and one dimensional dynamic problems
5. Enable the students to understand the convergence requirements, heat transfer , formulate 3D problems and perform engineering simulations using Finite Element Analysis software (ANSYS)

Outcomes: At the end of the course a student will be able to

1. Apply FE method for solving field problems using Virtual work and Potential energy formulations
2. Analyze linear problems like axial, trusses and beam problems
3. Analyze 2D structural problems using CST element and analyze plane stress, plane strain and axi-symmetric problems with triangular elements.
4. Write shape functions for 4 node quadrilateral isoparametric elements, apply numerical integration, Gaussian quadrature and to estimate natural frequencies for stepped bar
5. Check for convergence requirements, Solve linear 1D and 2D heat conduction and convection heat transfer problems, formulate 3D elements, apply finite element analysis software for engineering solutions

UNIT - I

Fundamental concepts: Introduction to finite element method, stresses and equilibrium, boundary conditions, strain – displacement and stress – strain relationship

One dimensional problems: Finite element modeling co-ordinates and shape functions, virtual work and potential energy approach, Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, analysis of axial element and quadratic element

UNIT - II

Analysis of trusses and frames: Element stiffness matrix for a truss member, Analysis of plane truss with two degrees of freedom at each node, Analysis of beams: element stiffness matrix for two nodes (two degrees of freedom per node), Analysis of frames with two translations and rotational degrees of freedom per node

UNIT - III

2D triangular elements: plane stress, plane strain and axisymmetry, finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Finite element modeling of axisymmetric solids subjected to axisymmetric loading with triangular elements

UNIT - IV

Quadrilateral elements and numerical integration: Two dimensional four noded isoparametric elements, numerical integration and Gauss quadrature

Dynamic analysis: Formulation of finite element model, element mass matrices, Evaluation of Eigen values and Eigen vectors for a stepped bar

UNIT - V

Heat transfer analysis: Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional analysis of thin plate

3 D elements and FEA software: Introduction to finite element formulation of three dimensional problems in stress analysis, convergence requirements

Introduction to Finite Element analysis software: Modeling, analysis and post processing

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. Ramamurthy, G. "Applied Finite Element Analysis", I.K. International Publishing House Pvt. Ltd., New Delhi, 2009.
2. Tirupathi R, Chandraputla and Ashok D Belagundu, "Introduction to Finite Elements in Engineering", Practice Hall of India, 1997.
3. Daryl L. Logan, "A First Course in the Finite Element Method", Cengage Learning, 2011.

Suggested Reading:

1. Rao S S, "The Finite Element Method in Engineering", Pergamon Press, 1989.
2. Segerlind L J, "Applied Finite Element Analysis", Wiley Eastern, 1984.
3. Reddy JN, "An Introduction to Finite Element Method ", McGraw-Hill, 1984.
4. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt., "Concepts and Applications of FiniteElement Analysis", 4/e, Wiley.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E15

BLOCKCHAIN TECHNOLOGY

(Core Elective -IV)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Course Objectives:

1. To provide Conceptual understanding of how blockchain technology can be used to improve business processes.
2. To facilitate understanding of bit coin and working with consensus in Bitcoin.
3. To impart knowledge about designing and building Permissioned blockchains.
4. To introduce supply chain management and internet enabled supplychains.
5. To familiarize with blockchain applications.

Course Outcomes: At the end of the course, the students are able to

1. Outline the concepts of blockchain technology. (BL-2)
2. Understand the bit coin, working with consensus in Bitcoin. (BL-2)
3. Develop knowledge about designing and building Permissioned block chains. (BL-3)
4. Explain the concepts of supply chain management and internet enabled supply chains. (BL-2)
5. Make use of blockchain applications involved in various sectors. (BL-3)

UNIT- I

Introduction: History, blockchain Architecture, nodes, crypto currency, tokens, cryptography- private and public keys, hash, ledgers, bitcoin, design Primitives- digital Signature, protocols, security, consensus, understanding Crypto currency.

UNIT- II

Bitcoin and block chain: creation of coins, payments and double spending, bitcoin scripts, bitcoin p2p network, transaction in bitcoin network, block mining, block propagation and block relay.

Working with consensus in bitcoin: distributed consensus in open environments, consensus in a bitcoin network, proof of work (pow) – basic introduction, hashcash pow, bitcoinpow, attacks on pow and the monopoly problem, proof of stake, proof of burn and proof of elapsed time, the life of a bitcoin miner, mining difficulty, mining pool.

UNIT- III

Permissioned Block chain: Definition, merits and demerits, differences between permissioned and permissionless blockchain, overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT, Byzantine fault tolerant (BFT) system, Lamport-Shostak-Pease BFT Algorithm.

Enterprise application of Block chain: Cross border payments, Know Your Customer (KYC), Food security, Mortgage over Blockchain, Blockchain enabled Trade.

UNIT- IV

Blockchain and the world economy: Supply chain industry-past and future, supply chain using blockchain technology, building blocks of a supply chain network, business processes in supply chains,

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

types of supply chains and examples, strategic, tactical, and operational decisions, supply chain performance measures. ERP and automation.

Internet-enabled supply chains: e-marketplaces, e-procurement, e-logistics, e-fulfillment, customer relationship management, web services.

UNIT -V

Applications of blockchain technology: Uses of blockchain in e-governance, land registration, property records, notary, titles, micropayments, medical information systems, next generation of industry 4.0 and additive manufacturing, government identity management, auto executing contracts, three signature escrow, triple entry.

Text Books:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", 1st Edition O'Reilly, 2015.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Crypto currencies", 1st Edition, O'Relly, 2015.
3. Tiana Laurence, "Introduction to blockchain technology", Van Haren Publishing, 's-Hertogenbosch, 2019.

Suggested Reading:

1. Daniel Drescher, "Block Chain Basics", 1st Edition, Apress, 2017.
2. RiteshModi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing, 2018.

PReddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E17

RENEWABLE ENERGY SOURCES

(Core Elective - V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Need and importance of non-conventional energy resources
2. Extent of solar energy which can be utilized as energy resource
3. Concept of wind energy and its merits and demerits
4. Operating principles of geothermal energy and bio-energy
5. Merits and demerits of tidal energy, wave energy and OTEC

Outcomes: At the end of the course, the students are able to

1. Understand the need for renewable energy sources in the context of environmental issues. (BL-2)
2. Apply the principles of solar energy for domestic and industrial usages. (BL-3)
3. Understand the working principle of wind power plants along with merits and demerits. (BL-2)
4. Describe the concepts of geothermal energy sources and biomass as a source of energy. (BL-2)
5. Explain the principles and impact of wave, tidal and OTEC plants on the environment. (BL-2)

UNIT-I

Energy Sources: Energy characteristics, forms of energy, energy chain (route), energy sectors, Indian energy scenario, energy pricing in India, energy and environment, energy security, energy conservation and its importance, energy strategy for future, classification of energy sources, availability of conventional and non-conventional (renewable) energy sources, classification of RES - solar, wind, geothermal, bio-mass, ocean tidal, ocean wave and ocean thermal energy conversion (OTEC), advantages and limitations of conventional and renewable energy sources.

UNIT-II

Solar Energy: Solar radiation, solar thermal collectors, working of flat plate and concentrating (focusing) solar collectors and their limitations, comparison of flat plate and focusing collectors, applications of solar collectors - water heating, space heating, low temperature power generation, solar cookers, water pumping, SODIS, solar thermal power plant, advantages and limitations of solar energy systems, PV materials, PV cells and their manufacturing, space based solar power (SBSP), solar satellite system, advantages and disadvantages of SBSP.

UNIT-III

Wind Energy: Sources of wind, merits and demerits of wind energy, site selection for wind energy conversion system, wind turbine (wind mill), classification of wind mills, working principle horizontal axis and vertical axis windmills, horizontal vs vertical axis windmills, power extracted from the wind, effect of velocity on power generation, new developments and problems in operating large wind power generators.

UNIT-IV

Geothermal Energy: Layers in earth, resources of geothermal energy, hydrothermal, petrothermal and geopressure resources, advantages, disadvantages, applications and environmental effects of geothermal energy sources.

Biomass Energy: Resources, biogas and its composition, process of biogas generation, wet process and dry process, raw materials available for biogas fermentation, economical, social, environmental and health benefits of biogas utilization, selection of site and constructional techniques of a biogas plant, working of KVIC, Pragathi design, Janata and Deenbandu biogas plants, common operational problems, causes and remedies relating to a biogas plant.

UNIT V

Tidal power: Tidal systems, site selection for tidal power plant, schematic layout of tidal power house, principle of operation of single basin and double basin tidal plants, advantages and disadvantages of tidal

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

power.

Wave energy - Differences between tides and waves, advantages and disadvantages of wave power, problems associated with wave energy collection, working principle of wave energy conversion devices.

Ocean thermal energy conversion (OTEC) - OTEC power plants, location, open cycle and closed cycle OTEC plants, advantages, limitations and applications of OTEC, environmental impact of OTEC plants.

Text Books:

1. S. Hasan Saeed and D.K. Sharma, "Non Conventional Energy Resources", S.K. Kataria & Sons, New Delhi, 2017.
2. Dr. R.K. Singal, "Non Conventional Energy Resources", S.K. Kataria & Sons, New Delhi, 2005.
3. G.D. Rai, "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.

Suggested Reading:

1. K. M. Mittal, "Non-Conventional Energy Systems", Wheeler Publishing Co. Ltd, New Delhi, 2003.
2. Shali Habibulla, "Non-Conventional Energy Sources", State Institute of Vocational Education, Hyderabad, 2005.

PReddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E18

CONTROL SYSTEMS THEORY
(Core Elective - V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:
1. To provide with basic knowledge of control systems, associated terminologies, transfer function.
2. Familiar with basic electrical, mechanical & electromechanical system and their representation in Differential Equation /Transfer function form.
3. To make students familiar with system performance analysis in time & frequency domain.
4. To understand different methods of stability analysis
5. To provide basic pathway to space representation and controllability and observability

Outcomes: At the end of the course, the students are able to
1. Understand control system, modeling and transfer functions of different systems. (BL-3)
2. Apply the concept of block diagram and signal flow graphs to different systems. (BL-3)
3. Differentiate between time domain and frequency domain techniques. (BL-2)
4. Examine the stability of a system using different approaches. (BL-3)
5. Analyze the system in state space and to find out the controllability and observability. (BL-4)

UNIT-I
Mathematical Modeling: Introduction to control systems , Open loop & closed loop systems, Mathematicalmodeling & Mechanical systems, Transfer functions from Governing equations, Electrical, hydraulic systems pneumatic, thermal systems, AC,DC servomotors &Electromechanical servo systems

UNIT-II
Components of Control System: Introduction to Block diagrams & Problems, Signal flow graph & mason'sgain formula, Transient response &time domain specifications of 1st order systems, 2nd order systems & time domain specifications, Steady state error, error coefficients, Sensitivity Performance Indices

UNIT-III
Time Domain Analysis: Routh criteria & root locus method, Frequency response, Bode & polar plots,Correlation between Transient & frequency response, Band width, Experimental determination of transfer function

UNIT-IV
Stability Analysis: Nyquist Criteria, Phase & gain margins, Lead, lag compensator design lead-lagcompensator design, PID-controller, linearization of non linear systems

UNIT-V
State Space Representation: State space representation of linear control systems, State transition matrix, **Solution of State Space Equations**: Zero input response and Zero state response, Concept of controllability &observability

Text Books:
1. K. Ogata, "Modern control Engineering", Prentice Hall, 2015.
2. M. Gopal., "Control Systems", Tata McGraw Hill, 2012.
3. D. Roy Choudhury, "Control System Engineering", PHI, 2005

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Norman S.Nise., "Control Systems Engineering", John Wiley & sons, Inc., 2018.
2. R.C. Dorf, "Modern Control systems", Addison Wesley, 2011

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E19

ARTIFICIAL INTELLIGENCE

(Core Elective - V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.
4. Familiarize with the types of machine learning.
5. Applications of AI in the field of mechanical engineering.

Outcomes: At the end of the course, the students are able to

1. Differentiate between a rudimentary Problem and an AI problem, its Characteristics and problem solving Techniques. (BL-2)
2. Compare and contrast the various knowledge representation schemes of AI. (BL-4)
3. Analyze various reasoning and planning techniques involved in solving AI problems. (BL-4)
4. Understand the different learning techniques. (BL-2)
5. Apply the AI techniques in the field of mechanical engineering. (BL-3)

UNIT - I

Introduction: Definition, history, applications. Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate-and-test, Hill Climbing, Constraint Satisfaction.

UNIT - II

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification. Knowledge Representation (Structured): Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III

Reasoning: Probability and Bayes theorem, certainty factors and rule based systems, Bayesian Networks, Dempster-Shafer theory. Planning: components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: decision tree. Intelligent Agents: classification, working of an agent, single agent and multi agent systems, multi agent application.

UNIT – V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition. Perception and Action: Real Time Search, Vision, Speech Recognition, Action: Navigation, Manipulation, Robot architectures. Scope and applications of AI in Mechanical Engineering

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence", 3/e, TMH, 2008
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3/e, PearsonEducation, 2010
3. Nilakshi Jain "Artificial Intelligence: Making a System Intelligent", Wiley India, 2019

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012
2. Deepak Khemani, "A First Course in Artificial Intelligence", TMH, 2017

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME E20

INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

(Core Elective - V)

Instruction	3	Hours per week
Duration of SEE	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. Various types of business organizations and organization structures and importance of plant location and plant layout
2. Importance of industrial engineering techniques like method study and work measurement.
3. The significance of quality control and production planning and control
4. The importance of project management techniques
5. The total cost of a product based on elements of cost

Outcomes: At the end of the course, the students are able to

1. Understand different types of business organizations, functions of management and importance of various types of plant layouts. (BL-2)
2. Apply techniques of method study and work measurement in organizations to enhance productivity (BL-3)
3. Usequality control charts and tools in industries. (BL-3)
4. Apply various optimization and project management techniques for solving real time problems. (BL-3)
5. Understand basic concepts of Cost accounting and financial management . (BL-2)

UNIT-I

Industrial Organization: Definition of an organization, types of various business organizations, organizationstructures and their relative merits and demerits, functions of management.

Plant location and layouts: Factors affecting the location of plant and layout, types of layouts and their meritsand demerits.

UNIT-II

Work study: Definitions, objectives of method study and time study, steps in conducting method study,symbols and charts used in method study, principles of motion economy, calculation of standard time by time study and work sampling, performance rating factor, types of ratings, job evaluation and performance appraisal, wages and incentive plans.

UNIT-III

Inspection and quality control: Types and objectives of inspection, S.Q.C., its principles. Quality control charts and sampling plans, quality circles, introduction to ISO.

Production planning and control (PPC): Types of production systems, principles of PPC and itsfunctions.

UNIT-IV

Optimization: Introduction to linear programming and graphical solutions, assignment problems.

Project Management: Introduction to CPM and PERT, determination of critical path.

Material Management: Classification of materials, materials planning, duties of purchase manager,determination of economic ordering quantities, types of materials purchase.

UNIT-V

Cost accounting: Elements of cost, various costs, types of overheads, break even analysis and its applications,depreciation, methods of calculating depreciation fund, nature of financial management, time value of money, techniques of capital budgeting and methods, cost of capital, financial leverage.

Text Books:

1. O.P. Khanna "Industrial Engineering and Management", Dhanapat Rai & Sons, 2018
2. S.D. Sharma, "Operations Research" , Kedarnat , Ramnath & Co., Meerut,2012
3. Pandey I.M. , " Financial Management", Vikas Publ. House, New Delhi, 2016

Suggested Reading:

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

1. William J Stevenson, "Operations Management", McGraw Hill, 2018
2. Paneer Selvam, "Production and Operations Management", Pearson Education, 2012.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE E10

TOTAL QUALITY MANAGEMENT (Core Elective - V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand

1. The essence of total quality management in design and manufacturing a product
2. The various principles and concepts of total quality management
3. The various technical tools of quality like control charts and ANOVA etc
4. The quality information system
5. The awareness about measuring and satisfying customer needs

Outcomes: At the end of the course, the student is able to

1. Apply TQM techniques in engineering applications
2. Use various theories and principles related to TQM
3. Use statistical techniques in TQM
4. Have awareness and use quality information system and innovative systems
5. Deal with customer grievances and satisfying the customers

UNIT-I

Strategic Quality Management: Quality policies, quality goals, obstacle to achieving successful strategic quality management, Organization for quality role of {Top, middle, work force team (Quality Circles)}, Developing a quality work culture, Maslow need theory, Herzberg two factor theory, Theory X, Y & Z methods to create and maintain awareness of quality, provide evidence of management leadership, types of self development and empowerment programmes, methods of participations means of inspiring action, recognition and rewards, Supplier quality rating plans (lot plot plan, OC curve, parent analysis), assignment of supplier capability, methods of evaluating supplier products, contract management (Joint economic plan, joint technological forecasting

UNIT-II

Design for Quality: Basic functional requirements of quality, design for (reliability, safety, cost and product performance), concurrent engineering (DFMA) value engineering, support for quality improvement processes (block diagram, brain storming, cause effect analysis, pareto analysis), quality function deployment, reliability analysis, failure rate, failure pattern of complex products (bath tub curve), weibull distribution relationship between part and the system, exponential reliability, availability, FMEA (Fracture Mode and Effect Analysis), Design for experiments: Factorial experiments, construction fractional designs

UNIT-III

Technical Tools for Quality: Analysis of variance (ANOVA), 4 factor ANOVA experiment, 2 levels, analysis of means, Techniques for online quality: data collection plan, variable and attribute charts, interpreting the control charts, Techniques for offline quality control: background to Taguchi method (quality loss and loss function, controllable factor, and non controllable factors in parameter performance, tolerance design

Taguchi analysis techniques: net variation and contribution ratio, estimation of process performance, accumulating analysis, performance measures, Taguchi tolerance design and tolerance (re) design

UNIT-IV

Quality Information System: Scope of Quality Information System, differences between QIS and MIS, creating new software (steps, types, defects) reports on quality (operational and executive reports), features of QIS software, software for inspection

Inspection System: Operational sorting and correlation sorting, AQL, LTPD, AOQL, Nondestructive test, Audit systems: (quality improvement planning and implementation, describing quality function, process control system, control of measurement system, material identification and control, drawing and specification control, process corrective action), the concept of POKAYOKE

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-V

Measure of Customer Needs: The need to measure customer satisfaction, importance of proper packaging, customer processing and installation of product, dealing with customer complaints, using weibull analysis, field feedback, parameter to measure customer (dis)satisfaction, problems with the customer satisfaction system

Beyond TQM: Difficulties in implementing TQM system, rating your quality system, JIT system, the people side of TQM system, system integration, Kansei engineering and flexibility in manufacturing

Text Books:

1. L. Suganthi, Aanand A. Samuel, "Total Quality Management", PHI Learning Pvt. Ltd., 2004.
2. H.G. Menon, "TQM in view Production Manufacturing", McGraw Hill Publishers.

Suggested Reading:

1. Joel E. Ross & Susan Perry, "Total Quality Management: Text, Cases, and Readings", 3/e, CRC Press, 1999.
2. John S Oakland, "Total Quality Management: The route to improving performance", 2/e, A Butterworth-Heinemann Title, 1994.
3. Jankiraman, "Total Quality Management: Text and Cases", 1/e, PHI Learning Private Limited-New Delhi, (2006).

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18ME C20

CAD/CAM LAB

Instruction	2	Hours per week
Duration of SEE	2	Hours
SEE	35	Marks
CIE	15	Marks
Credits	1	

Objectives:

1. To teach the basic design process and the importance and types of geometric modeling techniques
2. To teach Assembly modeling by applying suitable assembly constraints
3. To generate orthographic views of components and assemblies.
4. To demonstrate the Indication of size, form and positional tolerances on the drawing sheets
5. To demonstrate the working of CNC machines and write part programs for different operations

Outcomes: At the end of the course, the students are able to

1. Model components using CAD software. Select appropriate commands to generate 3D model (BL-3)
2. Select constraints to assemble the components (BL-3)
3. Develop manufacturing drawings from 3D models (BL-3)
4. Analyze the concept CNC part program to generate tool path for different machining operations (BL-4)
5. Develop a product using CAD/CAM technology (BL-6)

List of the Exercises:

1. Introduction to CAD Package, Working with sketch mode and introduction to various Part Features.
2. Part modeling of various machine components
3. Format of drawing sheet, title block, Generating and editing drawings
4. Assembly modeling of Stuffing Box
5. Assembly modeling of Screw Jack
6. Assembly modeling of Crosshead
7. Production drawing of components and indicating tolerances on size and geometrical form, Position; Indicate Surface finish, surface treatments if any and writing process sheet for anyone component
8. Introduction to CNC machines, Working, writing of process sheets, Contouring on CNC Milling Machine.
9. Rectangular & Circular Pocketing on CNC Milling Machine
10. Step Turning and Taper Turning on CNC Lathe Machine
11. Multiple Turning on CNC Lathe Machine
12. Study of 3D printer
13. Design a product and Manufacture / generate CNC Machining tool path for its components

Note: Student should complete a minimum of 10 exercises including exercise number 13 which is compulsory.

Text books:

1. P.N. Rao, "CAD/CAM: Principles and Applications",Tata McGraw-Hill, July 2017
2. N Mehta, "Machine Tool Design and Numerical Control", McGraw Hill Education, 3/e, 2017

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

3. Dassault Systems, "SOLIDWORKS Essentials: Training", SolidWorks corp., 2011

Suggested Reading:

1. https://my.solidworks.com/solidworks/guide/SOLIDWORKS_Introduction_EN.pdf
2. https://help.solidworks.com

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

18PE C10

MACHINE TOOL ENGINEERING LAB

Instruction	2 Hours per week
Duration of Semester End Examination	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Objectives: Students will learn
1. To grind single point cutting tool using HSS as cutting tool.
2. To do various operations on lathe and drilling machines
3. The gear cutting and to cut gear on milling machine.
4. Measure cutting forces during machining on Lathe machine, milling.
5. Unconventional machining operations like EDM & ECM.

Outcomes:
At the end of the course, a student will be able to
1. Grind single point cutting tool with various angles.
2. Perform various machines on lathe.
3. To manufacture a gear using milling machine.
4. Do operation on shaper.
5. Get exposure to various unconventional processes.

List of the Experiments
1. Introduction to Machine Tools, like Lathe, Drilling, Milling and Shaper.
2. Plain and step turning operations on Lathe.
3. Step turning and Knurling on Lathe machine.
4. Taper turning on Lathe.
5. Drilling and Boring on Lathe.
6. Thread Cutting on Lathe.
7. Grinding of Single Point Cutting Tool.
8. Gear Cutting using (a) Plain Indexing (b) Compound Indexing.
9. Measurement of Cutting forces during machining on Lathe machine and Milling machine.
10. Finding Shear angle experimentally in turning operation.

Text Books:

1. B.L. JuneJa and Shekon, "Fundamentals of Metal Cutting & Machines Tools", Wiley Eastern Ltd. 1987.
2. P.N. Rao, "Manufacturing Technology – Metal Cutting & Machine Tools", Vol. 2, Tata McGraw Hill Education Pvt. Ltd, 2010.
3. M.C. Shaw, "Metal Cutting Principles", Clarendon Press, Oxford 1984.

Suggested Reading:

1. Hazra Choudary, "Workshop Technology", Vol. II, Media Pub., New Delhi.
2. Kibbe Richand R, Meyer, R.D, Neely etal, "Machine Tool Practices", 9/e, PHI, 2014.
3. Jain & Chitale, "Text Book of Production Engineering", 2/e, PHI, 2014.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME C33

METROLOGY AND INSTRUMENTATION

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To familiarize with limits, fits & tolerances and fundamental concepts of linear and angular measurements.
2. To have knowledge of various precision measuring instruments and concept of limit gauges.
3. To learn the importance of Geometric form and how to measure form errors.
4. To have knowledge in the concepts of classification of instrument errors and their characteristics.
5. To understand the working principles of various instruments used for the measurement of displacement, pressure and temperature.

Outcomes: At the end of the course, students are able to

1. Learn and understand the need for measurement and fundamental concepts of measurement.
2. Demonstrate sound knowledge in gauges design and gauge selection for inspection.
3. Demonstrate an ability to select and use the appropriate measuring instruments to measure surface roughness.
4. Recognize the concepts of errors, strain measurement, classification and instrument characteristics.
5. Apply the skills in measuring various quantities like displacement, pressure & temperature.

UNIT-I

Limits, Fits and Tolerances: Interchangeability, nominal size, limits , tolerances, allowance, fundamental deviation, unilateral and bilateral tolerances, Types of fits, alpha numeric designation of limits/fits, hole and shaft basis systems, selective assembly.

Linear and Angular Measurement: line and end standards, Slip gauges, Tomlinson gauges and Sine bar.

UNIT-II

Design of Limit Gauges: Taylor's Principle for plan limit gauges, Design of GO and NO GO gauges, Use of Plug, Ring and Snap gauges.

Comparators: Introduction, Dial indicator, Sigma Mechanical comparator, Back pressure type Pneumatic comparator.

Optical Measuring Instruments: Optical projector principle and its uses, Tool maker's Microscope principle and its uses, interferometry.

UNIT-III

Straightness, Flatness and Roundness Measurement: Definitions, measurement by beam comparator, straight edge, spirit level, and bench centers.

Surface Roughness Measurements: Roughness and waviness, numerical assessment of surface roughness by CLA, RMS, Rz values, Surface roughness measurement by Profilometer, Taylor Hobson Talysurf, ISI symbols for indication of surface finish.

UNIT-IV

Screw Thread Metrology: Basic terminology of screw thread, measurement of effective diameter by 2 wire and 3 wire methods, Best wire size.

Gear Tooth Metrology: Spur Gear nomenclature, Gear tooth thickness measurement by gear tooth vernier.

Instrumentation: Static and Dynamic characteristics of instruments, Types of errors, Strain measurement with strain gauges, gauge factor, Rosette Gauges.

UNIT-V

Transducers: Displacement measurement by L.V.D.T, Pressure measurement by Bourdon pressure gauge, bulk modulus pressure gauge, pirani gauge, Temperature measurement by thermo couples, Laws of thermo electricity, Types of materials used in thermocouples.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. R.K. Jain, Engineering Metrology, Khanna Publications, 1996.
2. Doeblin, "Measurement Systems Application and Design", TMH, 5/e., 2004.
3. Beckwith, Buck, Lienhard, "Mechanical Measurements", PEA, 3rd Indian Reprint, 2001.
4. Anand Bewoore & Vinay Kulkarni , "Metrology & Management", McGrawhill Education India, 2014.
5. B.C. Nakra & K.K. Chaudhary , "Instrumentation Measurement and Analysis", 3/e., McGrawhill, 2014

Suggested Reading:

1. IC Gupta., "Engineering Metrology", Dhanpat Rai Pub., New Delhi, 1984.
2. Rega Rajendra," Principles of Engineering Metrology", Jaico Publishing House, Mumbai, 2008.
3. VSR Murti, "Metrology and Surface Engineering", Frontline Publications, 2011.

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PE C10

PRODUCTION DRAWING

Instruction	1 Lecture + 2 Drawing Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	2

Objectives: Students will understand
1. The need and the importance of production drawing
2. How to make part drawing from given assembly drawings and prepare process sheets.
3. Indication of size, form and positional tolerances on the drawing sheets
4. Surface finish and heat treatment process on the drawing sheets.
5. Notations, symbols and abbreviations on production drawings

Outcomes: On completion of the course the students will develop abilities to
1. Draw part drawings from given assembly drawings of machine parts.
2. Indicate tolerance values on the parts drawn on sheet as per alpha numeric codes for given assembly drawings
3. Indicate form tolerances and position tolerances on the parts drawn on the sheet as per universally accepted norms for a given assembly drawing
4. Indicate values of surface finish and heat treatment process on the parts drawn for a given assembly drawings.
5. Write process sheet for the part that is drawn from given assembly drawing and interpret production drawing and process sheet.

UNIT-I
Parts-I: Format of drawing sheet, title block, columns for materials, Processes, parts list, conventional representation of parts: screwed joints, welded joints, springs, gears.

UNIT-II
Parts II: Elements of electrical, hydraulic and pneumatic circuits, machine tool elements, methods of indicating notes on drawing

UNIT-III
Limits and Fits: Basic definition of terms, alpha numeric designation of limits/fits, types of fits, Interchangeability and selective assembly, Exercises involving selection/interpretation of fits and calculation of limits, dimensional chains.

UNIT-IV
Production Drawing: Conventional practices of indicating tolerance on size and geometrical form, position, surface finish, surface treatments, part drawing from assembled drawings (Stuffing box, Screw jack, I.C engine connecting rod, Revolving center, Square tool post, Single tool post, Universal coupling, Flange coupling, Steam engine cross head, Drill jig (plate type), Eccentric, Hydraulic cylinder), specification and indication of above features on the drawings, calculation of limits suggesting suitable fits for mating parts

UNIT-V
Assignments: Sketches of conventional representation of parts described with syllabus at (1) process sheets, tolerances and finishes obtainable from different processes. Study of IS 2709 on limits and fits

NOTE: Tolerance charts to be provided in the examination hall for calculation of limits

Text Books:
1. K.L. Narayana, P. Kannaiah and K. Venkat Reddy, "Production Drawing", New Age Intl., (P) Ltd., Revised Edition, 1997.
2. P. Narasimha Reddy, T.A. Janardhan Reddy and C. Srinivasa Rao, "Production Drawing Practice", Hitech Publishers, 2001.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME C34 With Effect from the Academic Year 2019 - 2020

OPERATIONS RESEARCH

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Students will come to know the formulation of LPP models
2. Students will understand the Algorithms of Graphical and Simplex Methods
3. Students will understand the Transportation and Assignment techniques
4. Students will come to know the procedure of Project Management along with CPM and PERT techniques
5. Students will understand the concepts of sequencing and queuing theory

Outcomes: At the end of the course, the students were able to

1. Formulate a managerial decision problem into a mathematical model;
2. Apply transportation problems in manufacturing industries;
3. Build and solve sssignment models and travelling salesmen problems.
4. Apply project management techniques like CPM and PERT to plan and execute project successfully
5. Apply sequencing and queuing theory concepts in industry applications

UNIT-I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, Degeneracy in Simplex, Duality in Simplex.

UNIT-II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT-III

Assignment Techniques: Introduction, Hungarian technique of Assignment techniques, unbalanced problems, problems with restrictions, Maximization in Assignment problems, Travelling salesman problems

UNIT-IV

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward path, Determination of critical path, duration of the project, Free float, Independent float and Total float, Crashing of network.

UNIT-V

Sequencing Models: Introduction, General assumptions, processing 'n' jobs through two machines, processing 'n' jobs through three machines.

Queuing Theory: Introduction, Kendal's Notation, single channel - poisson arrivals - exponential service times

Text Books:

1. Hamdy, A. Taha, "Operations Research-An Introduction", 6/e, Prentice Hall of India Pvt. Ltd., 1997.
2. S.D. Sharma, "Operations Research", Kedarnath, Ramnath & Co., Meerut, 2009.
3. V.K. Kapoor, "Operations Research", S. Chand Publishers, New Delhi, 2004.

Suggested Reading:

1. Harvey M. Wagner, "Principles of Operations Research", 2/e, Prentice Hall of India Ltd., 1980.
2. R. Paneer Selvam, "Operations Research", 2/e, PHI Learning Pvt. Ltd., New Delhi, 2008.
3. Nita H. Shah, Ravi M. Gor, Hardik Soni, "Operations Research", PHI Learning Private Limited, 2013.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. R.L. Murthy, "Precision Engineering in Manufacturing", New Age International Private Ltd., 1996
2. Venkata Reddy, "Production Drawing", New Age International, ISBN 978-81-224-2288-7, 2009
3. Farazdak Haideri, "Machine Drawing & Computer Graphics", Nirali Prakashan, ISBN 978-93-8072-527-7
4. Doeblin, "Measurement Systems Application and Design", TMH, 5/e, 2004.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PE C11

PRODUCTION AND OPERATIONS MANAGEMENT

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. Understand plant layout design to facilitate material flow and processing of a product in the most efficient manner
2. Gain some ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making on operations management and strategy.
3. Understand how Materials Requirement Planning and MRPII systems are used in managing operations
4. Recognize the importance of Inventory control to ensure their availability with minimum capital lock up.
5. Evaluate the quality processes in manufacturing and service sector to improve the operational performance

Outcomes: At the end of the course, the student will be able to

1. Identify and evaluate the processes, tools and principles of production and operations management to better understand the logistics and supply chain operations
2. Demonstrate the ability to apply mathematical forecasting techniques
3. Identify future challenges and directions that relate to production and operations management to effectively and efficiently respond to market changes
4. Apply the tasks, tools and underlying principles of operations management in the manufacturing and service sectors to improve organizational performance
5. Explain and evaluate the quality process in manufacturing and service sector to improve the operational performance

UNIT-I

Production & Operations Management: Introduction: Types of Production Systems, job shop, batch, flow shop

Plant Location and Layout: Factors affecting plant location, plant layout objectives, types of layouts, merits and demerits.

Work Study: Introduction to method study and work measurement, standard time calculations, work sampling, wages and incentives, types of incentive plans.

UNIT-II

Forecasting: Introduction, forecasting objectives and uses, demand patterns, qualitative models, market survey, Delphi method, quantitative models, moving average, weighted moving average, simple exponential smoothing, trend adjusted exponential smoothing, simple regression.

Forecast Errors: Mean Absolute Deviation (MAD), Mean Square Error (MSE), Mean Forecast Error (MFE), Mean Absolute Percentage Error (MAPE)

UNIT-III

Aggregate Planning and Master Scheduling: Introduction, objectives of aggregate planning, cost in aggregate planning, strategies in aggregate planning, master production scheduling

Materials Requirement Planning (MRP): Importance of MRP, MRP system inputs and outputs, bill of materials.

UNIT-IV

Inventory Control: Importance of inventory control, types of inventory models, inventory costs, deterministic inventory models, basic EOQ model, production model without shortages, purchase model with instantaneous replenishment and with shortages, production model with shortages, inventory model with price breaks, fixed order quality system, periodic review system .

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-V

Quality Control: Introduction, quality gurus and their contributions, quality tools, process capability, quality control by control charts, control charts for variables and attributes, sampling plans, operating characteristic curve, introduction to total quality management

Text Books:

1. Stevenson, "Operation Management", Mc-Graw Hill International.
2. Joseph Monks, "Operations Management", TMH Publishers, New Delhi, 2004.
3. Buffa Elwood S, "Modern Production /Operations Management", John Wiley Publishers, Singapore, 2002.

Suggested Reading:

1. Everrete E. Adama & Ronald J. Ebert, "Production & Operations Management", 5/e, Prentice Hall of India, 2005.
2. Panneer Selvam R, "Production and Operations Management," 2/e, PHI Learning Pvt. Ltd., New Delhi, 2006.
3. S.D. Sharma, "Operations Research", Kedarnath, Ramnath & Co., Meerut,2009
4. S.N. Chary, "Production and Operations Management", 3/e, Tata McGraw Hill, 2006.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PE C12

TOOL ENGINEERING

Instruction	3 Lecture + 1 Tutorial Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Objectives:

Students will understand

1. Various tool materials available including new materials like plastics
2. How to design simple tools independently as required by the industry like single point cutting tool, milling cutter, form tool and broaching tool
3. Design principles related to common tools used in manufacturing practices like drilling, reaming and tapping
4. The fundamentals of Tool Design that apply to different areas of sheet metal forming like blanking, drawing , plastics and mould design etc.
5. The fundamental concepts of Jigs and fixtures along with design principles

Outcomes:

At the end of the course, the students will be able to

1. Understand the importance of cutting tool materials
2. Design simple tools independently like single point cutting tool, milling cutter, form tool and broaching tool
3. Suggest appropriate tool geometry, tool material for manufacturing process like drilling, reaming and tapping
4. Design the tools for various operations like blanking, piercing, drawing and forging, mould design etc.
5. Design jigs and fixtures based on requirements.

Unit-I

Introduction to Tool Engineering: Role and importance of tool engineering in industries, tool engineering functions, duties of a tool engineer.

Tools : Types, classification, features and applications, Properties of Cutting tool materials, types of cutting tool material – Major constituents , relative characteristics and their applications, ISO classification and coding of carbide tools, coated tools, modern cutting tool materials and their applications, Introduction to plastics, their properties and commonly used plastics as tooling materials and their applications.

Unit-II

Design of Tools: Design of single point cutting tools, Design of flat and circular form tools, Design elements of a milling cutter, types of milling cutters, forces and power estimation, , Design of milling cutters.

Introduction to Broaching Operation: Types of broaches - pull, push broach, geometry of broach, and design of broaching tool and manufacturing of broaches.

Unit-III

Twist Drill Geometry: Design and manufacturing of twist drill, effect of variation of angles on torque and thrust forces and sharpening of twist drills.

Reamers: Types of reamers, geometry of a reamer, reaming allowance, tolerance disposition, design and manufacture of reamers

Taps and Dies: Types, geometry, calculation of tapping drill diameters, design and manufacturing of taps and dies.

Unit-IV

Introduction to Press Tools and Various Sheet Metal Forming Operations: Design of die set for blanking and piercing operations, design of bending dies, design of die set for deep drawing operation, design of die set for forging operation, design of dies for metal spinning operation.

Fundamentals of Plastic Products and Mould Design: Plastics product design – Concepts, Essential factors and Principles.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Injection Mould Design- Mould design concepts, mould elements, parting line and parting surface, mould alignment, Feed system- Sprue, runner, gate & position of gate - runner ,
Blow Mould Design - Types of blow moulds - extrusion - injection and stretch blow moulds ,blow ratio - parison design - pinch off design - parting line.
Extrusion Die Design- Principles of Extrusion- Die Geometry – Die swell. Introduction to mould flow software, performing simulations.

Unit-V
Jigs & Fixtures: Design principles and construction features, locating methods associated with flat, cylindrical, internal and external surfaces, type of locating pins, requirements and choice of locating systems, redundant location, fool proofing, setting blocks, types of clamping devices and their basic elements, quick action clamps and nuts, equalizing and multiple clamping pneumatics, hydraulic, magnetic, electrical and vacuum clamping, types of drill jigs and their classification, drilling bushings, indexing jigs, design of fixtures for turning, grinding, welding and milling, economic analysis of jigs and fixtures.

Text Books:

1. Cyril Donaldson, George H. LeCain, V. C. Goold and Joyjeet Ghose, "Tool Design", 4/e, Tata McGraw Hill Education Private Limited, New Delhi, 2012.
2. David Spitler, Jeff Lantrip, John Nee and David A. Smith, "Fundamentals of Tool Design", 5/e, Society of Manufacturing Engineers, 2003.

Suggested Reading:

1. P. C. Sharma, "A Textbook of Machine Tools and Tool Design", S.Chand (G/L) & Company Ltd, 2005.
2. Amitabha Battacharya and Inyong Ham, "Design of Cutting Tools Use of Metal Cutting Theory", ASTME Pub., Michigan, USA.
3. Surender Keshav & Umesh Chandra, "Production Engineering Design (Tool Design)", Satya Prakashan, New Delhi-1994.

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E10

RENEWABLE ENERGY SOURCES (Professional Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn the

1. Need and importance of non-conventional energy resources
2. Extent of solar energy which can be utilized as energy resource
3. Concept of wind energy and its merits and demerits
4. Operating principles of geothermal energy and bio-energy
5. Merits and demerits of tidal energy, wave energy and OTEC

Outcomes: At the end of the course, the students are able to

1. Understand the depletion and of environmental impact conventional sources of energy and will suggest suitable renewable energies in place of conventional energies
2. Determine the principles of absorption
3. Understand the problems associated with utilizing the wind energy
4. Describe the physics of geothermal resources and describe how biomass is currently used as a source of energy
5. Explain the physical principles of wave energy, tides and the environmental impact of OTEC plants

UNIT-I

Energy Sources: Statistics on conventional energy sources and supply in developing countries - Definition-Concepts of RES - Limitations of RES - Classification of RES-Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources - comparison of these energy sources.

UNIT-II

Solar Energy: Solar Radiation – Solar Thermal Collectors – Flat Plate and Concentrating Collectors and their limitations – Comparison - Solar Applications- Solar thermal power plant – Space based solar power – advantages and limitations of solar thermal energy – PV cells - PV materials - solar satellite system-advantages and disadvantages

UNIT-III

Wind Energy: Merits and demerits-Wind power plant-site selection - Power formula – Bett's limit – Effect of velocity on power generation - classification of wind power plants- Horizontal axis and vertical axis windmills - Working principle - New developments.

UNIT-IV

Geothermal Energy: Layers in earth-Classification of resources of Geothermal Energy – working principle.

Biomass Energy: Biomass-Raw materials-Source, Composition, Conversion technologies – Direct combustion-Pyrolysis—Gasification, Biomass gasifiers –float and fixed dome types-Common operational problems, causes and remedies relating to a biogas plant-Economical, social, environmental and health benefits of bio gas utilization

UNIT V

Wave, Tidal and OTEC Energy: Difference between tidal and wave power generation-Tidal power plant – principle of Operation-single basin and double basin tidal plants- advantages and limitations, OTEC power plants- Open and closed OTEC Cycles- advantages and limitations -Environmental impacts of OTEC.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. S. Hasan Saeed and D.K. Sharma, "Non Conventional Energy Resources", S.K. Kataria & Sons, New Delhi, 2014.
2. Dr. R.K. Singal, "Non Conventional Energy Resources", S.K. Kataria & Sons, New Delhi, 2005.
3. G.D. Rai, "Non Conventional Energy Sources", Khanna Publishers, New Delhi, 2011.

Suggested Reading:

1. Mittal K M, "Non-Conventional Energy Systems", Wheeler Publishing Co. Ltd, New Delhi, 2003.
2. Shali Habibulla, "Non-Conventional Energy Sources", State Institute of Vocational Education, Hyderabad, 2005.
3. Ashok V Desai, "Non-Conventional Energy", Wiley Eastern Ltd, New Delhi, 2003.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E11

ENERGY CONSERVATION, MANAGEMENT AND AUDIT (Professional Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To make the students to know the importance of energy sector in country's development
2. To identify various auditing services
3. To prepare the organizational structure energy policy
4. To get the concept of management in process industries
5. To explain how to take tax considerations

Outcomes: Students will be able to

1. Know energy scenario both India and world
2. Review and asses the various audit tools
3. Understand energy policy planning and take energy management as a profession
4. Analyze energy security, codes, standards,
5. Arrange the financial arrangements for industries

UNIT-I

Global & Indian Energy Scenario: Basics of Energy and its various forms - Classification of Energy sources- Applications of Non - Conventional and Renewable Energy Sources - Energy needs of growing economy- Energy sector reform, Energy and Environment: Global Environmental Concerns

UNIT-II

Energy Audit: Material and Energy Balance - Energy Action Planning - Energy Monitoring and Targeting - Types of energy audit, Energy Auditing Services Basic Components of an Energy Audit Specialized Audit Tools Industrial Audits Commercial Audits Residential Audits Indoor Air Quality

Energy Management: Program Organizational Structure Energy Policy Planning Audit Planning Educational Planning Strategic Planning, The Value of Energy Management The Energy Management Profession Some Suggested Principles of Energy Management, Energy Management Systems Justification of EMCSs Systems Integration

UNIT-III

Energy Efficiency in Thermal Utilities - Fuels and Combustion - Boilers -Steam System - Furnaces - Insulation and Refractory - FBC Boilers -Cogeneration -Waste heat recovery- Compressed Air System. - Diesel Generating System

Energy Efficiency in Electrical Utilities - Electrical Systems -Electric Motors - Lighting System - Energy Efficient Technologies in Electrical Systems

Energy Performance Assessment for Equipment and Utility systems - Turbines (Gas, Steam) - Heat Exchangers - Fans and Blowers - Pumps and Pumping System- Water Pumps - Compressors. HVAC Systems - Refrigeration System. - Cooling Tower

UNIT-IV

Waste Heat Recovery: Waste Minimization and Resource Conservation - Energy Management in Process Industries, Energy Security, Codes, Standards, Electricity Act, Energy Conservation Act. Economics of Waste-Heat Recovery, Energy management in water and waste water treatment – solid waste treatment- air pollution control systems . Energy Management in Boilers and Fired systems – Steam and condensate systems – cogeneration –

UNIT-V

Performing Financial Analysis: Introduction General Characteristics of Capital Investments Sources of Funds Tax Considerations Time Value of Money Concepts Project Measures of Worth Economic Analysis-Financing Energy Management Projects Introduction Financial Arrangements: A Simple Example Financial Arrangements: Details and Terminology Applying Financial Arrangements: A Case Study "Pros" & "Cons"

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. CB Smith, "Energy Management Principles", Pergamon Press.. New York, 1981
2. W R Murphy, G McKay, "Energy Management", Butterworth Heinemann, 2007.
3. "Energy Management Handbook", W.C. Turner, 5/e, Marcel Dekker, Inc, New York, 2005.
4. "Guide to Energy Management, B. L. Capehart", W. C. Turner, W. J. Kennedy, CRC Press, New York, 2005.

Suggested Reading:

1. Trivedi, PR, Jolka KR, "Energy Managemnent", Con Lin_onwealth Publication, Nei...Cell'1i, 1997
2. Witte, Larry C, "Industrial Energy Management & Utilization", Hemisphere Publishers, Washington, 1988.
3. Diamant, RME, "Total Energy", Pergamon, Oxford, 1970.
4. Guide book for National Certification Examination for Energy Managers and Energy Auditors, Bureau of energy efficiencies, 2005.
5. Han ides, "Energy Auditing and Conservation; Methods Measurements, Management & Case study," Hemisphere, Washington, 1980.
6. "General Aspects of Energy Management and Audit", National Productivity Council of India, Chennai (Course Material- National Certification Examination for Energy Management)

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E12

ENGINEERING RESEARCH METHODOLOGY (Professional Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design
4. To equip the students with good methods to analyze the collected data
5. To explain how to interpret the results and report writing

Outcomes: At the end of the course, the students are able to

1. Define research problem
2. Review and asses the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Improve the style and format of writing a report for technical paper/ Journal report

UNIT – I:

Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT–II

Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT – III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT – IV

Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT – V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Text Books:

1. C.R Kothari, "Research Methodology Methods & Technique", New Age International Publishers, 2004.
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011

Suggested Reading:

1. Vijay Upagade and Aravind Shende, "Research Methodology", S. Chand & Company Ltd., New Delhi, 2009.
2. G. Nageswara Rao, "Research Methodology and Quantitative methods", BS Publications, Hyderabad, 2012.
3. Naval Bajjai, "Business Research Methods", Pearson, 2011.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E14

FINITE ELEMENT METHODS (Professional Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
1. Equip the students with the Finite Element Analysis fundamentals and formulations
2. Enable the students to formulate the axial, truss and beam problems
3. Enable the students to formulate 2D problems with special cases
4. Enable the students to formulate quadrilateral element, use of numerical integration, Gaussian quadrature and one dimensional dynamic problems
5. Enable the students to understand the convergence requirements, heat transfer , formulate 3D problems and perform engineering simulations using Finite Element Analysis software (ANSYS)

Outcomes: At the end of the course a student will be able to
1. Apply FE method for solving field problems using Virtual work and Potential energy formulations
2. Analyze linear problems like axial, trusses and beam problems
3. Analyze 2D structural problems using CST element and analyze plane stress, plane strain and axi-symmetric problems with triangular elements.
4. Write shape functions for 4 node quadrilateral isoparametric elements, apply numerical integration, Gaussian quadrature and to estimate natural frequencies for stepped bar
5. Check for convergence requirements, Solve linear 1D and 2D heat conduction and convection heat transfer problems, formulate 3D elements, apply finite element analysis software for engineering solutions

UNIT - I

Fundamental Concepts: Introduction to finite element method, stresses and equilibrium, boundary conditions, strain – displacement and stress – strain relationship

One Dimensional Problem: Different co-ordinate systems and shape functions, virtual work and potential energy approach, Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, analysis of axial element and quadratic element

UNIT - II

Analysis of Trusses: Element stiffness matrix for a truss member, Analysis of plane truss with two degrees of freedom at each node

Analysis of Beams: element stiffness matrix for two nodes (two degrees of freedom per node),

Analysis of Frames: Analysis of frames with two translations and rotational degrees of freedom per node

UNIT - III

2D Triangular Elements: plane stress, plane strain and axisymmetry, finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions, Finite element modeling of axisymmetric solids subjected to axisymmetric loading with triangular elements

UNIT - IV

Quadrilateral Elements and Numerical Integration: Two dimensional four noded isoparametric elements, numerical integration and Gauss quadrature

Dynamic Analysis: Formulation of finite element model, element mass matrices, Evaluation of Eigen values and Eigen vectors for a stepped bar

UNIT - V

Heat Transfer Analysis: Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional analysis of thin plate

3 D Elements and FEA Software: Introduction to finite element formulation of three dimensional problems in stress analysis, convergence requirements

Introduction to Finite Element Analysis Software: Modeling, analysis and post processing

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. Ramamurthy, G., "Applied Finite Element Analysis", I.K. International Publishing House Pvt. Ltd., New Delhi, 2009.
2. Tirupathi R., Chandraputla and Ashok D. Belagundu, "Introduction to Finite Elements in Engineering", Practice Hall of India, 1997.
3. Daryl L. Logan, "A First Course in the Finite Element Method", Cengage Learning, 2011.

Suggested Reading:

1. Rao S. S., "The Finite Element Method in Engineering", Pergamon Press, 1989.
2. Segerlind L. J., "Applied Finite Element Analysis", Wiley Eastern, 1984.
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt., "Concepts and Applications of Finite Element Analysis", 4th Edition. Wiley

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME C36

METROLOGY AND INSTRUMENTATION LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Objectives:

1. To choose the proper measuring instrument for the precise measurement of Length, Height and diameter
2. To select the proper measuring instrument for the angular measurement.
3. To indentify gear & screw thread parameters using optical projector and tool makers microscope.
4. To familiarize with limits, fits and tolerances for gauge selection and design.
5. To understand the working principles in the measurement of Flatness, Roundness and Surface roughness.

Outcomes: At the end of the course, the students were able to

1. Identify methods and devices for measurement of length, height and diameter.
2. Acquire the knowledge about angular measurement and various measuring instruments.
3. Recognize & measure the gear and screw thread parameters using profile projector and tool maker microscope.
4. Demonstrate the sound knowledge in gauges selection, design and measurement.
5. Acquire adequate knowledge in the measurement of flatness, roundness and surface roughness.

Experiments:

1. Measurement with inside, outside and depth micrometers.
2. Measurement with height gauges, height masters.
3. Measurement of Linear and Angular dimensions with Tool Maker's Microscope – Diameter of thin wire and single point cutting tool angle.
4. Measurement with Dial Indicator and its calibration.
5. Measurement of angles with Sine bar and clinometers.
6. Measurement of roundness errors with bench centers.
7. Measurement of flatness errors of a surface plate with precision spirit level.
8. Measurement with optical profile projector.
9. Design of Plug gauge for a given hole.
10. Design of Snap gauge for a given shaft.
11. Surface roughness measurement by Taylor Hobson -Talysurf.
12. Measurement of Gear tooth thickness by gear tooth vernier.
13. Displacement measurement with LVDT.

Note: Student should complete a minimum of 10 experiments.

Suggested Reading:

1. IC Gupta, "Engineering Metrology", Dhanpat Rai Pub., New Delhi, 1984.
2. Benakra & K.K. Chaudhary , "Instrumentation Measurement and Analysis", 3/e, McGrawhill, 2014

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PE C13

MANUFACTURING ENGINEERING LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Objectives:
Students will learn

1. Various concepts of Manufacturing Processes and selection of right manufacturing process and materials
2. The concepts of process sheets
3. Various CAD packages
4. The Bill of Materials and MRP concepts
5. Limits, tolerances and fits in manufacturing

Outcomes:
Students able to

1. Apply right manufacturing techniques and choose the right material
2. Operate different machine tools
3. Prepare process sheets and Bill of Material
4. Apply limits, fits and tolerances while manufacturing components
5. Prepare CAD drawings

Part-1: **Manufacturing Mini Product**: Study of all manufacturing facilities available in various manufacturing related laboratories, manufacturing canon.

Part-2: **Manufacturing Major Product:** One/two of the following items have to be manufactured by a group of maximum two members using all the production facilities and processes as far possible and assembly techniques with fits and tolerances using CAD system, various exercises have to be allotted to different groups of students by the lab faculty

1. V block with U clamp
2. Dia test indicator stand
3. Simple Jig
4. Simple fixture
5. Simple die set
6. Simple tail stock mechanism
7. Lathe tool post
8. Milling Machine Arbor
9. Pipe vice
10. Paper Punch (double punch)
11. Hydraulic Cylinder
12. Gear box (Spur, Helical or Worm)

Suggested Reading:

1. P. N. Rao, "Manufacturing Technology – Metal Culling & Machine Tool", Vol. 2, Tata McGraw Hill Education Pvt. Ltd, 2010.
2. Jain K.C., Chitale, A.K., "Production Engineering", 2/e, PHI, 2014.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PE C14

PROJECT SEMINAR

Instruction	3 Hours per week
Duration of Semester End Examination	----
SEE	----
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:

Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E15

POWER PLANT ENGINEERING (Professional Elective – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn

1. Different types of power plants and their site selection criteria
2. Operation of thermal power plant
3. About hydraulic power plants, dams and spillways
4. Different types of nuclear power plants including Pressurized water reactor, Boiling water reactor, Liquid metal fast breeder reactor and Gas cooled reactor
5. The power plant economics, environmental and safety aspects of power plant operation.

Outcomes: At the end of the course, the student will be able to

1. Select the suitability of site for a power plant.
2. Propose ash handling, coal handling method in a thermal power plant
3. Understand the water cycle, flow-sheet of hydro-power plant and types of dams and spillways
4. Explain working principle of different types of nuclear power plant.
5. Know the various factors of plant load and economy and safety aspects of power plants

UNIT - I

Introduction: Power plant, classification of power plants, conventional and non-conventional power plants
Steam power plant: Plant Layout, types of coals, coal handling equipment, Ash and Dust handling systems

UNIT II

Steam Power Plant: Combustion Process - Overfeed and Underfeed stokers-traveling grate stokers, spreader stokers, retort stokers- single retort and multi-Retort - Pulverized fuel burning systems – components – burners – Unit and Bin - working

UNIT III

Hydro Electric Power Plant: Hydrological cycle, flow measurement, Hydrographs – flow/mass duration curve - drainage area characteristics, Types of hydroelectric power plants- working - storage and pondage - classification and working of dams and spill ways.

UNIT - IV

Nuclear Power Plant: Nuclear fuel - breeding and fertile materials - types of reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Gas cooled Reactor-Radioactive waste disposal.

UNIT - V

Power Plant Economics and Environmental Considerations:

Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor - related exercises-Fixed cost and variable cost-methods to find depreciation cost, Effluents from power plants and Impact on environment – pollutants - Pollution control.

Text Books:

1. R.K. Rajput, "A Text Book of Power Plant Engineering", 4/e, Laxmi Publications (P) Ltd., New Delhi, 2015
2. P.K. Nag, "Power Plant Engineering", 4/e, McGraHill Education(India) Private Limited, New Delhi, 2014.
3. S.C. Arora and S. Domukundwar, "A Course in Power Plant Engineering", Dhanpat Rai & Sons, New Delhi, 2005.

Suggested Reading:

1. R. Yadav, "Fundamentals of Power Plant Engineering", Central Publishing House, Allahabad, 2012.
2. R.K. Hegde, "Power Plant Engineering", Pearson Education India, 2015.
3. P.C. Sharma, "A Text Book of Power Plant Engineering", S.K. Kataria & sons, New Delhi, 2016.

16ME E16

PRINCIPLES OF ENTREPRENEURSHIP (Professional Elective - VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand
1. Concept and procedure of idea generation
2. The nature of industry and related opportunities and challenges
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Outcomes: After completing this course, students will be able to:
1. Analyse ideas for new and innovative products or services
2. Identify opportunities and deciding nature of industry
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioral aspects and use time management matrix

UNIT-I

Entrepreneurship: Definition, functions of entrepreneurship, qualities of entrepreneurs, Entrepreneur vs intrapreneur, First generation entrepreneurs, women entrepreneurs, need of innovation in entrepreneurial journey, Conception and evaluation of ideas and their sources,

UNIT-II

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Entrepreneurship and Engineering, Small Scale Industry in India, Objectives, Linkage among small, medium and large scale industries, Types of enterprises, Corporate Social Responsibility

UNIT-III

Formulation of Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary. Selection of Technology, Collaborative interaction for Technology development

UNIT-IV

Project Management: During construction phase, project organization, project planning, execution and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden, environmental issues.

UNIT-V

Behavioral Aspects of Entrepreneurs: Personality, determinants, Maslow's Hierarchy of needs, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", 5/e, Tata Mc Graw Hill Publishing Company Ltd., 2005
2. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster Publication, 1994.
3. G.S. Sudha, "Organizational Behavior", National Publishing House, 1996.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16ME E17

INNOVATIONS, PROTECTION AND LEGAL ASPECTS (Professional Elective - VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will learn
1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture and techno-business aspects of IPR

Outcomes: At the end of the course, a student
1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Will be capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IPR and converting creativity into IPR and effectively protect it.

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Geographical indications: Introduction, definition, difference between GI and trademark, difference between GI and appellation of origin, GI as factors of rural development, developing a geographical indication and protection

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition. Relationship between unfair competition and intellectual property laws.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd , 2006
2. B. L.Wadehra;" Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010

Suggested Reading:

1. Cronish W.R1 "Intellectual Property; Patents, copyright, Trad and Allied rights", Sweet & Maxwell, 1993.
2. P. Narayanan, "Intellectual Property Law", Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, "A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs", 4/e, .Sweet, Maxwell

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PE E11

SUPPLY CHAIN MANAGEMENT (Professional Elective – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand

1. The awareness about transportation and warehouse management systems.
2. The designing supply chain networks.
3. The concept of demand and supply and integrating it with supply chain management.
4. The planning and managing inventories.
5. The pricing and revenue management

Outcomes: At the end of the course, the student is able to

1. Plan an effective transportation and warehouse management systems
2. Design an effective supply chain networks
3. Integrate and optimize demand and supply gaps
4. Apply inventory management techniques
5. Understand and design pricing and revenue management systems

UNIT-I

Concept of SCM: Concept of Logistics Management, Supply Chain, Types of supply chain, functions in SCM, Transportation Management, Warehousing Management, Warehouse management systems.

UNIT-II

Designing the Supply Chain Network: Designing the distribution network, Network Design, Network Design in an uncertain environment.

UNIT-III

Planning and Demand: Planning demand & supply in a supply chain, demand forecasting, aggregate planning, planning supply & demand.

UNIT-IV

Planning & Managing Inventories in a Supply Chain: managing economies of scale, cycle inventory, and managing uncertainty safety inventory optimal level of product availability

UNIT-V

Sourcing, Transporting & Pricing Products: sourcing decisions, transportation, pricing & revenue management. Coordination & technology in the supply chains, coordination in supply chain, information technology and supply chain.

Text Books:

1. N. J. Kumar & Mukesh Bhatia, "Supply Chain Management", Neha publishers & Distributors, 2010.
2. Michael H. Hugos, "Essentials of Supply Chain Management", 3/e, John Wiley & Sons, Inc, Hoboken, New Jersy, 2011.
3. Sunil Chopra & Peter Meindl, "Supply Chain Management – Strategy, Planning and Operation", Pearson Education, Inc., Upper Saddle River, New Jersey, 2003.

Suggested Reading:

1. Martin Christopher, "Logistics & Supply Chain Management", 5/e, Financial Times Series, 2010.
2. Dobler Donald. W, David.N.Burt, "Purchasing & supply Management Text & Cases", McGraw-Hill, 1996.
3. Chitale A.K. Gupta R.C, "Materials Management-Text and Cases", Prentice-Hall Of India Pvt. Limited, 2007.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PE E12

TOTAL QUALITY MANAGEMENT (Professional Elective – VI)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
Student will understand
1. The essence of total quality management in design and manufacturing a product
2. The various principles and concepts of total quality management
3. The various technical tools of quality like control charts and ANOVA etc
4. The quality information system
5. The awareness about measuring and satisfying customer needs

Outcomes:
At the end of the course, the student is able to
1. Apply TQM techniques in engineering applications
2. Use various theories and principles related to TQM
3. Use statistical techniques in TQM
4. Have awareness and use quality information system and innovative systems
5. Deal with customer grievances and satisfying the customers

UNIT-I
Strategic Quality Management: Quality policies, quality goals, obstacle to achieving successful strategic quality management, Organization for quality role of {Top, middle, work force team (Quality Circles)}, Developing a quality work culture, Maslow need theory, Herzberg two factor theory, Theory X, Y & Z methods to create and maintain awareness of quality, provide evidence of management leadership, types of self development and empowerment programmes, methods of participations means of inspiring action, recognition and rewards, Supplier quality rating plans (lot plot plan, OC curve, parent analysis), assignment of supplier capability, methods of evaluating supplier products, contract management (Joint economic plan, joint technological forecasting

UNIT-II
Design for Quality: Basic functional requirements of quality, design for (reliability, safety, cost and product performance), concurrent engineering (DFMA) value engineering, support for quality improvement processes (block diagram, brain storming, cause effect analysis, pareto analysis), quality function deployment, reliability analysis, failure rate, failure pattern of complex products (bath tub curve), weibull distribution relationship between part and the system, exponential reliability, availability, FMEA (Fracture Mode and Effect Analysis), Design for experiments: Factorial experiments, construction fractional designs

UNIT-III
Technical Tools for Quality: Analysis of variance (ANOVA), 4 factor ANOVA experiment, 2 levels, analysis of means, Techniques for online quality: data collection plan, variable and attribute charts, interpreting the control charts, Techniques for offline quality control: background to Taguchi method (quality loss and loss function, controllable factor, and non controllable factors in parameter performance, tolerance design
Taguchi analysis techniques: net variation and contribution ratio, estimation of process performance, accumulating analysis, performance measures, Taguchi tolerance design and tolerance (re) design

UNIT-IV
Quality Information System: Scope of Quality Information System, differences between QIS and MIS, creating new software (steps, types, defects) reports on quality (operational and executive reports), features of QIS software, software for inspection
Inspection System: Operational sorting and correlation sorting, AQL, LTPD, AOQL, Nondestructive test, Audit systems: (quality improvement planning and implementation, describing quality function, process control system, control of measurement system, material identification and control, drawing and specification control, process corrective action), the concept of POKAYOKE

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-V

Measure of Customer Needs: The need to measure customer satisfaction, importance of proper packaging, customer processing and installation of product, dealing with customer complaints, using weibull analysis, field feedback, parameter to measure customer (dis)satisfaction, problems with the customer satisfaction system

Beyond TQM: Difficulties in implementing TQM system, rating your quality system, JIT system, the people side of TQM system, system integration, Kansei engineering and flexibility in manufacturing

Text Books:

1. L. Suganthi, Aanand A. Samuel, "Total Quality Management", PHI Learning Pvt. Ltd., 2004.
2. H.G. Menon, "TQM in view Production Manufacturing", McGraw Hill Publishers

Suggested Reading:

1. Joel E. Ross & Susan Perry, "Total Quality Management: Text, Cases, and Readings", 3/e, CRC Press, 1999
2. John S Oakland, "Total Quality Management: The route to improving performance", A Butterworth-Heinemann Title, 2/e, 1994
3. Jankiraman, "Total Quality Management: Text and Cases", PHI Learning Private Limited-New Delhi; 1 edition (2006)

Reddy

PROFESSOR & HEAD

Department of Mechanical Engineering

Chaitanya Bharathi Institute of Technology (A)

Gandipet, Hyderabad-500 075. Telangana

16CE O02

DISASTER MITIGATION AND MANAGEMENT (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Outcomes: At the end of the course the students are able to

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT- I:
Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT- II:
Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT- III:
Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT- IV:
Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and

Rreddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

national disaster trends; climate change and urban disasters.

UNIT- V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh,"Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs, "Government of India, "National disaster management plan, Part I and II"
2. K. K. Ghosh,"Disaster Management", APH Publishing Corporation, 2006.
3. "Hazards, Disasters and your community: A booklet for students and the community", Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16IT O02

PRINCIPLES OF INTERNET OF THINGS (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To provide an overview of Internet of Things, building blocks of IoT and real-world applications.
2. To explore various IOT enabling technologies.
3. To facilitate students, understand Python scripts for IoT platform.
4. To identify steps in IOT design Methodology.
5. To introduce about the Raspberry Pi device, its interfaces and Django Framework.

Outcomes:

Upon completing this course, students will be able to:

1. Comprehend the terminology, protocols and communication models of IoT.
2. Define the various IoT enabling technologies and differentiate between M2M and IoT.
3. Acquire the basics of Python Scripting Language used in developing IoT applications.
4. Describe the steps involved in IoT system design methodology.
5. Design simple IoT systems using Raspberry Pi board and interfacing sensors with Raspberry Pi.

UNIT-I

Introduction & Concepts: Introduction to Internet of Things- Definitions & Characteristics ofIoT, Physical Design of IOT-Physical Layer, Network Layer, Transport Layer, Application Layer, Things in IoT, IoT Protocols, Logical Design of IOT-IoTFunctional Blocks, IoT Communication Models-Request-reponse,Publisher-Subscriber,Push-Pull,Exclusive Pair, IoT Communication APIs-REST API, Websocket API.

UNIT-II

IOT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IOT Levels & Deployment Templates. Differences and similarities between IOT and M2M, Domain Specific IoT's – IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

UNIT-III

Introduction to Python–Motivation for using Python for designing IoT systems, Language features of Python, Data types- Numbers, Strings, Lists, Tuples, Dictionaries, Type Conversions, Data Structures: Control of flow- if, for, while, range, break/continue, pass, functions, modules, packaging, file handling, data/time operations, classes, Exception handling.

UNIT-IV

IoT Platforms Design Methodology: Introduction, IoT Design Methodology Steps-Purpose and Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specifications, IoT Level Specification, Functional View Specification, Operational View Specification, Device and Component Integration, Application Development, Case Study on IoT System for Weather Monitoring.

UNIT-V

IoT Physical Devices and End Points: Basic building blocks of an IoT device, Raspberry Pi about the Raspberry Pi board, Raspberry Pi interfaces-Serial, SPI, I2C, Other IoT Devices pcDuino, BeagleBone Black, Cubieboard. Python Web Application Framework: Django Framework-Roles of Model, Template andView

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach, Universities Press, 2015.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Willy Publications.

Web Resources:

1. The Internet of Things - Article
https://dl.acm.org/citation.cfm?id=1862541
2. Internet of Things - Tutorial
http://archive.eurescom.eu/~pub/about-eurescoiem/message_2009_02/Eurescom_message_02_2009.pdf
3. Publications on The Internet of Things.
http://www.itu.int/osg/spu/publications/internetofthings/InternetofThings_summary.pdf

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16EE O03

ENERGY AUDITING (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To know the concept of Energy auditing
2. To understand the formulation of efficiency for various engineering systems
3. To explore the different ways to design various technologies for efficient engineering systems.

Outcomes: After completion of this course, students will be able to:

1. Know the current energy scenario and importance of energy auditing.
2. Understand the concepts of energy auditing.
3. Evaluate the performance of existing engineering systems
4. Explore the methods of improving energy efficiency in different engineering systems
5. Design different energy efficient devices.

UNIT-I

Basics of Energy and its Various Forms: Overview of engineering, elements Solar energy, electricity generation methods using solar energy, PV cell, elements of wind energy, electricity generation using wind energy, elements of bio energy, bio mass energy conservation, elements of geothermal energy, sources of geothermal energy, sources of chemical energy, fuel cells, Energy Scenario in India

UNIT-II

Energy Auditing-1: Introduction: Need for energy audit, directions for the study of energy auditing, inclusions for energy auditing, types of energy audit: preliminary audit, general/mini audit, investment-grade/ comprehensive audit. Major energy consuming equipments and systems, energy audit team, energy auditing methodology: preliminary and detailed. Process flow diagram, energy audit report format

UNIT-III

Energy Auditing-2: For Buildings: Energy auditing instruments, energy efficiency, energy auditing for buildings: stages in programs, surveying, measurements and model analysis. Energy audit form of commercial buildings, checklist for energy saving measures

UNIT –IV

Energy Efficient Technologies-I: Importance of energy efficiency for engineers, Energy efficient technology in mechanical engineering: Heating, ventilation and air-conditioning, boiler and steam distribution systems Energy efficient technology in civil engineering: future of roads, harnessing road and transport infrastructure;

UNIT-V

Energy Efficient Technologies-II: Energy efficient technology in electrical engineering: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors; Energy efficient technology in chemical engineering: green chemistry, low carbon cements, recycling paper

Text Books:

1. Umesh Rathore, 'energy management', Kataria publications, 2nd ediiton, 2014.
2. Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects
3. Hargroves, K., Gockowiak, K., Wilson, K., Lawry, N., and Desha, C. (2014) An Overview of Energy Efficiency Opportunities in Mechanical/civil/electrical/chemical Engineering, The University of Adelaide and Queensland University of Technology.

Suggested reading:

1. Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org)

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16EC O07

SYSTEM AUTOMATION AND CONTROL (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: This course aims to
1. Learn the concepts industrial control systems
2. Learn how to measure the physical parameters in industry
3. Learn the applications of Robots in industry.

Outcomes: After completion of this course, students will be able to:
1. Understand various process control systems.
2. Measure the physical parameters in the industry.
3. Design PID controllers
4. Understand the role of digital computers in automation
5. Understand the applications of Robots.

UNIT-I

Introduction to Automatic Control Systems: Purpose of Automatic Control, How an Industrial Control System is implemented, Introduction to Automatic Control theory.
Sensors: Motion, Position, Force, Level sensors and Thermo couples.

UNIT-II

Theory of Measurements: Measurement goals and concepts, Scale factor, Linearity, accuracy, Range, Resolution, Precision and repeatability.
Measurement Techniques and Hardware: Typical Sensor outputs, Bridgemeasurements, Resistance balanced Wheatstone bridge, Variable voltage type measurements, Frequency type measurements.

UNIT-III

Process Controllers: What is a Controller, uses of Controllers, Open loop and closed loop Control, proportional, PD, PI, PID Controllers, Analog and Digital methods of Control.
Controller Hardware: Analog and Digital Controllers.

UNIT-IV

Digital Computers as Process Controllers: Use by Digital Computer for process control, Information required by the computer, Information required by the process, Computer Interface electronics, Digital Computer input-output, computer processing of data, Digital Process control computer design, Computer programming.
Actuators: Electro mechanical - Linear motion and rotary motion solenoids, DC motors, AC motors and Stepped motors.

UNIT-V

Robots: What are robots, Robots and process Control systems, Degrees of freedom, factories of the future, Delivery, Disposal and transport systems, Sensing elements, Robot Classifications and Applications.
Trouble shooting System failures: Preliminary stepsand other troubleshooting aids.

Text Books:
1. Ronald P. Hunter, "Automated process control systems – concepts and Hardware", 2/e, PHI, 1987.
2. Norman A. Anderson, "Instrumentation for process measurement and Control", 3/e, CRC Press, 2005.

Suggested reading:
1. Kuo BC, "Automatic Control Systems", 9/e
2. AK Sawhney, "A course on Electrical and Electronic Measurements and Instrumentation".

Rreddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16CS O09

BASICS OF ARTIFICIAL INTELLIGENCE (Open Elective – I)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: The objectives of this course are
1. Provide a strong foundation of fundamental concepts in Artificial Intelligence.
2. Discuss the various paradigms involved in solving an AI problems which involve perception, reasoning and learning
3. Apply the AI concepts to build an expert system to solve the real-world problems.

Outcomes: On Successful completion of this course, student will be able to
1. Differentiate between a rudimentary Problem and an AI problem, it's Characteristics and problem-solving Techniques.
2. Compare and contrast the various knowledge representation schemes of AI.
3. Understand and analyze the various reasoning and planning techniques involved in solving AI problems.
4. Understand the different learning techniques.
5. Apply the AI techniques to solve the real-world problems.

UNIT - I

Introduction: Definition, history, applications.
Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Constraint Satisfaction.

UNIT - II

Knowledge Representation (Logic): Representing facts in logic, proposition logic, predicate logic, resolution and unification.
Knowledge Representation (Structured): Declarative representation, Semantic nets, procedural representation, frames.

UNIT - III

Reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory.
Planning: Components, goal stack planning, nonlinear planning, hierarchical planning.

UNIT - IV

Learning: Introduction, Rote learning, learning by taking advice, learning in problem solving and learning from examples: Decision tree.
Intelligent Agents: Classification, Working of an agent, single agent and multi agent systems, multi agent application.

UNIT - V

Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition.
Perception and Action: Real Time Search, Vision, Speech Recognition, **Action:** Navigation, Manipulation, Robot architectures.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, "Artificial Intelligence", 3/E, 2008
2. Russell Norvig, "Artificial Intelligence-Modern Approach", 3/E, 2010.

Suggested Reading:

1. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2012.
2. Nelson M. Mattos, "An Approach to Knowledge Base Management", Springer Berlin Heidelberg, 1991.

Online Resources / Weblinks / NPTEL Courses:

1. http://nptel.ac.in/courses/106106126/
2. http://nptel.ac.in/courses/106105077/

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16IT O01

OBJECT ORIENTED PROGRAMMING USING JAVA (Open Elective – II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To familiarize with fundamentals of object-oriented programming paradigm.
2. To impart the knowledge of string handling, interfaces, packages and inner classes.
3. To facilitate learning Exception handling and Multithreading mechanisms.
4. To gain knowledge on collection framework, stream classes.
5. To familiarize with event driven GUI programming and Database connectivity.

Outcomes:

Upon completing this course, students will be able to

1. Understand Object-Oriented concepts.
2. Create Java applications using sound OOP practices e.g. Inheritance, Interfaces, Packages, and Inner classes.
3. Implement Exception Handling and Multithreading concepts in java programs.
4. Develop programs using the Java Collection API and Stream classes.
5. Design and Develop GUI applications with the integration of eventhandling, JDBC.

UNIT-I

OOP concepts - Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object oriented programming paradigms.

Introduction to Java: Java's Magic: The Byte code, The Java Buzzwords, Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

UNIT-II

Inheritance: super and subclasses , Member access rules ,super keyword, Method overriding, Dynamic method dispatch , Abstract classes, using final with inheritance , Introduction to Object class.

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Interfaces : Defining and implementing interfaces, Nested Interfaces.

Strings Handling: String & StringBuffer classes, StringTokenizer class and Wrapper classes and conversion between Objects and primitives.

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous inner classes.

UNIT-III

Exception Handling in Java: what are Exceptions? Exception types, Usage of try, catch, throw, throws and finally clauses, writing your own exception classes.

Multithreading in Java: The java Thread Model, How to create threads, Thread class in java, Thread priorities, Thread synchronization.

Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

UNIT-IV

Collections Framework: Overview of Collection Framework, Commonly used Collection classes – ArrayList, LinkedList, HashSet, LinkedHashSet, TreeSet, Collection Interfaces –Collection, List, Set, SortedSet, Accessing a collection via an Iteration,Storing user-defined classes in collections, Map Interfaces and Classes, Using a comparator. Legacy classes – Vector, Hashtable, The Enumeration interface.

Input/Output : How to read user input (from keyboard) using scanner class,Stream classes, InputStream, OutputStream, FileInputStream, FileOutputStream, Reader and Writer, FileReader, FileWriter cl asses. File class.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-V

GUI Design and Event Handling: Component, Container, window, Frame classes. Working with Frame window GUI Controls, Layout Managers, Introduction to Swings, Delegation Event Model, Event Classes, Source of Events, Event Listener Interfaces, Handling button click events, Adapter classes. Writing GUI Based applications.

Database Handling in Java: Java Database Connectivity (JDBC) using MySQL.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 8/e, Tata McGraw Hill Publications, 2011.
2. Cay S. Horstmann, Gary Cornell, "Core Java, Volume I, Fundamentals", 8/e, Prentice Hall, 2008.

Suggested Reading:

1. Sachin Malhotra & Saurabh Choudhary, "Programming in Java", 2/e, Oxford University Press, 2014.
2. C. Thomas Wu, "An introduction to Object-oriented programming with Java", 4/e, Tata McGraw-Hill Publishing company Ltd., 2010.
3. Kathy Sierra, Bert Bates, "Head First Java: A Brain-Friendly Guide" 2/e, O'Reilly, 2005

Web Resources:

1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-092-introduction-to-programming-in-java-january-iap-2010/lecture-notes/

PReddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PY O01

HISTORY OF SCIENCE AND TECHNOLOGY (Open Elective – II)

Instruction	3	Hours per week
Duration of Semester End Examination	3	Hours
SEE	70	Marks
CIE	30	Marks
Credits	3	

Objectives:

1. To enable students to understand science as a socio-cultural product in specific socio-historical contexts.
2. To expose students to philosophical, historical and sociological perspectives to look atscience as a practice deeply embedded in culture and society.
3. To inculcate the scientific culture and ethics in the development of technologies.

Outcomes:

1. Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures.
2. Recognize the values of a wide range of methodologies, conceptual approaches and the impact of competing narratives within the history of science, technology.
3. Identify, locate and analyze relevant primary and secondary sources in order to construct evidence-based arguments.
4. Think independently and critically, using appropriate methodologies and technologies to engage with problems in the history of science, technology.
5. Demonstrate academic rigor and sensitivity to cultural and other diversity, and understanding of the ethical implications of historical and scientific enquiry within a global context.

UNIT- I

Science - The Beginning (through 599 BC): The Stone Ages, Knowledge among hunter gatherers, Agricultural Revolution and other revolutions,Civilization,Major advances.

Science in Antiquity (600 BC - 529 AD): Philosophy, a precursor to science, Hellenistic world and the Roman Empire, Other cultures of the period, major advances.

UNIT- II

Medieval Science (530 AD - 1452 AD): The decline of science in Europe , Science in China, Science and mathematics in India, Arab science, revival of science in Europe, technology revolution of the Middle ages, Major advances.

The Renaissance and the Scientific Revolution (1453 AD – 1659 AD): Renaissance, Scientific Revolution, Technology, Major advances.

UNIT- III

Scientific Method: Measurement and Communication (1660 AD – 1734): European domination, The scientific method, Major advances.

The Industrial Revolution (1735 AD – 1819 AD): Industrial Revolution, Rise of the engineer, Major Advances.

UNIT- IV

Science and Technology in the 19th Century (1820 AD – 1894 AD): philosophical basis of 19th-century science, Science and the public, Science and technology, Major advances.

Rise of Modern Science and Technology (1895 AD – 1945 AD): The growth of 20thcentury science, Newphilosophies, Quantum reality, Energy sources, Electricity: a revolution intechnology, Majoradvances.

UNIT- V

Big Science and the Post-Industrial Society (1946 AD – 1972 AD): Big science, Specialization and changing categories, Technology changes society, Major advances.

The Information Age (1973 AD – 2015 AD): Information and society, Globalization, The post-industrial society,Problems of the Information age, Major Advances

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. Bryan Bunch and Alexander Hellemans, "The History of Science and Technology", Houghton Mifflin Company (New York), 2004
2. JD Bernal, "Science in History", 4 Volumes, Eklavya Publishers, 2012

Suggested Readings:

1. "The 100 Most Influential Scientists of All Time", Edited by Kara Rogers, Britannica Educational Publishing, 2010
2. Alberto Hernandez, "A Visual History of Science and Technology", The Rosen Publishing Group, 2016

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16EE O05

WASTE MANAGEMENT (Open Elective – II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
1. To imbibe the concept of effective utilization of any scrap
2. To Become familiar with the processes of all disciplines of engineering.
3. To learn the technique of connectivity from waste to utility.

Outcomes:
After completion of this course, students will be able to
1. Understand the various processes involved in allied disciplines of engineering
2. Infer the regulations of governance in managing the waste
3. Distinguish the nature of waste materials concerned to the particular branch of engineering
4. Explore the ways and means of disposal of waste material
5. Identify the remedies for the disposal of a selected hazardous waste material

UNIT-I
Introduction to Waste Management: Relevant Regulations Municipal solid waste (management and handling) rules; hazardous waste (management and handling) rules; biomedical waste handling rules; fly ash rules; recycled plastics usage rules; batteries (management and handling) rules. Municipal Solid Waste Management – Fundamentals Sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options.

UNIT-II
Hazardous Waste Management : Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects, Radioactive Waste Management – Fundamentals Sources; measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.

UNI-III
Environmental Risk Assessment: Defining risk and environmental risk; methods of risk assessment; case studies, Physicochemical Treatment of Solid and Hazardous Waste Chemical treatment processes for MSW (combustion, stabilization and solidification of hazardous wastes); physicochemical processes for hazardous wastes (soil vapor extraction, air stripping, chemical oxidation); ground water contamination and remediation

UNIT-IV
Biological Treatment: Solid and Hazardous Waste Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation.

UNIT-V
Landfill design aspects: Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration

Text Books:
1. John Pichtel, "Waste Management Practices", CRC Press, Taylor and Francis Group 2005.
2. LaGrega, M.D.Buckingham, P.L. and Evans, J.C., "Hazardous Waste Management", McGraw Hill International Editions, New York, 1994
3. Richard J. Watts, "Hazardous Wastes - Sources, Pathways, Receptors", John Wiley and Sons, New York, 1997

Suggested Reading:
1. Kanti L.Shah, "Basics of Solid and Hazardous Waste Management Technology", Prentice Hall, 1999.
2. S.C.Bhatia, "Solid and Hazardous Waste Management", Atlantic Publishers & Dist, 2007

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16EC O05

MEMS AND ITS APPLICATIONS (Open Elective – II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:
This course aims to:
1. Provide knowledge of semiconductors, various materials used for MEMS.
2. Introduce various Electrostatic and Thermal Sensors and Actuators.
3. Educate on the applications of MEMS to various disciplines.

Outcomes:
Upon completion of this course, students will be able to:
1. Select various materials used for MEMS.
2. Design the micro devices and systems using the MEMS fabrication process.
3. Understand the operation of different Sensors and Actuators.
4. Design the micro devices and systems using Polymer MEMs.
5. Apply different MEMS devices in various disciplines.

UNIT- I
Introduction: The History of MEMS Development, The Intrinsic Characteristics of MEMS: Miniaturization, Microelectronics Integration, Parallel Fabrication with Precision, Devices: Sensors and Actuators- Energy Domains and Transducers, Sensors Considerations, Sensor Noise and Design Complexity: Actuators Considerations.

UNIT- II
Introduction to Micro Fabrication: Overview of Micro fabrication, Overview of Frequently used Micro fabrication Processes: Photolithography, Thin Film Decomposition, Thermal Oxidation of Silicon, Wet Etching, Silicon Anisotropic Etching, Plasma Etching and Reactive Etching, Doping, Wafer Dicing, Wafer Bonding, Microelectronics Fabrication Process Flow, Silicon based MEMS Processes, Packaging and Integration, Process Selection and Design.

UNIT- III
Electrostatic Sensing and Actuation: Introduction to Electrostatic Sensors and Actuators, Parallel: Plate Capacitor, Applications of Parallel Plate Capacitors, Interdigitated Finger Capacitors, Applications of Combo-Drive Devices: Inertia Sensors, Actuators.
Thermal Sensing and Actuation: Introduction to Thermal Sensors, Thermal Actuators, Fundamentals of Thermal Transfer, Sensors and Actuators Based on Thermal Expansion, Thermal Couples, Thermal Resistors, Applications- Inertia Sensors, Flow Sensors, Infrared Sensors.

UNIT- IV
Piezoresistive Sensors: Origin and Expression of Peizoresistivity, Piezoresistive Sensor Materials: Metal Strain Gauges, Single crystal Silicon, Polycrystalline Silicon, Applications of Piezoresistive Sensors:Inertial sensors, Pressure Sensors, Tactile Sensors, flow Sensors.
Piezoelectric Sensors: Introduction, Properties of Piezoelectric Materials, Applications- Inertia Sensors, Acoustic Sensors, Tactile Sensors, Flow Sensors.

UNIT- V
Polymer MEMS: Introduction, Polymers in MEMS- Polyimide, SU-8, Liquid Crystal Polymer(LCP), Representative Applications- Acceleration Sensors, Pressure Sensors, Flow Sensors, Tactile Sensors.
Case Studies of Selected MEMS Products: Blood Pressure (BP) Sensor, Microphone, Acceleration Sensor and Gyros.

Text Books:
1. Chang Liu, "Foudations of MEMS", 2/e, Pearson Education Inc., 2012.
2. Tai Ran Hsu, "MEMS & Micro Systems Design and Manufacture", ~~Tata~~ McGraw Hill, 2002.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Reference Books:

1. P. Rai-Choudary, "MEMS and MOEMS Technology and Applications", PHI publications, 2009.
2. Mohamed Gad-el-Hak, "The MEMS Handbook", CRC press, 2001.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16CS O07

BASICS OF CYBER SECURITY (Open Elective – II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: The main objectives of this course are:

1. To Identify and present indicators that a cybercrime has occurred and understand methods and tools used in cybercrimes.
2. To collect, Process, Analyze and Present Computer Forensics Evidence.
3. To understand the legal perspectives and Organizational implications of Cyber Security

Outcomes: On Successful completion of this course, student will be able to:

1. Discuss different types of cybercrimes and analyze legal frameworks to deal with these cybercrimes.
2. Describe Tools used in cybercrimes and laws governing cyberspace.
3. Analyze and resolve cyber security issues.
4. Recognize the importance of digital evidence in prosecution.
5. Analyze the commercial activities in the event of significant information security incidents in the Organization.

UNIT - I

Introduction to Cyber Crime: Cyber Crime: Definition and Origins of the Word, Cyber crime and Information Security, Classification of Cyber Crimes, Cyber Crime: The Legal Perspective, Cyber Crime: An Indian Perspective, A Global Perspective of Cyber Crime.

UNIT - II

Cyber Offenses: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector. **Tools and Methods Used in Cybercrime:** Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT - III

Cyber Security: The Legal Perspectives: Cyber Crime and the Legal Landscape around the World, Need of Cyber laws: the Indian Context, The Indian IT Act, Challenges to Indian Law and Cyber Crime Scenario in India, Digital Signatures and the Indian IT Act, Cyber Crime and Punishment, Cyber Law, Technology and Students: The Indian Scenario.

UNIT - IV

Understanding Cyber Forensics: Introduction ,Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Forensics Analysis of Email, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Cyber Forensics Investigation, Challenges in Computer Forensics.

UNIT - V

Cyber Security: Organizational Implications: Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Sunit Belpre and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt.Ltd, 2011.
2. Kevin Mandia, Chris Prosise, "Incident Response and Computer Forensics", Tata McGraw Hill, 2006.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Alfred Basta, Nadine Basta, Mary Brown, Ravinder Kumar, "Cyber Security and Cyber Laws", Paperback, 2018.
2. Mark F Grady, Fransesco Parisi, "The Law and Economics of Cyber Security", Cambridge University Press, 2006.

Online Resources:

1. https://www.edx.org/learn/cybersecurity
2. https://www.coursera.org/courses?query=cyber%20security
3. https://swayam.gov.in/course/4002-cyber-law

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

16PE C15

With Effect from the Academic Year 2019 - 2020

SEMINAR

Instruction	3 Hours per week
Duration of Semester End Examination	----
SEE	----
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summaryand Conclusions
5. References

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.

Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

16PE C16

PROJECT

Instruction	6 Hours per week
Duration of Semester End Examination	----
SEE	100 Marks
CIE	50 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)

CIE (Continuous Internal Evaluation) Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE:

(Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study
	20	Viva-Voce

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C101

COMPUTER AIDED MODELING AND DESIGN

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students

1. Understand the basics of computer aided design
2. Gain the knowledge on design process
3. Explain the uses of wireframe and surface entities
4. Learn and apply various geometrictransformations
5. Understand various advanced modeling concepts

Outcomes: At the end of the course, student will be able to

1. Understand the design process, visualize models through graphics standards and apply principles of computer graphics like geometric transformations, windowing andclipping
2. Recognize various wireframe entities and model them
3. Apply surface modelling techniques for generating various parts
4. Differentiate various solid modelling techniques
5. Understand various advanced modelling concepts like parametric and variational modelling , feature based design, interference detection

UNIT - I

Introduction: Criteria for selection of CAD workstations, Shigley's design process, Design criteria, Geometric modelling, Entities, 2d and 3d primitives, Computer Aided Design, Iterative Design, CAD process

Geometric Transformations: 2d Translation, Scaling, Rotation, Reflection and shearing, Homogeneous Coordinates, Rotation and Scaling about arbitrary points, 3D transformations, Windowing - View ports -Clipping transformations

Graphics Standards: GKS, IGES, PDES and their relevance

UNIT – II

Modeling of Curves: Curve representation, Analyticcurves- Lines, and Circles, Ellipse, and Conics, Synthetic curves – Cubic, Bezier, B-Splines, and Non Uniform Rational B-Splines. Curve Manipulations,

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT- III

Surface Modeling: Surface representation, Analytic Surfaces: Plane Surface, Ruled Surface, Surface of Revolution, Tabulated Cylinder. Synthetic Surface: Cubic, Bezier, B-spline, Coons surface.

UNIT - IV

Solid Modeling Techniques: Boundary Representation (B-rep) & Constructive Solid Geometry (CSG), Graph Based Models, Boolean Models, Primitive Instancing, Cell Decomposition & Spatial Occupancy Enumeration

UNIT - V

Advanced Modeling Concepts: Feature Based Modeling, Assembly Modeling, Conceptual Design and Top down design, Parametric and Variational Modeling, Feature recognition, Design by Features, Computer Aided Design of Mechanical parts and Interference Detection by Motion analysis

Text Books:

1. Ibrahim Zeid, "CAD/CAM Theory and Practice", Mc Graw Hill, 1998.
2. Foley, Van Dam, Feiner and Hughes, "Computer Graphics Principles and Practice", 2 /e., Addison Wesley, 2000.

Suggested Reading:

1. E. Michael, "Geometric Modelling", John Wiley & Sons, 1995.
2. Hill Jr, F.S., "Computer Graphics using open GL", Pearson Education, 2003.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C102

COMPUTER INTEGRATED MANUFACTURING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students

1. To understand the role of computers in manufacturing
2. To provide an in-depth understanding of manufacturing and database systems
3. To provide an understanding of needs of the market and design the product
4. To design and develop material handling, storage and retrieval systems for specific cases ofmanufacturing
5. To develop CIM systems for current manufacturing scenario by using computer and networking tools.

Outcomes: At the end of the course, student will be able to

1. Select the necessary computing tools for development of product
2. Use appropriate database systems for manufacturing a product and store the same for future use
3. Use modern manufacturing techniques and tools including principles of networking
4. Apply the concepts of lean manufacturing and agile manufacturing
5. Apply the latest technology of manufacturing systems and software for the development of a product.

UNIT - I

Basic Concepts of CIM: The meaning of Manufacturing, Types of Manufacturing; CIM Definition, Elements of CIM, CIM wheel, concept or technology, Evolution of CIM, Benefits of CIM, Needs of CIM: Hardware and software. Fundamentals of Communication: Communications Matrix. Product Development Cycle, Concurrent Engineering: Definition, Sequential Engineering Versus Concurrent Engineering, Benefits of Concurrent Engineering, Characteristics of concurrent Engineering, Framework for integration of Life-cycle phases in CE, Concurrent Engineering Techniques, Integrated Product Development (IPD), Product Life-Cycle Management (PLM), Collaborative Product Development.

Rreddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - II

Introduction, Manufacturing Data: Types, sources; Database Terminology, Database requirements, Database models, Database Management System, DBMS Architecture, Query Language, Structural Query Language (SQL): Basic structure, Data definition Language (Create, Alter, Drop, Truncate, View), Data Manipulation Language (store, retrieve, update, delete). Illustration of Creating and Manipulating a Manufacturing Database. SQL as a Knowledge Base Query Language. Features of commercial DBMS: Oracle, MySQL, SQLAccess, Sybase, DB2. Product Data Management (PDM), Advantages of PDM.

UNIT- III

Product Design: Needs of the market, Design and Engineering, The design Process, Design for Manufacturability (DFM): Component Design, Design for Assembly. Computer-Aided Process Planning: Basic Steps in developing a process plan, Variant and Generative Process Planning, Feature Recognition in Computer-Aided Process Planning. Material Requirements Planning (MRP), Manufacturing Resource Planning (MRP –II), Cellular Manufacturing: Design of Cellular Manufacturing Systems, Cell Formation Approaches: Machine–Component Group Analysis, Similarity Coefficients-Based Approaches. Evaluation of Cell Design. Shop-floor Control: Data Logging and Acquisition, Automated Data Collection, Programmable Logic Controllers, Sensor Technology. Flexible Manufacturing Systems: Physical Components of an FMS. Types of Flexibility, Layout Considerations: Linear Single Machine Layout, Circular Machine Layout, Cluster Machine Layout, Loop Layout; Operational Problems of FMS. FMSbenefits

UNIT – IV

Introduction to Networking: Principles of Networking, Network Terminology, Types of Networks: LAN, MAN, WAN; Selection of Network Technology: Communication medium, Network Topology, Medium access control Methods, Signaling methods; Network Architectures and Protocols: OSI Model, MAP & TOP, TCP/IP, Network Interconnection and Devices, Network Performance. Framework for Enterprise-wide Integration.

CIM Models: ESPRIT-CIM OSAModel, NIST-AMRF Model, Siemens Model of CIM, Digital Equipment Corporation Model, IBM Concept of CIM.

UNIT - V

Lean Manufacturing: Definition, Principles of Lean Manufacturing, Characteristics of Lean Manufacturing, Value of Product, Continuous Improvement, Focus on Waste, Relationship of Waste to Profit, Four Functions

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

of Lean Production, Performance Measures, The Supply Chain, Benefitsof Lean Manufacturing. Introduction to Agile and Web Based Manufacturing systems.

Text Books:

1. S.Kant Vajpayee: "Principles of Computer Integrated Manufacturing", Prentice HallIndia
2. Nanua Singh: "Systems Approach to Computer Integrated Design and Manufacturing", John Wiley

Suggested Reading:

1. P.Radhakrishnan, S.Subramanyam: "CAD/CAM/CIM", New Age International
2. Alavudeen, Venkateshwaran:"Computer Integrated Manufacturing", Prentice HallIndia.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME M103

RESEARCH METHODOLOGY AND IPR

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Outcomes: At the end of the course, student will be able to

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT - I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT - II

Literature Survey Report writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT- III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT - V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan,"Research Methodologyfor Engineers", MJPPublishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004.

Suggested Reading:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

20ME E101

ADVANCED MACHINE DESIGN

(Programme Elective – I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to understand the

1. Failure theories of engineering components
2. Fatigue life estimation by S-N approach
3. LEFM approach
4. Fatigue from variable amplitude loading
5. Surface failure

Outcomes: At the end of the course, student will be able to

1. Predict failure of engineering components using failure theories
2. Identify and explain the types of fractures of engineered materials and their characteristic features
3. Understand LEFM approach
4. Estimate life of components using stress life and strain life
5. Categorize different types of surface failure

UNIT - I

Introduction: Role of failure prevention analysis in mechanical design, Modes of mechanical failure, Review of failure theories for ductile and brittle materials including Mohr's theory and modified Mohr's theory, Numerical examples. Fatigue of Materials: Introductory concepts, High cycle and low cycle fatigue, Fatigue design models, Fatigue design methods, Fatigue design criteria, Fatigue testing, Test methods and standard test specimens, Fatigue fracture surfaces and macroscopic features, Fatigue mechanisms and microscopic features

UNIT - II

Stress-Life (S-N) Approach: S-N curves, Statistical nature of fatigue test data, General S-N behavior, Mean stress effects, Different factors influencing S-N behavior, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S-N approach. Strain-Life(å-N)approach: Monotonic stress-strain behavior, Strain controlled test methods, Cyclic stress-strain behavior, Strain based approach to life estimation, Determination of strain life fatigue properties, Mean stress effects, Effect of surface finish, Life estimation by å-N approach

UNIT- III

LEFM Approach: LEFM concepts, Crack tip plastic zone, Fracture toughness, Fatigue crack growth, Mean stress effects. Notches and their effects: Concentrations and gradients in stress and strain, S-N approach for notched membranes, mean stress effects and Haigh diagrams, Notch strain analysis and the strain – life approach. Neuber's rule.

UNIT - IV

Fatigue from Variable Amplitude Loading: Spectrum loads and cumulative damage, Damage quantification and the concepts of damage fraction and accumulation, Cumulative damage theories, Load interaction and sequence effects, Cycle counting methods, Life estimation using stress life approach.

UNIT- V

Surface Failure: Introduction, Surface geometry, Mating surface, Friction, Adhesive wear, Abrasive wear, Corrosion wear, Surface fatigue spherical contact, Cylindrical contact, General contact, Dynamic contact stresses, Surface fatigue strength.

Text Books:

1. Ralph I. Stephens, Ali Fatemi, Robert and Henry O. Fuchs, "Metal Fatigue in Engineering", John Wiley NewYork, Second edition. 2001.
2. Jack. A. Collins, "Failure of Materials in Mechanical Design", John Wiley, NewYork1992.
3. Robert L. Norton, "Machine Design", Pearson Education India, 2000

Suggested Reading:

1. S. Suresh, "Fatigue of Materials", Cambridge University Press, 1998.
2. Julie. A. Benantine, "Fundamentals of Metal Fatigue Analysis", Prentice Hall,1990.
3. "Fatigue and Fracture", ASM Hand Book, Vol 19, 2002.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E102

ADVANCED VIBRATIONS AND ACOUSTICS

(Programme Elective – I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to understand the

1. Knowledge of mathematical modeling of a physical system and applying the principles of Newton's Second Law and conservation of energy to derive the equations of motion.
2. Evaluate damping in vibrating structure.
3. Develop the equations of motion for a continuous system in elongation, bending and torsion to find the natural frequencies and mode shapes.
4. Knowledge on fundamentals of acoustics, measuring techniques.
5. Knowledge on vibration and noise measuring instruments.

Outcomes: At the end of the course, student will be able to

1. Predict response of a SDOF system, damped or undamped, subjected to simple harmonic excitations. They will be able to obtain Step Response Spectrum of SDOF systems for suchexcitations
2. Write differential equations of motion for MDOF systems, should be able to obtain the Eigen-values and mode shapes of natural vibrations and response to harmonic excitations, able to measure damping in the system using logarithmic decrement and half power method.
3. Obtain the frequency and mode shapes for string, rod and beam using continuous systems.
4. Understand basic concept of acoustics, source of models, and measuring of noise.
5. Understand vibration and noise measuring instruments.

Unit 1

Review of Mechanical Vibrations: Free and harmonically forced vibration of single degree of freedom systems with and without damping.

Transient Vibration of Single Degree-of Freedom Systems: Impulse excitation, Arbitrary excitation: step excitation. Laplace transforms formulation.Convolution (Duhamel's) integral, impulse response function.

Unit 2

Multi Degree of Freedom Systems: Free and forced vibrations of two degree of freedom systems, Eigen values and Eigen vectors, normal modes and their

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

properties, mode summation method, use of Lagrange's equations to derive the equations of motion.

Measurement of Damping Capacity and their Interpretation of Damping Coefficient: damping factor, logarithmic decrement, and half power band width.

Unit 3

Continuous Systems: Vibrating string, longitudinal vibration of rods, beams–Differential equation of motion, solution by the method of separation of variables, forced vibration of simply supported beam subjected to concentrated harmonic force at a point, Mode summation method.

Unit 4

Fundamentals of Acoustics: The homogeneous acoustic wave equation-1-D,3-D,Fundamental acoustic source models: Monopoles, Dipoles, Monopolesnear rigid, reflecting, ground plane, Sound radiation from a vibrating piston mounted in a rigidbaffle, Noise measuring units: decibels, frequency analysis bandwidths, The measurement of sound power, sound pressure levels, sound intensity levels, frequency response function, Sound power models-constant power. Sound power evaluation methods,

Unit 5

Noise and Vibration Measuring Instruments: Transducers: piezoelectric, electrodynamic. Vibration pickups: Vibrometer, accelerometer, velometer. Frequency measuring instruments, Vibration exciters: Mechanical exciter, Electrodynamic shaker and impact hammer. Microphones: Condenser, dynamic. Sound intensity probe, Sound level meter.

Text Books:

1. W.T.Thomson, "Theory of Vibrations with applications", George Allen and Unwh Ltd. London, 1981.
2. S.S. Rao, Addison, "Mechanical Vibrations", Wesley Publishing Co., 1990.
3. Leonard Meirovitch, "Fundamentals of vibrations", McGraw Hill International Edition

Suggested Reading:

1. S. Timoshenko, "Vibration problems in Engineering", Wiley, 1974.
2. Lawrence E. Kinsler andAustin R.Frey,"Fundamentalsofacoustics", Wiley Eastern Ltd., 1987.
3. Michael Rettinger, "Acoustic Design and Noise Control", Vol. I & II. Chemical Publishing Co., New York, 1977.
4. M.P. Norton and D.G. Karczub.,"Fundamentals of Noise and vibration analysis for engineers", Cambridge university press.,2/e, 2003.

20ME E103

OPTIMIZATION TECHNIQUES

(Programme Elective – I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: The students will

1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignmenttechniques
3. Come to know theprocedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques and game theory

Outcomes: At the end of the course, student will be able to

1. Formulate a linear programming problems (LPP)
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully
4. Apply queing and inventory concepts in industrial applications
5. Apply sequencing models and game theory in industries

UNIT - I

Operations Research: Definition, scope, Models, Linear programming problems, Formulation, Graphical Method, Simplex Method, and Duality in simplex.

UNIT - II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT- III

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward path, Determination of critical path, duration of the project, Free float, Independent float and Total float, Crashing of network.

UNIT - IV

Queuing Theory: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT - V

Sequencing Models: Introduction, General assumptions, processing 'n' jobs through two Machines, processing 'n' jobs through three machines. Game Theory – definition saddle point Principle of Dominance.

Text Books:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi,2008

Suggested Reading:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010
3. Harvey M Wagner,"Principles of Operations Research", Prentice Hall of India2010

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E104

AUTOMATION
(Programme Elective – II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to understand
1. Basic concepts of automation & its significance in manufacturing industries.
2. Automated flowlines.
3. Conceptualize & design following assembly line balancing.
4. About automated material handling systems
5. Effective design and appropriate tests & inspection systems

Outcomes: At the end of the course, student will be able to
1. Conceptualize and design automated flow lines.
2. Implement line balancing concepts in production and assembly lines
3. Understandand developautomatedmaterialhandlingsystemsuitable for plant operations.
4. Design, implement and use and appropriate automated inspection facility.
5. Design and develop an automated production system for manufacturing a product using futuristic technologies

UNIT - I

Introduction: Definition of automation, Types of production, Functions of Manufacturing, Organization and Information Processing in Manufacturing, Production concepts and Mathematical Models, Automation Strategies, Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break-Even Analysis, Unit cost of production, Cost of Manufacturing Lead time andWork-in-process.

UNIT - II

Analysis of Automated Flow Lines: Automated Flow lines, Methods of Workpart Transport, Transfer Mechanism, Buffer Storage, Control Functions, Automation for Machining Operations, Design and Fabrication Considerations. General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT- III

Assembly Systems and Line Balancing: The Assembly Process, Assembly Systems, Manual Assembly Lines, The Line Balancing Problem, Methods of Line Balancing, Computerized Line Balancing Methods, Other ways to improve the Line Balancing, Flexible Manual Assembly Lines. *Automated Assembly Systems:* Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multi-station Assembly Machines, Analysis of a Single Station Assembly Machine.

UNIT - IV

Automated Materials Handling: The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/ Retrieval Systems, Carousel Storage Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing.

UNIT - V

Automated Inspection and Testing: Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods. Modeling Automated Manufacturing Systems: Role of Performance Modeling, Performance Measures, Performance Modeling Tools: Simulation Models, Analytical Models. The Future Automated Factory: Trends in Manufacturing, The Future Automated Factory, Human Workers in the Future Automated Factory, The socialimpact.

Text Books:

1. Mikell P.Grover, Automation, "Production Systems and Computer Integrated Manufacturing", Pearson Education Asia, 2012.
2. Nanua Singh, "Systems Approach to Computer-Integrated Design and Manufacturing", Wiley India Pvt Ltd, New York, 1995.

Suggested Reading:

1. C.Ray Asfahl, "Robots and Manufacturing Automation", John Wiley and Sons New York, 1995.
2. Stephen J. Derby, "Design of Automatic Machinery", Special Indian Edition, Marcel Decker, New York, Yesdee publishing Pvt. Ltd, Chennai, 1998
3. N.Viswanadham and Y.Narahari, "Performance Modeling of Automated Manufacturing Systems", Prentice Hall India Pvt. Ltd, 1980.

20ME E105

DESIGN FOR MANUFACTURING AND ASSEMBLY

(Programme Elective – II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to

1. Understand the need for design of a product
2. Understand the selection of material on the basis of manufacturing process
3. To familiarize various fabrication procedures
4. To reduce the manufacturing / process time
5. Make design according to ergonomics

Outcomes: At the end of the course, student will be able to

1. Understand the product development cycle
2. Know the manufacturing issues that must be considered in the mechanical engineering design process
3. Know the effect of manufacturing process and assembly operations on the product
4. Know the principles of assembly to minimize the assembly time
5. Be familiar with tools and methods to facilitate development of manufacturing mechanical designs

UNIT - I

Introduction: Need Identification and Problem Definition, Concept Generation and Evaluation, Embodiment Design, Selection of Materials and Shapes

UNIT - II

Properties of Engineering Materials: Selection of Materials – I, Selection of Materials – II, Case Studies – I, Selection of Shapes, Co-selection of Materials and Shapes, Case Studies – II

UNIT- III

Selection of Manufacturing Processes: Review of Manufacturing Processes, Design for Casting, Design for Bulk Deformation Processes, Design for Sheet Metal Forming Processes, Design for Machining, Design for Powder Metallurgy, Design for Polymer Processing, Co- selection of Materials and Processes, Case-Studies – III

UNIT - IV

Design for Assembly: Review of Assembly Processes, Design for Welding – I, Design for Welding – II, Design for Brazing and Soldering, Design for Adhesive Bonding, Design for Joining of Polymers, Design for Heat Treatment, Case-Studies -IV

UNIT - V

Design for Reliability: Failure Mode and Effect Analysis and Quality, Design for Quality, Design for Reliability, Approach to Robust Design, Design for Optimization

Text Books:

1. M F Ashby and K Johnson, "Materials and Design - The art and science of material selection in product design", Butterworth-Heinemann, 03.
2. G Dieter, Engineering "Design - a materials and processing approach", McGrawHill,NY,
3. M FAshby,"Material Selection in Mechanical Design", Butterworth-Heinemann, 1999.
4. K.G.Swift and J.D.Booker, "Process Selection from Design to Manufacture", Wiley Publishers, New York, 1997.

Suggested Reading:

1. T H Courtney, "Mechanical Behavior of Materials", McGraw Hill, NY, 00.
2. G Boothroyd, P Dewhurst and W Knight, "Product design for manufacture and assembly", John Wiley, NY: Marcel Dekkar, 1994.
3. J G Bralla, "Handbook for Product Design for Manufacture", McGraw Hill, NY, 1998.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E106

INDUSTRIAL ROBOTICS

(Programme Elective– II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand the

1. Principle of working of a robot , types and specifications
2. Transformations, various types of representations, kinematics of robots
3. Singularities, jacobian and trajectory planning of a robot to prepare the robot for various tasks
4. Design, working of sensors and controllers for finding position and orientation of various industrial robots
5. Robot vision for image acquisition and processing and plan for various tasks and programming

Outcomes: At the end of the course, student will be able to understand the

1. Principle of working of a robot , types and prepare specifications for various requirements.
2. Transformations, kinematics of robots to find out the position and orientation.
3. Singularities, avoiding singularities while designing, find jacobian and trajectory planning of a robot to prepare the robot for various tasks
4. dynamic analysis using various formulations and design the robots
5. Working of sensors and controllers for finding position and orientation, analyze robot vision for image acquisition and processing and plan for various tasks andprogramming.

UNIT - I

Overview of Robot Subsystems: Brief History, Types of robots, Overview of robot subsystems, resolution, repeatability and accuracy, Degrees of freedom of robots, Robot configurations and concept of workspace, Mechanisms and transmission, End effectors and Different types of grippers, vacuum and other methods of gripping, Pneumatic, hydraulic and electrical actuators, applications of robots, specifications and requirements of different industrial robots.

UNIT – II

Direct Kinematics: Rotation matrices, Euler angle and RPY representation, Homogeneous transformation matrices, Denavit-Hartenberg notation, representation of absolute position and orientation in terms of joint parameters, direct kinematics

UNIT- III

Inverse Kinematics: Inverse Kinematics, inverse orientation, inverse locations, Singularities, Jacobian, Trajectory Planning: joint interpolation, task space interpolation, executing user specified tasks, sensor based motion planning: The Bug Algorithm, The Tangent Bug Algorithm, The Incremental Voronoi Graph

UNIT - IV

Analysis of RP and RR Type Robots: Static force analysis of RP type and RR type planar robots, Dynamic analysis using Lagrangean and Newton-Euler formulations of RR and RP type planar robots, , Independent joint control, PD and PID feedback, actuator models, nonlinearity of manipulator models, force feedback, hybrid control

UNIT - V

Sensorsand Controllers: Sensorsand controllers: Internaland externalsensors, position, velocity and acceleration sensors, proximity sensors, force sensors, laser rangefinder.

Robot Vision: Image processing fundamentals for robotic applications, image acquisition and preprocessing. Segmentation and region characterization object recognition by image matching and based on features

Text Books:

1. Nagrath and Mittal, "Robotics and Control", Tata McGraw-Hill, 2003.
2. Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and sons, 2008.

Suggested Reading:

1. Fu. K.S, Gonzalez, R.C., Lee, C.S.G, "Robotics, control, sensing, Vision and Intelligence", McGraw Hill International, 1987
2. Steve LaValle, "Planning Algorithms", Cambridge Univ. Press, New York, 2006.
3. Howie Choset, Kevin Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki and Sebastian Thurn, "Principles of Robot Motion: Theory, Algorithms, and Implementations", Prentice Hall of India, 2005.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C104

INTEGRATED DESIGN AND MANUFACTURING LAB

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Objectives: To make the students to

1. Generate the part and assembly models using cad software
2. Create automated drawing and apply proper annotations on them.
3. Write different part programs for different components to be machined on lathe and milling machine
4. Understand the reverse engineering concept
5. Understand the stl file generation and manipulations

Outcomes: At the end of the course, student will be able to

1. Generate complex components in the part module and assemble them by using suitable constraints.
2. Generate engineering drawing and apply size, form and positional tolerances on the drawing
3. Write part programs using G and M codes for lathe and milling operations for various components.
4. Differentiate additive and subtractive methods of manufacturing and their integration to build the component
5. Gain confidence to operate the 3d printing machine.

List of Experiments:

1. Part modeling of simple and complex components by using various features of the software
2. Assembly modeling of components using different constraints
3. Creation of Engineering drawing details and adding various annotations and generation of automated BOM.
4. Specifying tolerances for part and assembly Drawings
5. Writing of CNC programming for creation of Contours and Pockets
6. Surface Roughing of Crane Hook
7. Manufacturing of Bottle Die
8. Taper Turning and Multiple Turning on CNC Lathe Machine.
9. Introduction to RP machine, Machine Specifications, Materials, Stl file generation

10. Slicing of stl files and obtaining the tool path data and sending it to RP machines
11. Demonstration of rapid tooling using fused deposition modeling.
12. Conversion of physical model to digital data format to demonstrate Reverse Engineering

Note: Out of the above 12 experiments, any 10 experiments have to be carried out.

Suggested Reading :

1. Solidworks Essentials, "Solidworks" *By* Dassault Systems

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C105

VIBRATION AND ACOUSTICS LAB

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Objectives: To make the students to

1. Determine mass moment of inertia from vibrating systems.
2. Evaluate damping in vibrating structure.
3. Evaluate natural frequencies and mode shapes for continuous system.
4. Gain the knowledge on using impact hammer.
5. Gain knowledge on fundamentals of acoustics, measuring techniques.

Outcomes: At the end of the course, student will be able to

1. Predict response of a SDOF system, damped or undamped, subjected to simple harmonic excitations. They will be able to obtain Step Response Spectrum of SDOF systems for suchexcitations
2. Measure damping in the system using logarithmic decrement and half powermethod.
3. Obtain the frequency and mode shapes for beam using continuous systems.
4. Understand basic concept of acoustics, source of models, and measuring of noise.
5. Understand vibration and noise measuring instruments.

List of Experiments:

1. To find damping coefficient and undamped natural frequencies of an under-damped single degree of freedom system from its response to an initialdisplacement.
2. SDOF system to harmonic excitation applied to the mass for different values of damping factor.
3. To find fundamental natural frequency of a cantilever beam by free vibration and find the damping by logarithmic decrement, plot number of cycles Vsdamping.
4. To find FRF and damping for cantilever beam, giving impact test.
5. The response of a cantilever beam by sinusoidal excitation. Plotting FRF curve and phase plot.
6. Determining the oscillation frequency of a string as a function of the string length and tension

7. Determining the wavelength of standing sound waves
8. Demonstration on stroboscope for natural frequencies of beam.
9. Sloshing due to vibration of partially filled liquid cylinder.
10. Measure the sound pressure (in Pa) and sound pressure level (in dB)as a function of distance from a simple source consisting of a smallboxed loudspeaker producing white noise.
11. Directivity patterns.

Text Books:

1. Yvan, "Mechanical Vibrations, Applications to Equipment",Willey Publications, 2017.
2. H. Ginsberg. Jerry, "Acoustics, A Text Book for Engineers and Physicists", Springer International Publishers, 2014.

Suggested Reading:

1. G.K.Grover,"Mechanical Vibrations", Nem Chad and Brothers, 1996.
2. Finch, "Introduction to Acoustics", Pearson Education India; 1/e,, 2016

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EC A101

VALUE EDUCATION

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: This course aims to:

1. Understand the need and importance of Values for self-development and for Nationaldevelopment.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Outcomes: After completion of the Course, students will be able to:

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Valuesfor self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books : Self-management and Good health; internal & external cleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasic gunas.

Text Books:

1. Chakroborty, S.K. "Values & Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1998.

Suggested Reading:

1. Jaya Dayal Goyandaka, "Srimad Bhagavad Gita with SanskritText, Word Meaning and Prose Meaning", Gita Press, Gorakhpur, 2017.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20IT A101

PEDAGOGY STUDIES

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Course Objectives:

1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development.

Course Outcomes: Upon completing this course, students will be able to:

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare", 31 (2): 245 – 261, 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Reading:

1. Akyeampong K, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)", Country Report 1.London: DFID, 2003.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33(3):272-282,2013.
3. Alexander R J, "Culture and Pedagogy: International Comparisons in Primary Education", Oxford and Boston: Blackwell, 2001.
4. Chavan M, "Read India: A mass scale, rapid, 'learning to read' campaign", 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

20CE A101

DISASTER MITIGATION AND MANAGEMENT

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives:

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Outcomes: At the end of the course the students are able to

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management

UNIT- I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III:

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Casestudies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT- IV:

Disaster Impacts: Disasterimpacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects-gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT- V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response-water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh,"Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs, "Government of India, "National disaster management plan, Part I and II"
2. K. K. Ghosh,"Disaster Management", APH Publishing Corporation, 2006.
3. "Hazards, Disasters and your community: Abooklet for students and the community", Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file/disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/(National Disaster management in India, Ministry of Home Affairs)

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EE A101

SANSKRIT FOR TECHNICAL KNOWLEDGE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. To explore the huge knowledge from ancient Indian literature

Outcomes: At the end of the course the students are able to

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT-I

Introduction to Sanskrit Language: Sanskrit Alphabets-vowels-consonants-significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/ Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic Sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).
Themeasurementsystem-time-mass-length-temp,Matterelasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):

Building construction-soil testing-mortar-town planning-Machine definition-

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

crucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures, Chemical laboratory location and layout-equipment-distillation vessel-kosthi yanthram

Text Books:

1. M Krishnamachariar, "History of Classical Sanskrit Literature", TTD Press, 1937.
2. M.R. Kale, "A Higher Sanskrit Grammar: For the Use of School and College Students", Motilal Banarsidass Publishers, ISBN-13: 978-8120801783, 2015

Suggested Reading:

1. Kapail Kapoor, "Language, Linguistics and Literature: The Indian Perspective", ISBN-10: 8171880649, 1994.
2. "Pride of India", Samskrita Bharati Publisher, ISBN: 81-87276-27-4, 2007.
3. Shri RamaVerma, "Vedas the source of ultimate science", Nag publishers, ISBN:81-7081-618-1,2005.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C106

FINITE ELEMENT TECHNIQUES

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to
1. Understand finite element analysis fundamentals andformulations
2. Formulate the axial, truss, beam and 2D problems
3. Formulate the heat conduction and dynamics problems, understand the use of numerical integration and Gauss quadrature
4. Understand the convergence requirements and 3D problems
5. Perform engineering simulations using finite element analysis software (ANSYS)

Outcomes: At the end of the course, Student will be able to
1. Apply FE method for solving field problems using virtual work and potential energy formulations
2. Analyze linear problems like axial, truss and beam, torsional analysis of circular shaft
3. Analyze 2D structural problems using CST element and analyze the axi-symmetric problems with triangular elements. Write shape functions for 4 node quadrilateral, isoparametric elements and apply numerical integration and Gaussian quadrature to solve theproblems.
4. Evaluate the eigen values and eigen vectors for stepped bar, formulate 3 D elements, check for convergence requirements
5. Solve linear 1 D and 2 D heat conduction and convection heat transfer problems, Use of FEAsoftware ANSYS for engineering solutions

UNIT - I

Introduction to Finite Element Method of Solving Field Problems: Stress and Equilibrium. Boundary conditions. Strain-Displacement relations. Stress-strain relations.

One Dimensional Problem: Finite element modeling. Local, natural and global coordinates and shape functions. **Potential Energy Approach**: Assembly of Global stiffness matrix and load vector. Finite element equations, treatment of boundary conditions. Quadratic shape functions.

UNIT - II

Analysis of Trusses: Analysis of plane truss with number of unknowns not exceeding two at each node.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node for beam element

Analysis of Frames: Analysis of frames with two translations and a rotational degree of freedom at each node.

UNIT- III

Two Dimensional StressAnalysis: Finite element modeling of two dimensional stress analysis problems with constant strain triangles and treatment of boundary conditions. Two dimensional four noded isoparametric elements and numerical integration. Finite element modeling of Axisymmentric solids subjected of axisymmetric loading with triangular elements.

Convergence requirements and geometric isotropy

UNIT - IV

Steady State Heat TransferAnalysis: One dimensional analysis of a fin and two dimensional conduction analysis of thin plate.

Time Dependent Field Problems: Application to one dimensional heat flow in a rod.

Dynamic Analysis: Formulation of finite element modeling of Eigen value problem for a stepped bar and beam. Evaluation of Eigen values and Eigen vectors.

Analysis of a uniform shaft subjected to torsion using Finite Element Analysis.

UNIT - V

Three Dimensional Problems in StressAnalysis: 3D elements: Introduction to tetrahedron and brick elements.

Introduction to thin and thick plates

Introduction to non-linear formulation through FE.

Text Books:

1. R. Tirupathi, Chandrupatla and A.D Ashok,"Introduction of Finite Element in Engineering", Prentice Hall of India, 2004
2. S.S. Rao,"The Finite Element Methods in Engineering", 2/e Pergamon Press, 2001.
3. David.V.Hutton, "Fundamentals of Finite Element Analysis", Tata McGrawHill,2003

Suggested Reading:

1. Robert Cook , "Concepts and applications of finite element analysis", 4/e, John Wiley andsons,2009
2. K..J Bathe, "Finite element procedures", 2/e,Prentice Hall of India,2007
3. D.L. Logan, "First course in finite element method", (5/e). Mason, OH: SouthWestern, Cengage Learning, 2011.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C107

MECHANICAL DESIGN AND ANALYSIS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to

1. Develop the necessary skills to understand and analyze problems in pressure vessels
2. Achieve fundamental understanding of the theory of bending offlat plates with various loading and boundary conditions
3. Understand design principles of a component and structures using fracture mechanics approaches
4. Enable the importance of vibrations in mechanical design to understand the basic concepts of matrix algebra and understand the different mode extraction methods in vibrations
5. Understand the fundamental concepts various algorithms used for dynamic analysis

Outcomes: At the end of the course, Student will be able to

1. Apply knowledge of mathematics, sciences and computations in solving the stresses & strains in pressure vessels
2. Demonstrate the ability to identify, formulate and solve problems for a given flat plate bending applications
3. Design a system or a component to meet the desired needs of fracture mechanics
4. Understand, solve various Eigen value and Eigen vectors and will understand different mode extraction methods to calculate frequencies
5. Understand methods in solving single degree freedom dynamic analysis problems

UNIT - I

Design of Pressure Vessels: Introduction and selection of materials for pressure vessels, stresses in thick walled cylindrical pressure vessels subjected to both internal and external pressures, shrink fit stresses in built up cylinders, auto frettage of thick cylinders, thermal stresses and their significance.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - II

Stresses in Flat Plates: Introduction, Bending of plate in one direction, Bending of plate in two perpendicular directions, Thermal stresses in plates, Bending of circular plates of constant thickness, Bending of uniformly loaded plates of constant thickness

UNIT- III

Fracture Mechanics: Introduction, Modes of fracture failure Griffith Analysis, Energy release rate, Stress Intensity Factor: SIF's for edge and centre line crack, Fracturetoughness, Elasticplasticanalysisthrough J-integralmethod: Relevance and scope, Definition of J-integral, Path independence, Strain Energy Release Rate Vs J-integral

UNIT - IV

Eigen Value Problems: Properties of Eigen values and Eigen Vectors, Torsional, Longitudinal vibration, lateral vibration, Sturm sequence method. Subspace iteration and Lanczo's method, Component mode synthesis

UNIT - V

Dynamic Analysis: Direct integration method, Central difference method, Wilson-q method, Newmark method, Mode superposition, Single degree of freedom system response, Rayleigh damping. (Note: The related algorithms and codes to be practiced by students)

Text Books:

1. John, V. Harvey, "Pressure Vessel Design: Nuclear and Chemical Applications", Affiliated East West Press Pvt. Ltd., 1969.
2. Prasanth Kumar, "Elements of Fracture Mechanics", Wheeler Publishing, NewDelhi-1999.
3. David.V.Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill, 2003.

Suggested Reading:

1. G.Ramamurti, "Computer Aided Mechanical Design and Analysis", Tata Mc Graw Hill-1992.
2. J. Bathe, "Finite Element Procedures", Prentice Hall of India-1996.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E206

COMPUTATIONAL FLUID DYNAMICS

(Programme Elective – III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to learn the

1. Basic equations and concept of CFD
2. Concept of pdes and finite difference methods
3. Various types of grid generation and errors in numerical solution
4. Crank-Nihcolson, Implicit and Explicit methods & Jacobi, Gauss Seidel and ADI methods
5. Importance of FVM

Outcomes: At the end of the course, student will be able to

1. Derive CFD governing equations and turbulence models
2. Apply elliptical, parabolic and hyperbolic pdes and forward, backward and center difference methods
3. Understand errors, stability, consistency and develop O,H and C grid generated models
4. Evaluate the use of Crank-Nihcolson, Implicit and Explicit methods and analyze problem by Jacobi, Gauss Seidel and ADI methods
5. Solve conduction and convection problems using FVM.

UNIT - I

Governing Equations: Continuity, Momentum and Energy equations, Navier Stokes equations, Reynolds and Favre averaged N – S equations. Introduction to turbulence, Turbulence models-mixing length model, K-å turbulence Model.

UNIT - II

Grid Generation: Grid Generation- Types of grid O,H,C. Coordinate transformation, Unstructured grid generation, Errors, Consistency, Stability analysis by von Neumann. Convergence criteria

UNIT- III

Classification of PDEs: Elliptic, parabolic and hyperbolic equations, Initial and boundary conditions. Concepts of Finite difference methods – forward, backward and central difference

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - IV

Finite Difference Solutions: Finite difference solutions - Crank Nicholson, Implicit and Explicit, ADI - Jacobi, Gauss Seidel, solution for Viscous incompressible flow using Stream function – Vorticity method

UNIT - V

Finite Volume Method: Introduction to Finite volume method, Finite volume formulations for diffusion equation, convection diffusion equation, Solution algorithm for pressure velocity coupling in steady flows. Use of Staggered grids SIMPLEAlgorithm

Text Books:

1. John D Anderson, "Computational Fluid Dynamics", Mc Graw Hill, Inc., 2015.
2. H.K.Versteeg and Malala Shekara, "Introduction to Finite Volume Method", Pearson, 2015

Suggested Reading:

1. K. Muralidhar and T. Sundararajan, "Computational Fluid flow and Heat transfer", Narosa Publishing House, 2003.
2. S.V.Patankar, "Numerical Heat transfer and Fluid flow", Hemisphere Publishing Company, New York, 1980.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E107

MECHANICS OF COMPOSITE MATERIALS

(Programme Elective – III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to learn the

1. Basics of composite materials, types of fibers and reinforcements.
2. Evaluation of material properties using micro-mechanics approach and semi-empiricalrelations..
3. Analysis of laminates using classical laminate plate theory.
4. Failure analysis of an orthotropic lamina.
5. Analysis of composite beams and plates for simple cases.

Outcomes: At the end of the course, student will be able to

1. Understand different types of composites and their fabrication methods.
2. Characterize a UD lamina using micromechanics.
3. Analyze a given laminate for strains and stress.
4. Decide the failure of a UD lamina.
5. Design simple composite beams and plates.

UNIT - I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT - II

Micromechanics of lamina and mechanical properties: Prediction of elastic constants, thermal properties, moisture properties using mechanics of materials approach. Halpin-Tsai equations for elastic constants. Mechanics of load transfer from matrix to fiber.

UNIT- III

Macro-mechanical Analysis: Introduction, Hooke's law for different types of materials, Hooke's law for 2D UD lamina, relationship between compliance and stiffness matrix to engineering elastic constants of a lamina, engineering constants of an angle lamina. Laminate code, stress-strain relationships for a laminate using CLT, force and moment resultants related to mid-plane strains and curvatures.

UNIT - IV

Strength and fracture: Tensile and compressive strength's of unidirectional fiber composites, fracture modes in composites: single and multiple fractures, de-bonding, fiber pullout and de-lamination. Interlaminar stresses and edge effects.

Strength of an orthotropic lamina: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength;

UNIT - V

Composite Beams: comparison of CLTto Isotropic beam theory, effective axial and flexural rigidities of rectangular composite beams.

Governing equations of thin –plate theory: equations of equilibrium for symmetric laminates and specially orthotropic laminate. Levy –Navier solution applied to specially orthotropic laminates.

Text Books:

1. R.M. Jones, "Mechanics of Composite Materials", Mc Graw Hill Co., 1967
2. B.D. Agarwal et.al, "Analysis and performance of fiber composites", 3/e, Wiley sons., 2013
3. P.K. Mallick, "Fiber Reinforced Composites Materials",
4. Taylor & Francis, "Manufacturing, and Design", 3/e, 2007

Suggested Reading:

1. Ever J Barbero, "Introduction to composite materials design", Taylor &Francis, 1999.
2. M.W. Hyer, "StressAnalysis of Fibre Reinforced Composite Materials", McGraw Hill Co., 1998.
3. Carl. T.Herakovich, "Mechanicsof Fibrous Composites", John Wiley Sons Inc, New York, 1998.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E108

FRACTURE MECHANICS
(Programme Elective – III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to learn the
1. Classification of fracture
2. Importance of crack tip
3. Experimental setup while performing standard test
4. About R curve
5. Fatigue crack propagation.

Outcomes: At the end of the course, student will be able to
1. Analyze the fracture mechanism
2. Gain familiarity with thedifferent modesoffailure under thepresence of crack
3. Establish specimen size in accordance with the standardprocedures
4. Distinguish between Plane stress fracture toughness and Plane strain fracture toughness
5. Accomplish the relationship between crack propagation and stress intensity factor

UNIT - I
Introduction: Crack in a structure – Griffith criterion
Mechanism of Fracture and Crack Growth: cleavage fracture – ductile fracture – fatigue cracking – service failure analysis

UNIT - II
Elastic Crack Tip Stress Field: Solution to crack problems – effect of finite size – stress intensity factor – special cases
Crack Tip Plastic Zone: Irwin plastic zone correction – actual shape of plastic zone

UNIT- III
Energy Principle: Energy release rate – criterion for crack growth – J integral
Plane Strain Fracture Toughness: Standard test – size requirement – nonlinearity

UNIT - IV

Plane Stress and Transitional Behavior: concept of plane stress – R curve concept – thickness effect – plane stress testing

Elastic Plastic Fracture: crack tip opening displacement.

UNIT - V

Fatigue Crack Propagation: Crack growth and stress intensity factor – factors affecting crack propagation – variable amplitude service loading and its numerical – retardation model

Text Books:

1. David Broek ,"Elementary Engineering Fracture Mechanics, Kluwer Academic Publishers , The Hague – 1984.
2. Prashant Kumar., "Elements of fracture mechanics", Mc Graw Hill Education (India) Private Limited, New Delhi - 2014.

Suggested Reading:

1. T.L. Anderson, "Fracture Mechanics - Fundamentals and Applications", 3/e, Taylor and Francis Group, 2005.
2. R.N.L.Smith, "Basic Fracture Mechanics", Butterworth Heinemann Publications, 1991.
3. K. Ramesh," e-Book on Engineering Fracture Mechanics", IIT Madras, 2007. URL:http://apm.iitm.ac.in/smlab/kramesh/book_4.htm
4. K. R.Y. Simha, "Fracture Mechanics for Modern Engineering Design", Universities Press (India) Limited, 2001

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E109

MULTI BODY DYNAMICS

(Programme Elective – IV)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to learn the

1. Equations of motions in 3D for a multibody systems
2. Implementation and demonstration methods for formulation of motion equations in interconnected bodies
3. Constrained differential equations
4. Static and dynamic analysis in a multibody systems
5. Modeling and simulation of multibody dynamic systems

Outcomes: At the end of the course, student will be able to

1. Derive equations of motion for interconnected bodies in multi-body systems with three dimensional motions.
2. Implement and analyze methods of formulating equations of motion for interconnected bodies.
3. Write programs to solve constrained differential equations for analyzing multi-body systems.
4. Simulate and analyze all types of static and dynamic behaviors of the multi-body systems including the kineto-static analysis.
5. Lead team projects in academic research or the industry that require modeling and simulation of multi-body systems

UNIT - I

Introduction: The method of constraints for planar kinematic analysis. Revolute, prismatic, gear and cam pairs are considered together with other 2 degrees-of-freedom types of constraints.

UNIT - II

Basic Principles for Analysis of Multi-body Systems: The automatic assembly of the systems of equations for position, velocity and acceleration analysis. Iterative solution of systems of non linear equations. Geometry of masses. The principle of virtual work and Lagrange's equations

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT- III

Dynamics Of Planar Systems: Dynamics of planar systems. Systematic computation and assembly of mass matrix. Computation of planar generalized forces for external forces and for actuator-spring-damper element. Simple applications of inverse and forward dynamic analysis. Numerical integration of first-order initial value problems. The method of Baumgarte for the solution of mixed differential-algebraic equations of motion. The use of coordinates partitioning, QR and SVD decomposition for the orthogonalization of constraints.

UNIT - IV

Kinematics of Rigid Bodies in Space: Reference frames for the location of a body in space. Euler angles and Euler parameters. The formula of Rodrigues. Screw motion in space. Velocity, acceleration and angular velocity. Relationship between theangular velocity vector and the timederivativesof Euler parameters.

UNIT - V

Kinematic Analysis of Spatial Systems: Basic kinematic constraints. Joint definition frames. The constraints required for the description in space of common kinematic pairs (revolute, prismatic, cylindrical, spherical). Equations of motion of constrained spatial systems.

Text Books:

1. J. Wittenburg, J., "Dynamics of Systems of Rigid Bodies", B.G. Teubner, Stuttgart, 1977.
2. T.R. Kaneand D.A. Levinson,"Dynamics: Theory andApplications", McGraw-Hill Book Co., 1985.
3. P.E. Nikravesh, "Computer Aided Analysis of Mechanical Systems", Prentice-Hall Inc., Englewood Cliffs, J,1988.
4. R.E. Roberson, and R. Schwertassek,"Dynamics of Multibody Systems", Springer-Verlag,Berlin,1988.

Suggested Reading:

1. R.K.Turton, "Principles of Turbomachinery", E & F N Spon Publishers, London & New York.
2. Dennis G. Shepherd, "Principles of Turbomachines", Macmillan, 2007

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E110

TRIBOLOGY IN DESIGN
(Programme Elective – IV)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to learn the

1. Material properties which influence the tribological characteristics of surfaces
2. Concepts of wear
3. Lubrication aspects of machine components.
4. Analytical behavior of different types bearings
5. Design of bearings based on analytical /theoretical approach.

Outcomes: At the end of the course, student will be able to

1. Understand surface topography and model a rough engineering surface.
2. Understand friction and wear aspects of machine.
3. Decideuponlubricantsandlubricationregimesfordifferentoperating conditions.
4. Understand Hertz contact and rough surface contact.
5. Select material/surface properties based on the tribological requirements

UNIT - I

Topography of Surfaces: Surface features -Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction –Rolling Friction-Friction propertiesofmetallic and non-metallicmaterials – friction in extreme conditions –Thermal considerations in sliding contact

UNIT - II

Wear: Types of wear – Mechanism of various types of wear – Laws of wear – Theoretical wear models-Wear of Metals and Non metals – Surface treatments – Surface modifications – surface coatings methods- Surface Topography measurements –Laser methods – instrumentation - International standards in friction and wear measurements.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT- III

Lubricants and Properties: Lubricants and their physical properties- Viscosity and other properties of oils –Additives-and selection of Lubricants- Lubricants standards ISO,SAE,AGMA, BIS standards – Lubrication Regimes –Solid Lubrication-Dry and marginally lubricated contacts- Boundary Lubrication-Hydrodynamic lubrication — Elasto and plasto hydrodynamic - Magneto hydrodynamic lubrication – Hydro static lubrication – Gas lubrication.

UNIT - IV

Reynolds and Sommerfield boundary conditions: Reynolds Equation - Assumptions and limitations-One and two dimensional Reynolds Equation-Reynolds and Sommerfield boundary conditions- Pressure wave, flow, load capacity and friction calculations in Hydrodynamic bearings-Long and short bearings-Pad bearings and Journal bearings- Squeeze film effects-Thermal considerations-Hydrostatic lubrication of Pad bearing-Pressure , flow , load and friction calculations-Stiffness considerations- Various types of flow restrictors in hydrostatic bearings

UNIT-V

Rolling Contact Bearings: Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation- Spherical and cylindrical contacts-Contact Fatigue life- Oil film effects- Elasto Hydrodynamic lubrication Theory-Soft and hard EHL-Reynolds equation for elasto hydrodynamic lubrication- - Film shape within and outside contact zones-Film thickness and friction calculation- Rolling bearings.

Text Books:

1. E. Rabinowicz. "Friction and Wearof materials", John Willey &Sons, UK,1995
2. A. Cameron,"Basic Lubrication Theory", Ellis Herward Ltd., UK, 1981
3. J. Halling, "Principles of Tribology" , Mac Millan – 1984.

Suggested Reading:

1. Kenneth C Ludema and Layo Ajay, "Friction, wear , lubrication", A text book in Tribology, 2e, CRC Press, Taylor and Francis Group, 2019
2. Ross Beckett,"Engineering Tribology", Larsenand Keller Education, 2017.
3. Stachon Iak, Andrew W Batchelor, "Engineering Tribology", 4e, Butterworth – Heinemann, 2015.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

20ME E111

FAILURE ANALYSIS AND DESIGN

(Programme Elective –IV)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to learn

1. Design methodology and various aspects involved in design process
2. Creative and inventive problem solving techniques
3. Different types of design processes, concepts of reliable and robust design
4. Concept of buckling of cylinders under various loading conditions
5. Fundamentals of fracture, fracture types and concepts of fatigue crack growth, fatigue life prediction and various stress theories of failure, crack propagation concepts under combined loading, fracture toughness of weld metals.

Outcomes: At the end of the course, student will be able to

1. Apply the concepts of design processes
2. Provide solutions by inventive problem solving techniques
3. Develop reliable and robust design
4. Analyze the behavior of buckling of cylinders under various loading conditions
5. Predict the fracture behavior under static and fatigue loads , apply the crack propagation concepts , fracture toughness of weld metals

UNIT - I

Importance of design: The design process-Considerations of Good Design – Morphology of Design –Organization for design– Computer Aided Engineering – Concurrent Engineering – Product and process cycles –Market Identification – Competition Bench marking. Identification of customer needs- customer requirements- Product Design Specifications- Human Factors in Design – Ergonomics and Aesthetics.

UNIT - II

Creativity and Problem Solving: Creativity methods-Theory of Inventive Problem Solving(TRIZ)– Conceptual decomposition-Generating design concepts-

Axiomatic Design – Evaluation methods-Embodiment Design-Product Architecture-Configuration Design- Parametric Design. Role of models in design-Mathematical Modeling – Simulation – Design for Reliability –Introduction to Robust Design-Failure mode Effect Analysis.

UNIT- III

Buckling Phenomenon: Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT - IV

Theories of Failure: Failure analysis and determination of stress patterns from plastic flow observations – Dynamicloading– Fracturetypes in tension—Fatigue crack growth– Fatigue life prediction- Cumulative fatigue damage-Stress theory of failure vessels-Thermal stress fatigue

UNIT - V

Fracture Mechanics: Introduction –Through cracks emanating from holes – Corner cracks at holes – Cracks approaching holes-Combined loading-Fatigue crack growth binder- Mixed mode loading-Fracture toughness of weld metals-Service failureanalysis

Text Books:

1. Dieter and E. George, "Engineering Design - A Materials and Processing Approach", McGraw Hill, International Editions, Singapore, 2000.
2. David Broek, "Elementary Engineering Fracture Mechanics", Fifthoff and Noerdhoff International Publisher, 1978.
3. John F. Harvey, "Theory and Design of Pressure Vessels", CBS Publishers and Distributors, 1987.

Suggested Reading:

1. G. Pahl and W. Beitz,,"Engineering Design", Springer –Verlag, NY. 1984.
2. Prashant Kumar, "Elements of Fracture Mechanics", Wheeler Publishing, 1999.
3. Henry H. Bedner, "Pressure Vessels, Design Hand Book", CBS publishers and Distributors, 1987.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C108

COMPUTER AIDED ENGINEERING LAB

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Objectives: To make the students

1. Model one and two-dimensional elements in ANSYS
2. Understand vibration, harmonic and transient analysis
3. Carry out buckling analysis
4. Analyze forming and sheet metal operations by FEA
5. Model crackelement

Outcomes: At the end of the course, student will be able to

1. Understand the applications of one and two-dimensional elements
2. Solve engineering problems
3. Find buckling factors
4. Understand industrial applications of forming and sheet metal operations
5. Find fracture toughness

List of Exercises:

1. Introduction to Finite Element Analysis Software
2. Statically indeterminate reaction force analysis and determination of Beam stresses and Deflection
3. Static analysis of a corner bracket
4. Analysis of cylindrical shell under pressure
5. Bending of a circular plate using axisymmetric shell element.
6. Vibration analysis of a simply supported beam
7. Harmonic analysis of plates and shells
8. Transient analysis of vehicle crash
9. Buckling analysis of shells
10. Analysis of forming
11. Analysis of sheet metal operation
12. Stress intensity factor in cracked plates

<u>**Note**</u>: Out of the above 12 experiments, any **ten (10)** experiments have to be carried out.

Text Books:

1. R. Tirupathi, Chandrupatla and B.D. Ashok, "Introduction of Finite Element in Engineering", Prentice Hall of India, 2004
2. David.V.Hutton, "Fundamentals of Finite Element Analysis", Tata McGrawHill,2003

Suggested Reading:

1. Robert Cook , "Concepts and applications of finite element analysis", 4/e, JohnWiley and sons,2009
2. S.S. Rao, ,"The Finite Element Methods in Engineering", 2 /e, Pergamon Press,2001.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C206

COMPUTATIONAL FLUID DYNAMICS LAB

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Objectives: To acquaint the student with

1. Basic steps in a CFD simulation: ANSYS Workbench design modular and meshing
2. Simulation of laminar, turbulent, internal flow, steady and unsteady problems
3. Simulation of steady and unsteady problems
4. Physics setup involves boundary conditions
5. Solution of thermal related problems

Outcomes: At the end of the course, student will be able to

1. Analyze laminar flow problems in plates and pipes
2. Solve steady and unsteady flow past a cylinder
3. Perform analysis for free and forced convection
4. Evaluate the effect of angle of attack and velocity on NACA aerofiol
5. Simulate compressible flow in a nozzle, premixed combustion

List of Experiments:

1. Laminar Flow over Flat plate
2. Laminar PipeFlow
3. Steady Flow past aCylinder
4. Unsteady Flow past a Cylinder
5. Two Dimensional Steady Free Convection
6. Forced Convection for pipe cross section
7. Study of Hot & Cold Fluid Mix
8. Flow analysis of Aerofoil.
9. Study of compressible flow through a nozzle
10. Partially premixed combustion analysis
11. Supersonic flow over a wedge
12. Study of flow over wind turbine blade/flow through bifurcation artery

Note: Out of the above 12 experiments, any **ten (10)** experiments have to be carried out.

Text Books:

1. John D Anderson, "Computational Fluid Dynamics", Mc Graw Hill, Inc., 2015.
2. H.K.Versteeg and Malala Shekara, "Introduction to Finite Volume Method", Pearson, 2015.

Suggested Reading:

1. J.H. Ferziger and M. Peric, "Computational Methods for Fluid Dynamics", Springer.
2. K. Muralidhar and T. Sundararajan T, "Computational Fluid flow and Heat transfer", Narosa Publishing House, 2003.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20MEC 109

MINI PROJECT WITH SEMINAR

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Outcomes: Students are able to

1. Formulate a specific problem and give solution
2. Develop model/models either theoretical/practical/numerical form
3. Solve, interpret/correlate the results and discussions
4. Conclude the results obtained
5. Write the documentation in standard format

Guidelines:

1. As part of the curriculum in the II- semester of the progarmme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Eachstudentwillbeallottedtoafacultysupervisorformentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Miniprojectsshallhaveinterdisciplinary/ industryrelevance.
5. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
6. All the investigations are clearly stated and documented with the reasons/explanations.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks:50		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EG A101

ENGLISH FOR RESEARCH PAPER WRITING

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: The Course will introduce the students to

1. Understand the nuances of language and vocabulary in writing a Research Paper.
2. Develop the content, structure and format of writing a research paper.
3. Produce original research papers without plagiarism.

Outcomes: After successful completion of the course, the students will be able to

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT - I

Academic Writing : Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT - II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT- III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT - IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - V

Research Paper Publication: Reputed Journals– National/International– ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Text Books:

1. C. R Kothari, Gaurav, Garg, "Research Methodology Methods and Techniques", 4/e, New Age International Publishers.

Suggested Reading:

1. Day R, "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006
2. "MLA Hand book for writers of Research Papers", 7/e, East West Press Pvt. Ltd, New Delhi
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers", Tata McGraw Hills Pvt. Ltd, New Delhi.

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EG A102

INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: The Course will introduce the students to

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement. to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Outcomes: After successful completion of the course, the students will be able to

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

UNIT - I

History of making of the Indian constitutions: History, Drafting Committee (Composition &Working).

Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT - II

Contours of Constitutional Rights and Duties - Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT- III

Organs of Governance - Parliament: Composition, Qualifications, Powers and Functions

Union Executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT - IV

Local Administration - District's Administration head: Role andimportance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role. Block level: Organizational Hierarchy(Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT - V

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodiesfor the welfare of SC/ST/OBCand women.

Text Books:

1. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1/e, 2015.
2. M. P. Jain, "Indian Constitution Law", 7/e, Lexis Nexis, 2014

Suggested Reading:

1. "The Constitution of India", 1950 (Bare Act), Government Publication
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EG A103

STRESS MANAGEMENT BY YOGA

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: The Course will introduce the students to

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

Outcomes: After successful completion of the course, the students will be able to

1. Understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

UNIT - I

Meaning and Definition of Yoga- Historical perspective of Yoga- Principles of Astanga Yoga by Patanjali.

UNIT - II

Meaning and Definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT- III

Concept of Stress According to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress

UNIT - IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation Techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Text Books:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Rajayoga or Conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.

Suggested Reading:

1. Nagendra H.R nad Nagaratna R, "Yoga Perspective in Stress Management", Swami Vivekananda Yoga Prakashan, Bangalore,

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EG A104

PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: The Course will introduce the students to

1. Learn to achieve the highest goal happily.
2. Become a person with stable mind, pleasing personality and determination.
3. Awaken wisdom amongthem.

Outcomes: After successful completion of the course, the students will be able to

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. Practice emotional self regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT - I

Neetisatakam – Holistic Development of Personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT - II

Neetisatakam – Holistic Development of Personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT- III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagavadgeetha: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT - IV

Statements of Basic Knowledge - Shrimad Bhagavadgeetha: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - V

Role of Bhagavadgeetha in the Present Scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Text Books:

1. "Srimad Bhagavad Gita" , Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

Suggested Reading:

1. "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Online Resources:

1. NTPEL: http://nptel.ac.in/downloads/109104115/

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEE 112

ADVANCED FINITE ELEMENT METHOD (Programme Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: To make the students to learn the

1. FE formulation for 1D and 2D elements
2. Able to solve non-linear equilibrium equations using different methods
3. About theories of plasticity
4. Formulation of 2D and 3D plasticity problems using different procedures
5. Techniques of solving large deformation problems using FE procedures

Outcomes: At the end of the course, student will be able to

1. Demonstrate understanding of FE formulation for linear problems in solid mechanics
2. Understand behavior of elastic-plastic materials and visco-plasticity, Use of Newton- Raphson method for solving nonlinear equations of equilibrium
3. Understand flow rules and strain hardening, loading and unloading conditions, Drucker's stability postulates, J2 flow of theory of plasticity
4. Demonstrate use of FE formulation to solve the problems of large deformation of structures under loads
5. Solve contact problems by using the techniques of non-linear FEM

UNIT - I

Review of Linear FEA: FE formulation of 1D bar, 3D linear elastic continuum, 2D plane strain, plane stress, and axisymmetric elements; Iso-parametric mapping; numerical integration.

UNIT - II

FE Formulation for 1D Plasticity: Elastic-perfectly plastic material; Isotropic and kinematic hardening; Integration algorithms for 1D plasticity; FE formulation;

Newton-Raphson method for solving nonlinear equilibrium equations; 1D visco-plasticity and integration algorithm

UNIT - III

Continuum Theories of Plasticity: Review of tensor algebra; Yield condition, flow rule and hardening rules; loading and unloading conditions; Drucker's stability postulates; Convexity and normality; J2 flow theory of plasticity and visco-plasticity, Gurson model.

UNIT - IV

FE procedures for 2D and 3D plasticity: Integration algorithms for rate independent plasticity—explicit forward Euler and implicit backward Euler; Return mapping algorithm; visco-plasticity; FE formulation; Consistent linearization; Algorithmic and consistent tangent modulii; Treatment of incompressible deformation (Locking); B-bar method.

UNIT - V

FE Procedures for Large Deformation Problems: Continuum mechanics—deformation gradient, polar decomposition, Green-Lagrange strain, rate of deformation, Cauchy stress, P-K stresses, Balance laws; Principle of objectivity and isotropy; Constitutive equations for hyper elasticity; Neo-Hookean model; FE formulation—Total Lagrangian and updated Lagrangian descriptions; Tangent Stiffness Matrix. Introduction to finite strain plasticity.

Text Books:

1. K. J. Bathe, "Finite Element Procedures", Prentice-Hall of India Private Limited, New Delhi,1996
2. J. C. Simo and T. J. R. Hughes, "Computational Inelasticity ", Springer-Verlag New York, Inc.,New York, 1998
3. O. C. Zienkiewicz and R. L. Taylor, "Finite Element Method: Volume 2 Solid Mechanics", 5/e, Butterworth-Heinemann, Oxford.

Suggested Reading:

1. T. Belytschko and W. K. Liu and B. Moran, "Nonlinear Finite Elements for Continua and Structures", John Wiley & Sons Ltd., England
2. D. R. J. Owen and E. Hinton, "Finite Elements in Plasticity: Theory and Practice", Pineridge Press Ltd.,

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEE 113

PRODUCT DESIGN AND PROCESS PLANNING

(Programme Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: To make the students to learn the

1. Basic concepts of Product design and Process planning.
2. Reliability, IPR and value analysis.
3. Conceptual design rules for few manufacturing techniques.
4. Ergonomical principles and advanced productivity techniques.
5. Role of computers in design and manufacturing.

Outcomes: At the end of the course, student will be able to

1. Design and process of a product.
2. Implement reliability techniques, IPR and value engineering.
3. Understand and develop appropriate manufacturing techniques.
4. Implement Ergonomical concepts and productivity techniques.
5. Use computers in product design and process planning.

UNIT - I

Product Design And Process Design Functions: Selection of a right product, essential factors of product design, Morphology of design, sources of new ideas for products, evaluation of new product ideas, Product innovation procedure- Flow chart. Qualifications of product design Engineer, Criteria for success/failure of a product. Value of appearance, colours and Laws of appearance

UNIT - II

New Product Development: Product reliability, Mortality Curve, Reliability systems, Manufacturing reliability and quality control. Patents: Definitions, classes of patents, applying for patents, Trademarks and copyrights. Cost and quality sensitivity of products, Elements of cost of a product, costing methods, cost reduction and cost control activities, Economic analysis, Break even analysis Charts, Value engineering in product design, creativity aspects and techniques, Procedures of value analysis – cost reduction, material and process selection

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - III

Various Manufacturing Processes: degree of accuracy and finish obtainable, process capability studies. Methods of improving tolerances. Basic product design rules for Casting, Forging, Machining, Sheet metal and Welding. Physical properties of engineering materials and their importance on products. Selection of plastics, rubber and ceramics for product design.

UNIT - IV

Industrial Ergonomics: Man-machine considerations, ease of maintenance. Ergonomic considerations in product design-Anthropometry, Design of controls, man-machine information exchange. Process sheet detail and their importance, Advanced techniques for higher productivity. Just-in-time and Kanban System. Modern approaches to product design; quality function development, Rapid prototyping.

UNIT - V

Role Of Computer In Product Design: Management of manufacturing, creation of manufacturing data base, Computer Integrated Manufacturing, communication network, production flow analysis, Group Technology, Computer Aided product design and process. Planning. Integrating product design, manufacture and production control.

Text Books:

1. B.W. Niebel and A.B. Draper, A.B., "Product Design And Process Engineering", Mc Graw Hill – Kogalkusha Ltd., Tokyo,1974.
2. A.K. Chitale and Gupta, R.C., "Product Design And Manufacturing", PHI., New Delhi, 2004.

Suggested Reading:

1. Mahajan, M. "Industrial Engineering And Production Management", Dhanpath Rai & Co., 2000.
2. Bhaskaran Gopalakrishnan, " Product Design and Process Planning", Chapman and Hall, New York, 1994.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEE 114

THEORY OF ELASTICITY AND PLASTICITY

(Programme Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: To make the students to learn the

1. Concepts of Stress & Strain.
2. Problems related to Stress and Strain tensor.
3. Stress tensor for a given strain tensor and vice versa for an isotropic and orthotropic material.
4. Derivations of the constitutive equations in plasticity.
5. Evaluation of the load required in deformation process such as forging, rolling, extrusion and wire drawing processes by various methods and compare them.

Outcomes: At the end of the course, student will be able to

1. Describe concepts of stress and strain.
2. Estimate principle components, normal & stress components, deviatoric and hydrostatic components of a given stress or strain tensor.
3. Compute the stress tensor for a given stress tensor and vice versa for isotropic and orthotropic materials under various conditions.
4. Express the stress strain relations of plastic deformation
5. Compute load required in various bulk deterministic processes such as forging, rolling, extrusion, wire drawing with various methods and compose them.

UNIT - I

Basic Concepts of Stress: Definition, State of Stress at a point, Stress tensor, invariants of stress tensor, principle stresses, stress ellipsoid, derivation for maximum shear stress and planes of maximum shear stress, octahedral shear stress, Deviatoric and Hydrostatic components of stress, Invariance of Deviatoric stress tensor, plane stress.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - II

Basic Concepts of Strain: Deformation tensor, Strain tensor and rotation tensor; invariants of strain tensor, principle strains, derivation for maximum shear strain and planes of maximum shear strain, octahedral shear strain, Deviatoric and Hydrostatic components of strain tensor, Invariance of Deviatoric strain tensor, plane strain.

UNIT - III

Generalized Hooke's Law: Stress-strain relationships for an isotropic body for three dimensional stress space, for plane stress and plane strain conditions, differential equations of equilibrium, compatibility equations, Material (D) matrix for Orthotropic Materials.

UNIT - IV

True Stress and True Strain: Von-Mise's and Tresca yield criteria, Haigh–Westergard stress space representation of von - Mise's and Tresca yield criteria, effective stress and effective strain, St. Venants theory of plastic flow, Prandtle–Reuss and Levy–Mise's constitutive equations of plastic flow, Strain hardening and work hardening theories, work of plastic deformation.

UNIT - V

Analysis Methods: Slab method, Slip line field method, uniform deformation energy method, upper and lower bound solutions, Application of Slab method to forging, wire drawing, extrusion and rolling processes.

Text books:

1. Timoshenko and Goodieer, "Theory of Elasticity", 3/e, McGraw Hill Publications, 2004
2. J. Chakrabarty, "Theory of Plasticity", 2/e, McGraw Hill Publications 1998.

Suggested Reading:

1. George E Dieter, "Mechanical Metallurgy", McGraw Hill Publications 1988.
2. L.M. Kachanov, "Fundamentals of Theory of Plasticity", Dover Publications, 2004.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEO 101

INDUSTRIAL SAFETY (Open Elective)

Instruction	3 Theory Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: The students will be able to understand

1. Causes for industrial accidents and preventive steps to be taken.
2. Fundamental concepts of Maintenance Engineering.
3. About wear and corrosion along with preventive steps to be taken
4. The basic concepts and importance of fault tracing.
5. The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry

Outcomes: At the end of the course the students will be able to

1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc

UNIT - I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT – II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT – III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT–IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT – V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication

Suggested Readings:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
2. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London.

19MEO 102

INTRODUCTION TO OPTIMIZATION TECHNIQUES (Open Elective)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: The students will

1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignment techniques
3. Come to know the procedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques

Outcomes: At the end of the course, student will be able to

1. Formulate a linear programming problems (LPP)
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully
4. Apply queing and inventory concepts in industrial applications
5. Apply sequencing models in industries

UNIT - I

Operations Research: Definition, scope, Models, Linear programming problems (LPP), Formulation, Graphical Method, and Simplex Method

UNIT - II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT - III

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

path, Determination of critical path, duration of the project, Free float, Independent float and Total float

UNIT - IV

Queuing Theory and Inventory:: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT - V

Sequencing Models: Introduction, Objectives, General assumptions, processing 'n' jobs through two Machines, processing 'n' jobs through three machines

Text Books:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008.

Suggested Reading:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009.
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010.
3. Harvey M Wagner, "Principles of Operations Research", Prentice Hall of India 2010.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEO 103

COMPOSITE MATERIALS (Open Elective)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand

1. Composite materials and their constituents.
2. Classification of the reinforcements and evaluate the behavior of composites.
3. Fabrication methods of metal matrix composites.
4. Manufacturing of Polymer matrix composites.
5. Failure mechanisms in composite materials.

Outcomes: At the end of the course, student will be able to

1. Classify and characterize the composite materials.
2. Describe types of reinforcements and their properties.
3. Understand different fabrication methods of metal matrix composites.
4. Understand different fabrication methods of polymer matrix composites.
5. Decide the failure of composite materials.

UNIT - I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepegs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V

Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength

Text Books:

1. R.W.Cahn – VCH , "Material Science and Technology", Vol 13, Composites, West Germany.
2. WD Callister, Jr., Adapted by R. Balasubramaniam , "Materials Science and Engineering, An introduction"., John Wiley & Sons, NY, Indian edition, 2007.

Suggested Readings:

1. Ed-Lubin, "Hand Book of Composite Materials"
2. K.K.Chawla, "Composite Materials".
3. Deborah D.L. Chung, "Composite Materials Science and Applications"
4. Daniel Gay, Suong V. Hoa, and Stephen W. Tsai, "Composite Materials Design and Applications"

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19CEO 101

COST MANAGEMENT OF ENGINEERING PROJECTS (Open Elective)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To enable the students to understand the concepts of Project management.
2. To provide knowledge on concepts of Project Planning and scheduling.
3. To create an awareness on Project Monitoring and Cost Analysis
4. To provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis
5. To train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

Outcomes: At the end of the course, student will be able to

1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and leveling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT-I:

Project Management: Introduction to project managements, stakeholders, roles, responsibilities and functional relationships, Principles of project management, objectives and project management system, Project team, organization, roles, and responsibilities, Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT-II:

Project Planning and Scheduling: Introduction for project planning, defining activities and their interdependency, time and resource estimation. Work break

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT-III:

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost, Project direct and indirect costs.

UNIT-IV:

Resources Management and Costing-Variance Analysis: Planning, Enterprise Resource Planning, Resource scheduling and leveling, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis: Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing, Costing of service sector. Just-in-time approach, Material Requirement

UNIT-V:

Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets, Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management: Linear Programming, PERT/CPM, Transportation Assignment problems, Simulation, Learning Curve Theory.

Text Books:

1. Charles T Horngren "Cost Accounting A Managerial Emphasis", Pearson Education; 14 edition (2012),
2. Charles T. Horngren and George Foster, "Advanced Management Accounting" Prentice-Hall; 6th Revised edition (1 February 1987)
3. Robert S Kaplan Anthony A. Atkinson, "Management & Cost Accounting" , Pearson; 2 edition (18 October 1996)

Suggested Reading:

1. K. K Chitkara, "Construction Project Management: Planning, scheduling and controlling", Tata McGraw-Hill Education. (2004).
2. Kumar Neeraj Jha "Construction Project Management Theory and Practice",Pearson Education India; 2 edition (2015)

19EEO 101

WASTE TO ENERGY (Open Elective)

Instruction	3 Theory Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Outcomes: At the end of the course, student will be able to

1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT - I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT – II

Biomass Pyrolysis: Pyrolysis – Types, slow, fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT – III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT–IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT – V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Text Books:

1. V. Ashok V., "Non Conventional Energy", Desai, Wiley Eastern Ltd., 1990.
2. K.C. Khandelwal and Mahdi, S. S., "Biogas Technology - A Practical Hand Book" - Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Suggested Readings:

1. D.S. Challal,"Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.
2. C. Y. WereKo-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1996.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEC 110

DISSERTATION PHASE - I

Instruction	20 Hours per week
CIE	100 Marks
Credits	10

Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.

- Seminar should be based on the area in which the candidate has undertaken the dissertation work.

- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.

- The preliminary results (if available) of the problem may also be discussed in the report.

- The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.

- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 100		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note: Department committee has to assess the progress of the student for every two weeks.

PROFESSOR & HEAD
epartment of Mechanical Engineering
naitanya Bharathi Institute of Technology (A)
ndipet, Hyderabad-500 075. Telangana

19MEC 111

DISSERTATION PHASE - II

Instruction	32 Hours per week
Duration of Semester End Examination	Viva
SEE	100 Marks
CIE	100 Marks
Credits	16

Outcomes: At the end of the course:

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

- It is a continuation of Project work started in semester III.
- The student has to submit the report in prescribed format and also present a seminar.
- The dissertation should be presented in standard format as provided by the department.
- The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
- The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.
- The candidate has to be in regular contact with his/her guide/co-guide.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 100		
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report standard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE (Semester End Examination): Max. Marks: 100		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C201

THERMO DYNAMICS AND COMBUSTION

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to

1. Review the basic laws of thermodynamics and create awareness of the importance of thermodynamic principles in engineering applications
2. Understand the behavior of real gases vis-à-vis ideal gas
3. Create awareness about the importance of combustion reactions in real timeapplications
4. Understand the basic principles of power cycles and its relation with combustion processes
5. Understand various methods of direct energy conversion

Outcomes: At the end of the course, student will be able to

1. Apply various laws of thermodynamics to suit the engineering applications.
2. Apply the knowledge of thermodynamics for the behavior of real gases.
3. Understand the phenomenon of combustion
4. Understand the application of power cycles to engineeringpractice.
5. Understand various non-conventional energy conversion methods like fuel cells etc

UNIT – I

Thermodynamic Laws: Review of Thermo dynamic Laws and Corollaries – Transient Flow Analysis – Second law of thermodynamics – Entropy - Availability and unavailability – Irreversibility – Thermo dynamic Potentials – Maxwell Relations – Specific Heat Relations – Mayer's relation - Evaluation of Thermodynamicpropertiesofworkingsubstance. Third law of thermodynamics, Nerst heat theorem, Introduction to - Statistical thermodynamics, statistical interpretations of first and second law and Entropy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT – II

Real Gas Behaviour: P.V.T. surface – Equations of state – Real Gas Behaviour – Vander Waal'sequation - Generalized compressibility Factor – Energy properties of Real Gases – Vapour pressure – Clausius – Clapeyron Equation – Throttling – Joule – Thompson coefficient, Non-reactive Mixture of perfect Gases – Governing Laws, Real Gas Mixture

UNIT – III

Combustion: Combustion – Combustion Reactions – Enthalpy of Formation – Entropy of Formation – Reference Levels for Tables – Heat of Reaction – Adiabatic flame Temperature, General product – Enthalpies – Equilibrium. Chemical Equilibrium of Ideal Gases – Effects of Non-reacting Gases Equilibrium in Multiple Reactions. The Van Hoff's Equation - The chemical potential and phase Equilibrium – The Gibbs phase Rule

UNIT – IV

Power Cycles: Power cycles, Review Binary vapour cycle, co-generation and combined cycles – Second law analysis of cycles – Refrigeration cycles. Thermo Dynamics of irreversible processes – Thermo electric circuits

UNIT – V

Direct Energy Conversion: Introduction – Fuel Cells - Thermo electric energy – Thermo-ionic power generation -Thermodynamic devices - Magneto Hydrodynamic Generations – Photo voltaic cells

Text Books:

1. Younus. A. Cengel & Michael. A. Boles, "Thermodynamics: An Engineering Approach", 7/e, TMH.
2. Y.V.C. Rao. "Postulates and Statistical Thermodynamics", Allied Publishers Inc., 1994.

Suggested Reading:

1. P.K. Nag, "Basic and Applied Thermodynamics", TMH, 2008.
2. J.P. Holman, "Thermo Dynamics", Mc Graw Hill, 2008
3. Howell and Dedcius, "Fundamentals of Engineering Thermodynamics", McGraw Hill Inc., U.S.A.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C202

ADVANCED FLUID DYNAMICS

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand

1. Understanddifferent typesoffluid flowsand variousfunctionsrelated to fluids
2. Learn important equations related to fluids
3. Understand the concept of boundary layer
4. Understand the isentropic behavior of gas in nozzles
5. Learn about shocks of fluids

Outcomes: At the end of the course, student will be able to

1. Understand the concept of stream and velocity potential function
2. Apply of the knowledge of equations for analysis in cfd
3. Calculate thickness of boundary layer and shear stress
4. Design nozzles and diffusers
5. Estimate various parameters in fluids subjected to shocks

UNIT - I

Fluid Flows: Classification of fluids. Lagrangian and Eularian Methods of Study of fluid flow. Velocity and acceleration vectors. Circulation and Vorticity. Stream lines. Stream tube. Path lines. Streak lines and Time lines. Stream function and Potential function

UNIT - II

Laws of Fluid Flow: Continuity. Euler's and Bernoulli's equations. Incompressible and Compressible flows. Potential and viscous flows. Navier – Stoke's equation and applications

UNIT- III

Concept of Boundary Layer: Flow over an aerofoil– Lift and Drag coefficients. Boundary layer theory – laminar and turbulent boundary layers. Hydrodynamic and thermal boundary layer equations. Flow separation in boundary layers

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - IV

Gas Dynamics: Energy equation for flow and non flow processes. Application of Steady flow energy equation for turbines, turbo-compressors, nozzles and diffusers. Adiabatic energy equation. Acoustic velocity, Mach Number. Stagnation properties. Relationships between static and stagnation properties. Various regimes of flow – Steady flow ellipse

UNIT - V

Principles of Gas Dynamics Applicable to Shocks: Isentropic flow through variable area passages. Design of supersonic and subsonic nozzles and diffusers. Supersonic flows. Expansion and Shock waves. Normal and Oblique Shock waves. Prandtl-Meyer and Rankine-Hugoniot Relations. Simple problems on normal and oblique shock waves.

Text Books:

1. C. P. Kothandaraman, R. Rudramoorthy, "Basic Fluid Mechanics", New Age Intl. Publishers, 2014.
2. S. M. Yahya,"Fundamentals of Compressible flow", Wiley Eastern Ltd, 2014.
3. S. Radhakrishnan, "FundamentalsofCompressibleflow", TMH, 2014.

Suggested Reading:

1. Shapiro, "Compressible fluid flow", Ronold Press, New York, 1956.
2. Liepmen & Rosko, "Elements of Gas Dynamics", Wiley, New York, 1956.
3. Zoeb Hussain, "Gas Dynamics Though Problems", Wiley, New York, 1980.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME M103

RESEARCH METHODOLOGY AND IPR

Instruction	2 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Objectives: To make the students to

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Outcomes: At the end of the course, student will be able to

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques:ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT - I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT - II

Literature Survey Report Writing: Literature Survey: Importanceandpurpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT- III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT - IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT - V

Patents and Copy Right: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C. R. Kothari, "Research Methodology, Methods & Technique", New Age International Publishers, 2004.
2. R. Ganesan,"Research Methodologyfor Engineers", MJPPublishers, 2011.
3. Y. P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004.

Suggested Reading:

1. Ajit Parulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications", Macmillan India ltd, 2006
2. B. L.Wadehra, "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications", Universal law Publishing Pvt. Ltd., India2000.
3. P. Narayanan, "Law of Copyright and Industrial Designs", Eastern law House, Delhi 2010.

20ME E201

THERMAL AND NUCLEAR POWER PLANTS

(Programme Elective – I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand

1. Performance of steam power plant and to observe the importance of combustion of coal
2. Combined cycle effect in gas turbine power plants
3. Different nuclear reactors and estimate the economical benefits
4. Calculation of different energy tariffs under various load conditions
5. Pressure, temperature and flow parameters of a power plant

Outcomes: At the end of the course, student will be able to

1. Analyze on combustion of coal and find performance of different power plant cycles
2. Analyze the combined cycle power plants and waste heat recovery systems
3. Design various types of nuclear reactors taking safety precautions and making economically beneficial
4. Calculate the energy rates of power distribution considering the factors affecting the economy
5. Determine the pressure, temperature and flow measurements of steam and water to operate the power plant most efficiently and suggest various remedies to control pollutants

UNIT - I

Layout of Power Plants: Sources of Energy, types of Power Plants, Direct Energy Conversion System, Energy Sources in India, and Recent developments in Power Generation. Combustion of Coal, Volumetric Analysis, Gravimetric Analysis, and Flue gas analysis. Steam Power Plants: Introduction – General Layout of Steam Power Plant, Modern Coal-fired Steam Power Plants, Power Plant cycles, Fuel handling, Combustion Equipment, Ash handling, Dust Collectors

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - II

Combined Cycle Power Plant: Cogeneration, Combined cycle Power Plants, Analysis, Waste-Heat Recovery, IGCC Power Plants, Fluidized Bed Combustion – Advantages & Disadvantages

UNIT- III

Nuclear Power Plant: Nuclear Physics, Nuclear Reactors, Classification – Types of Reactors, Site Selection, Methods of enriching Uranium, Applications of Nuclear Power Plants. Nuclear Power Plants Safety: By-Products of Nuclear Power Generation, Economics of Nuclear Power Plants, Nuclear Power Plants in India, Future of Nuclear Power

UNIT - IV

Economics of Power Plant: Economics of Power Generation: Factors affecting the economics, Load Factor, Utilization factor, Performance and Operating Characteristics of Power Plants. Economic Load Sharing, Depreciation, Energy Rates, Criteria for Optimum Loading, Specific Economic energy problems

UNIT - V

Power Plant Instrumentation: Classification, Pressure measuring instruments, Temperature measurement and Flow measurement. Analysis of Combustion gases, Pollution – Types, Methods to Control

Text Books:

1. E.L.Wakil,"Power Plant Technology", Mc Graw Hill, New York, 1985.
2. J. Weis Man and R Eckert, "Modern Power Plant Engineering", PHI, NewDelhi, 1983.

Suggested Reading:

1. S.C.Arora and S. Domkundwar, "Acourse in Power Plant Engineering", Dhanpat Rai & Sons 2002.
2. P. K. Nag, "Power Plant Engineering", TMH, 2003.
3. P.C. Sharma, "Power Plant Engineering", Kataria Publications. 2007.

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E202

ENVIRONMENTALENGINEERINGAND POLLUTION CONTROL

(Programme Elective – I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand

1. Harmful effects of pollutants and their control
2. Different techniques adopted in solid waste management
3. Causes and remedies for waterpollution
4. Other types of pollution like oils, pesticides, noiseetc
5. Controlling methods adopted to reduce pollution from their power plants

Outcomes: At the end of the course, student will be able to

1. Estimate air pollutants and suggest suitable remedial methods to control them
2. Suggest a suitable solid waste disposal system
3. Suggest suitable remedy to control water pollution
4. Suggest suitable remedy to control other pollutants like oils, pesticides, noise etc.
5. Suggest a suitable instrumentation for pollution control

UNIT - I

Air Pollution: Sources and Effect - Acid Rain - Air Sampling and Measurement - Analysis of Air Pollutants - Air Pollution Control Methods and Equipments - Issues inAir Pollution control.

UNIT - II

Solid Waste Management: Sources and Classification - Characteristics of solid waste-Potential methods of solid waste Disposal – Process and Equipments for Energy Recovery from Municipal Solid Waste and Industrial Solid Waste

UNIT- III

Water Pollution: Sources and Classification of Water Pollutants - Characteristics - Waste Water Sampling Analysis - Waste Water Treatment - Monitoring compliance with Standards - Treatment, Utilization and Disposal of Sludge

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

UNIT - IV

Other Types of Pollution: Noise Pollution and its impact- Oil Pollution - Pesticides - Radioactivity Pollution Prevention and Control

UNIT - V

Pollution from Thermal Power Plants and Control Methods: Instrumentation for pollution control - Water Pollution from Tanneries and other Industries and their control

Text Books:

1. G. Masters, "Introduction to Environmental Engineering and Science", Prentice –Hall, International Editions, 1988..
2. S. Peavy, D. R. Rowe and G. Tchobanoglous, "Environmental Engineering", McGraw- Hill Book Company, NY, 1985.

Suggested Reading:

1. H. Ludwig and W. Evans, "Manual of Environmental Technology in Developing Countries", 1991.
2. "Environmental Considerations in Energy Development", Asian Development Bank (ADB), Manilla, 1991.

PReddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E103

OPTIMIZATION TECHNIQUES

(Programme Elective – I)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: The students will

1. Come to know the formulation of LPP models
2. Understand the Algorithms of Graphical and Simplex Methods
3. Understand the Transportation and Assignmenttechniques
4. Come to know the procedure of Project Management along with CPM and PERTtechniques
5. Understand the concepts of sequencing and queuing theory

Outcomes: At the end of the course, student will be able to

1. Formulate a managerial decision problem into a mathematical model.
2. Apply Operations Research models to real time industry problems
3. Build and solve Transportation Models and Assignment Models.
4. Apply project management techniques like CPM and PERT to plan and execute project successfully
5. Apply sequencing and concepts in industry applications

UNIT - I

Basic Concepts: Operations Research definition, scope, Models, Linear programming problems, Formulation, Graphical Method, Simplex Method, and Duality insimplex.

UNIT - II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel'sApproximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT- III

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times,

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

Determination of ES and EF times in forward path, LS & LF times in backward path, Determination of critical path, duration of the project, Free float, Independent float and Total float, Crashing of network.

UNIT - IV

Queuing Theory: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT - V

Sequencing Models: Introduction, General assumptions, processing 'n' jobs through two Machines, processing 'n' jobs through three machines. Game Theory – definition saddle point Principle of Dominance.

Text Books:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi,2008

Suggested Reading:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010
3. Harvey M Wagner,"Principles of Operations Research", Prentice Hall of India 2010

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E203

AIR CONDITIONING SYSTEM DESIGN

(Programme Elective – II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand

1. The difference between refrigeration and air conditioning
2. Working principles of simple vapour compression refrigeration cycle and absorption refrigeration
3. Necessity of psychrometry chart in air conditioning system design
4. Classification of air conditioning systems
5. How to calculate loads on air conditioning sysem

Outcomes: At the end of the course, student will be able tounderstand

1. Effect of refrigerants on environment and ozone depletion,
2. List out merits and demerits of absorption refrigeration systemover simple vapour compression refrigerationsystem
3. List out factors effecting design of air conditioning system
4. Importance of air conditioning in engineering applications
5. Design components used in air conditioning circuits

UNIT - I

Refrigeration and Air Conditioning: Differentiation of refrigeration and air conditioning, COP, tone of refrigeration, classification of refrigerant, properties of refrigerants, eco-friendly refrigerants, green-house effect, ozone depletion, air refrigeration, Bell Coleman cycle, air craft refrigeration, classification of ari craft refrigeration

UNIT - II

Refrigeration Systems: Simple vapor compression refrigeration system, COP, pressure-enthalpy, temperature-entropy diagrams, theoretical and practical cycles, absorption refrigeration cycle, COP of absorption refrigeration cycle, simple and practical NH3 refrigeration cycle, Electrolux refrigeration cycle, lithium bromide refrigerationcycle

UNIT- III

Psychrometry : Introduction to psychrometry, psychrometric processes, comfort air conditioning, factors effecting comfort air conditioning, thermodynamics of human being, effective temperature, comfort chart, by-pass factor, indoor air quality, infiltration, problems on summer air conditioning and winter air conditioning

UNIT - IV

Air Conditioning Systems : Classification of air conditioning systems, window air conditioning system, split air conditioning system, year round air conditioning system, ERSH, GSHF, industrial air conditioning, transport air conditioning, food processing industries, photographic industries, food preserving industries, chillers

UNIT - V

Design of Air Conditioning System: Loads on air conditioning system, factors effecting design of air conditioning system, design of condensers, evaporators, fillers, humidifiers, de-humidifiers, fans, blowers and ducts, expansion devices, case studies of calculation of heat loads like auditorium, operation theatre, chilling centers, software used in design of air conditioning system.

Text Books:

1. C. P. Arora, "Refrigeration &Air Conditioning", Tata Mc Graw Hill, 1985.
2. Stoecker, "Refrigeration &Air Conditioning", Mc Graw Hill, 1992.
3. W. P. Jones, "Air Conditioning Engineering", Edward Arnold Publishers Ltd., London, 1984.

Suggested Reading:

1. Norman C. Harris, "Modern Air Conditioning", New York, McGraw-Hill,1974.
2. Manohar Prasad, "Refrigeration &Air Conditioning", New Age Publishers, 2014.
3. ASHRAE Hand book.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E205

DESIGN OF SOLAR AND WIND SYSTEMS

(Programme Elective – II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand

1. Need and importance of NCES and extent of Solar Energy as source.
2. Concepts of Solar collectors, applications and Storage.
3. Concepts of Solar Energy storage
4. Wind Energy Conversion Fuel cell and MHD principles
5. Biomass conversion principles and also about Geothermalenergy

Outcomes: At the end of the course, student will be able to

1. Understand the implementation status of NCES in India along with basic concepts of Solar Energy
2. Analyze the performance of Solar Collectors
3. Understand PV Cell technology and storage methods
4. Conceptually design the wind turbine and understand fuel cells functioning.
5. Understand various Waste to Energy conversion technologies.

UNIT - I

Basics And Solar Energy: Definition-Concepts of Non Conventional Energy Sources (NCES), potential and limitations of NCES, their Classification and comparison, Solar Radiation, Basic definitions, Sun to Earth angles, Sun rise, Sunset and Day length

UNIT - II

Solar Energy Collectors: Flat plate and concentrating collectors along with their applications. Performance of flat plate and concentrating collectors. P-V Cell.

UNIT- III

Solar Energy Storage and Applications: Solar Satellite, Different Methods of storage, Sensible, Latent and Stratified, Solar engine Stirling and Brayton engines Solar Ponds, solar chimney, solar satellite, Stand alone grid connection.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - IV

Wind Energy: Wind energy conversion, General formula -Lift and Drag- Basics of wind energy conversion -Effect of density, frequency variances, angle of attack, and wind speed. Windmill rotors- Horizontal axis and vertical axis rotors. Determination of torque coefficient, Induction type generators- working principle, Fuel Cells and MHD Working principles

UNIT - V

Bio-mass and Geothermal Energy: Availability of Biomass and various conversion process; Direct Combustion, Thermo chemical and Bio chemical conversion process, Factors effecting generation of Biogas and various types of biogas plants, Introduction to Geothermal Energy

Text Books:

1. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley.
2. Hasan Sayed, and D K Sharma, "Non Conventional Energy Sources", Katson Publishing.
3. G. D. Rai, "Non Conventional Energy Sources".

Suggested Reading:

1. S.P. Sukhatme. "Solar Energy", Tata Mcgraw Hill Publishing, 2014..
2. N.K. Bansal, "Non Conventional Energy Sources", Vikas Publishers, 2012.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

20CE A101

DISASTER MITIGATION AND MANAGEMENT

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives:

1. To equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. To equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Outcomes: At the end of the course the students are able to

1. Analyze and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various participatory approaches/strategies and their application in disaster management.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

UNIT- I:

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II:

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III:

Human induced hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Casestudies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storeyed buildings.

UNIT- IV:

Disaster Impacts: Disasterimpacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects- gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT- V:

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response- water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni, "Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh,"Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs, "Government of India, "National disaster management plan, Part I and II"
2. K. K. Ghosh,"Disaster Management", APH Publishing Corporation, 2006.
3. "Hazards, Disasters and your community: Abooklet for students and the community", Ministry of home affairs.

Online Resources:

1. http://www.indiaenvironmentportal.org.in/files/file disaster_management_india1.pdf
2. http://www.ndmindia.nic.in/(National Disaster management in India, Ministry of Home Affairs)

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EG A101

ENGLISH FOR RESEARCH PAPER WRITING

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: The Course will introduce the students to

1. Understand the nuances of language and vocabulary in writing a Research Paper.
2. Develop the content, structure and format of writing a research paper.
3. Produce original research papers without plagiarism.

Outcomes: After successful completion of the course, the students will be able to

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. To review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the research work.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT - I

Academic Writing : Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT - II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT- III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT - IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

UNIT - V

Research Paper Publication: Reputed Journals– National/International– ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – /Advantages/Benefits

Text Books:

1. C. R Kothari, Gaurav, Garg, "Research Methodology Methods and Techniques", 4/e, New Age International Publishers.

Suggested Reading:

1. Day R, "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006
2. "MLA Hand book for writers of Research Papers", 7/e, East West Press Pvt. Ltd, New Delhi
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers", Tata McGraw Hills Pvt. Ltd, New Delhi.

Online Resources:

1. NPTEL: https://onlinecourses.nptel.ac.in/noc18_mg13/preview

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EG A102

INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Objectives: The Course will introduce the students to

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement. to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Outcomes: After successful completion of the course, the students will be able to

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutional remedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
5. Understand Electoral Process, special provisions.

UNIT - I

History of making of the Indian constitutions: History, Drafting Committee (Composition &Working).

Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT - II

Contours of Constitutional Rights and Duties - Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT- III

Organs of Governance - Parliament: Composition, Qualifications, Powers and Functions

Union Executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT - IV

Local Administration - District's Administration head: Role andimportance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role. Block level: Organizational Hierarchy(Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT - V

Election commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

Text Books:

1. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1/e, 2015.
2. M. P. Jain, "Indian Constitution Law", 7/e, Lexis Nexis, 2014

Suggested Reading:

1. "The Constitution of India", 1950 (Bare Act), Government Publication
2. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E204

ENERGY CONSERVATION AND MANAGEMENT

(Programme Elective – II)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand

1. Know the importance of energy sector in countries' development
2. Identify various auditing services
3. Prepare the organizational structure energy policy
4. Get the concept of management in process industries
5. Explain how to take tax considerations

Outcomes: At the end of the course, student will be able to

1. Know energy scenario both India and world
2. Review and asses the various audit tools
3. Understand energy policy planning and take energy management as a profession
4. Analyze energy security, codes, standards
5. Arrange the financial arrangements forindustries

UNIT - I

Global & Indian Energy Scenario: Classification of Energy sources-Energy needs of growing economy-Energy sector reform, Energy and Environment: Global Environmental Concerns, Basics of Energy and its various forms.

UNIT - II

Energy Audit: Types of energy audit, Energy Auditing Services Basic Components of an Energy Audit Specialized Audit Tools Industrial Audits Commercial Audits Residential Audits Indoor Air Quality

UNIT- III

Energy Management: Program

Organizational Structure, Energy Policy Planning Audit Planning Educational Planning Strategic Planning, The Value of Energy Management The Energy Management Profession Some Suggested Principles of Energy Management, Energy Management Systems Justification of EMCSs Systems Integration

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - IV

Waste Heat Recovery: Energy Management in Process Industries, Energy Security, Codes, Standards, Electricity Act, Energy Conservation Act. Economics of Waste-Heat Recovery, Energy management in water and waste water treatment – solid waste treatment- air pollution control systems . Energy Management in Boilers and Fired systems – Steam and condensate systems – cogeneration –

UNIT - V

Capital Investments: Introduction General Characteristics of Capital Investments, Sources of Funds Tax Considerations Time Value of Money Concepts Project Measures of Worth Economic Analysis-Financing Energy Management Projects Introduction Financial Arrangements: A Simple Example Financial Arrangements: Details and Terminology Applying Financial Arrangements: A Case Study "Pros" & "Cons"

Text Books:

1. W. C. Turner, "Energy Management Handbook", 5/e, Marcel Dekker, Inc, New York, 2005.
2. W. R. Murphy and G. McKay, "Energy Management", Butterworth Heinemann, 2007.

Suggested Reading:

1. "General Aspects of Energy Management and Audit", National Productivity Council of India, Chennai (Course Material- National Certification Examination for Energy Management).
2. B. L. Capehart, W. C. Turner, W. J. Kennedy, "Guide to Energy Management", CRC Press, New York, 2005.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EG A104

PERSONALITY DEVELOPMENT THROUGH LIFE'S ENLIGHTENMENT SKILLS

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: The Course will introduce the students to

1. Learn to achieve the highest goal happily.
2. Become a person with stable mind, pleasing personality and determination.
3. Awaken wisdom amongthem.

Outcomes: After successful completion of the course, the students will be able to

1. Develop their personality and achieve their highest goal of life.
2. Lead the nation and mankind to peace and prosperity.
3. Practice emotional self regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatile personality.

UNIT - I

Neetisatakam – Holistic Development of Personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT - II

Neetisatakam – Holistic Development of Personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT- III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagavadgeetha: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 – Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT - IV

Statements of Basic Knowledge - Shrimad Bhagavadgeetha: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - V

Role of Bhagavadgeetha in the Present Scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Text Books:

1. "Srimad Bhagavad Gita" , Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

Suggested Reading:

1. "Bhartrihari's Three Satakam (Niti-sringar-vairagya)", P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Online Resources:

1. NTPEL: http://nptel.ac.in/downloads/109104115/

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C203

THERMAL SYSTEMS LAB

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Objectives: Student will understand to

1. Evaluate the performance of I.C Engine
2. Determine heat transfer coefficient in two phase heat transfer
3. Determine effectiveness of cross flow heat exchanger
4. Evaluate the thermal properties of fluids
5. Evaluate the COP of Refrigeration & Air conditioning Tutors

Outcomes: At the end of the course, student will be able to

1. Estimate the thermal efficiency of IC engine
2. Prove that value of convection heat transfer coefficient is very high with two phase heat transfer
3. Estimate the effectiveness of cross flow heat exchanger and prove that it is very high compared with other configurations
4. Find out properties of fluids such as coefficient of thermal expansion, enthalpy of fusion
5. Determine COP of Refrigeration and air conditioned tutors

List ofExperiments:

1. Performance Evaluation on single/multi cylinder 4-stroke SI Engine.
2. Performance Evaluation on single/multi cylinder 4 stroke CI Engine.
3. Determination of heat transfer coefficient in Film wise and Drop wise condensation
4. To determine the effectiveness of Cross flow Heat Exchanger.
5. Heat Pipe Demonstration
6. Performance text on Axial flow compressor
7. Determination of coefficient of thermal expansion of Solids, Liquids and Gases
8. Determination of thermal capacity of Solids
9. Determination of isentropic coefficient of air by Clement-Desormes method
10. Measure of enthalpy of fusion and solidification
11. Determination of COP of Refrigeration tutor
12. Determination of COP of Air-conditioning tutor

<u>**Note**</u> : Out of the above 12 experiments, any ten experiments have to be carried out.

Text Books:

1. Younus. A. Cengel & Michael A. Boles, "Thermodynamics An Engineering Approach", 7/e, TMH.
2. Y.V.C. Rao. "Postulates and Statistical Thermodynamics", Allied Publishers Inc., 1994.

Suggested Reading:

1. P.K. Nag, "Basic and Applied Thermodynamics", TMH, 2008.
2. J.P.Holman, "Thermo Dynamics", Mc Graw Hill, 2008.
3. Howell and Dedcius, "Fundamentals of Engineering Thermodynamics", McGraw Hill Inc., U.S.A.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C204

DESIGN OF SOLAR AND WIND SYSTEMS LAB

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Objectives: To make the students to understand

1. Concepts of solar energy collection and measurements
2. Wind and solar thermal applications
3. Direct conversion using solar PV cell
4. Wind turbine working and factors effecting its performance
5. Bio energy conversion principles

Outcomes: At the end of the course, student will be able to

1. Measure radiation using various instruments
2. Find the performance of solar water pump, water heater
3. Determine the effect of tilting angle on pv cell
4. Evaluate efficiency of wind turbine
5. Differentiate KVIC and JANATAbio energy conversion systems

List of Experiments:

1. Study of direct and diffused beam solar radiation (Solar Radiation Measurement)
2. Performance evaluation of solar flat plate collector (water heating, water pumping)
3. Performance evaluation of concentrating solar collector
4. Performance of PV panel in series and parallel combination: (Charging characteristics of a battery using PV panel, Effect of tilt angle on solar PV panel, Effect of shadow on solar PV panel , Effect of surrounding temperature on PV panel)
5. Study of direct and indirect solar dryer (how to dry various types of Agricultural products)
6. Analysis of KVIC Bio gas plant
7. Performance studies of Gasifier
8. Study of Janata Bio gas plant, Deenabandhu Biogas plant for demonstration
9. Small wind turbine of 500kw for the purpose of demonstration

Text Books:

1. J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley.
2. Hasan Sayed and D. K. Sharma, "Non Conventional Energy Sources", Katson Publishing.
3. G.D. Rai, "Non Conventional Energy Sources".

Suggested Reading:

1. P. Sukhatme "Solar Energy", Tata Mcgraw Hill Publishing, 2004
2. N.k. Bansal, "Non Conventional Energy Sources". Vikas Publishing, 2009.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C106

FINITE ELEMENT TECHNIQUES

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to

1. Understand finite element analysis fundamentals andformulations
2. Formulate the axial, truss, beam and 2D problems
3. Formulate the heat conduction and dynamics problems, understand the use of numerical integration and Gauss quadrature
4. Understand the convergence requirements and 3D problems
5. Perform engineering simulations using finite element analysis software (ANSYS)

Outcomes: At the end of the course, Student will be able to

1. Apply FE method for solving field problems using virtual work and potential energy formulations
2. Analyze linear problems like axial, truss and beam, torsional analysis of circular shaft
3. Analyze 2D structural problems using CST element and analyze the axi-symmetric problems with triangular elements. Write shape functions for 4 node quadrilateral, isoparametric elements and apply numerical integration and Gaussian quadrature to solve theproblems.
4. Evaluate the eigen values and eigen vectors for stepped bar, formulate 3 D elements, check for convergence requirements
5. Solve linear 1 D and 2 D heat conduction and convection heat transfer problems, Use of FEA software ANSYS for engineering solutions

UNIT - I

Introduction to Finite Element Method of Solving Field Problems: Stress and Equilibrium. Boundary conditions. Strain-Displacement relations. Stress-strain relations.

One Dimensional Problem: Finite element modeling. Local, natural and global coordinates and shape functions. **Potential Energy Approach**: Assembly of Global stiffness matrix and load vector. Finite element equations, treatment of boundary conditions. Quadratic shape functions.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - II

Analysis of Trusses: Analysis of plane truss with number of unknowns not exceeding two at each node.

Analysis of Beams: Element stiffness matrix for two noded, two degrees of freedom per node for beam element

Analysis of Frames: Analysis of frames with two translations and a rotational degree of freedom at each node.

UNIT- III

Two Dimensional StressAnalysis: Finite element modeling of two dimensional stress analysis problems with constant strain triangles and treatment of boundary conditions. Two dimensional four noded isoparametric elements and numerical integration. Finite element modeling of Axisymmentric solids subjected of axisymmetric loading with triangular elements.

Convergence requirements and geometric isotropy

UNIT - IV

Steady State Heat TransferAnalysis: One dimensional analysis of a fin and two dimensional conduction analysis of thin plate.

Time Dependent Field Problems: Application to one dimensional heat flow in a rod.

Dynamic Analysis: Formulation of finite element modeling of Eigen value problem for a stepped bar and beam. Evaluation of Eigen values and Eigen vectors.

Analysis of a uniform shaft subjected to torsion using Finite Element Analysis.

UNIT - V

Three Dimensional Problems in StressAnalysis: 3D elements: Introduction to tetrahedron and brick elements.

Introduction to thin and thick plates

Introduction to non-linear formulation through FE.

Text Books:

1. R. Tirupathi. Chandrupatla and D.B. Ashok, "Introduction of Finite Element in Engineering", Prentice Hall of India, 2004.
2. S.S. Rao. "The Finite Element Methods in Engineering", 2/e, Pergamon Press, 2001.
3. David. V. Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill, 2003.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Suggested Reading:

1. Robert Cook , "Concepts and applications of finite element analysis", 4/e, John Wiley and sons, 2009.
2. K.J. Bathe, "Finite element procedures", 2/e, Prentice Hall of India, 2007.
3. D.L. Logan, "First course in finite element method", 5/e, Mason, OH: South Western, Cengage Learning, 2011.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C205

ADVANCED HEAT AND MASS TRANSFER

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to

1. Understand the basic principles of fins and unsteady state heat transfer applied to industries.
2. Learn various equations and their application in engineering heat transfer
3. Understand boundary layer concept and their applications
4. Learn about principles of phase heat transfer and radiation heat transfer
5. Learn about mass transfer and its applications in process industries

Outcomes: At the end of the course, Student will be able to

1. Apply the equations pertaining to unsteady state heat transfer and knowledge in extended surfaces
2. Evaluate mass, momentum and energy equations with approximate and exact methods
3. Apply heat transfer knowledge in calculation of boundary layer thickness and various dimensionless numbers
4. Evaluate heat transfer coefficients under phase change phenomena and radiation heat transfer
5. Apply the knowledge of mass transfer in process industries

UNIT - I

Brief Introduction to Different Modes of Heat Transfer: Conduction: General heat conduction equation-Initial and Boundary conditions Steady State Heat Transfer: Simplified heat transfer in 1D and 2D – Fins. Transient heat conduction; Lumped system analysis- Heisler charts-semi infinite solid-use of shape factors in conduction - 2D transient heat conduction – product solutions

UNIT - II

Finite Difference Methods for Conduction: 1D & 2D steady state and simple transient heat conduction problems – implicit and explicit methods. Forced Convection: Equations of Fluid Flow – Concepts of Continuity, momentum

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

equations – Derivation of Energy equation - Methods to determine heat transfer coefficient: Analytical Methods - Dimensional Analysis and concept of exact solution.Approximate Method – Integral analysis

UNIT- III

External Flows: Flow over a flat plate: Integral method for laminar heat transfer coefficient for different velocity and temperature profiles. Application of empirical relations to variation geometrics for Laminar and Turbulent flows. Internal flows: Fully developed flow: Integral analysis for laminar heat transfer coefficient – Types of flow – Constant Wall Temperature and Constant Heat Flux Boundary Conditions - Hydrodynamic & thermal entry lengths; use of empirical correlations

UNIT - IV

Free Convection & Radiation: Approximate analysis on laminar free convective heat transfer – Boussinesque Approximation - Different geometries – combined free and forced convection, Boiling and condensation: Boiling curve – Correlations- Nusselt's theory of film condensation on a vertical plate – Assumptions & correlations of film condensation for different geometrics

UNIT - V

Mass Transfer: Radiation Heat Transfer, Radiant heat exchange in grey,non-greybodies, withtransmitting, reflectingandabsorbingmedia, specularsurfaces, gas radiation – radiation from flames. Mass Transfer: Concepts of mass transfer – Diffusion & convective mass transfer Analogies – Significance of non-dimensional numbers.

Text Books:

1. Necati Ozisik, "Heat Transfer", TMH, 1998.
2. Incropera Dewitt, "Fundamentals of Heat & Mass Transfer", John Wiley,2007.
3. Yunus A. Cengel, "Heat Transfer: A basic approach", TMH, 2008.

Suggested Reading:

1. R. C. Sachdeva, "Fundamentals of Engineering Heat & Mass Transfer", New Age International Publications, 2010.
2. J.P. Holman, "Heat Transfer", Mc Graw Hill, 2008.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E206

COMPUTATIONAL FLUID DYNAMICS
(Programme Elective – III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to learn the

1. Basic equations and concept of CFD
2. Concept of pdes and finite difference methods
3. Various types of grid generation and errors in numerical solution
4. Crank-Nihcolson, Implicit and Explicit methods & Jacobi, Gauss Seidel and ADI methods
5. Importance of FVM

Outcomes: At the end of the course, student will be able to

1. Derive CFD governing equations and turbulence models
2. Apply elliptical, parabolic and hyperbolic pdes and forward, backward and center difference methods
3. Understand errors, stability, consistency and develop O,H and C grid generated models
4. Evaluate the use of Crank-Nihcolson, Implicit and Explicit methods and analyze problem by Jacobi, Gauss Seidel and ADI methods
5. Solve conduction and convection problems using FVM.

UNIT - I
Governing Equations: Continuity, Momentum and Energy equations, Navier Stokes equations, Reynolds and Favre averaged N – S equations. Introduction to turbulence, Turbulence models-mixing length model, K-å turbulence Model.

UNIT - II
Grid Generation: Grid Generation- Types of grid O,H,C. Coordinate transformation, Unstructured grid generation, Errors, Consistency, Stability analysis by von Neumann. Convergence criteria

UNIT- III
Classification of PDEs: Elliptic, parabolic and hyperbolic equations, Initial and boundary conditions. Concepts of Finite difference methods – forward, backward and central difference

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - IV

Finite Difference Solutions: Finite difference solutions - Crank Nicholson, Implicit and explicit, ADI - Jacobi, Gauss Seidel, solution for Viscous incompressible flow using Stream function – Vorticity method

UNIT - V

Finite Volume Method: Introduction to Finite volume method, Finite volume formulations for diffusion equation, convection diffusion equation, Solution algorithm for pressure velocity coupling in steady flows. Use of Staggered grids SIMPLEAlgorithm

Text Books:

1. John D. Anderson, "Computational Fluid Dynamics", Mc Graw Hill Inc., 2015.
2. H. K. Versteeg and Malala Shekara, "Introduction to Finite Volume Method", Pearson, 2015.

Suggested Reading:

1. K. Muralidhar and T. Sundararajan T., "Computational Fluid flow and Heat transfer", Narosa Publishing House, 2003.
2. S.V. Patankar, "Numerical Heat transfer and Fluid flow", Hemisphere Publishing Company, New York, 1980.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E207

REFRIGERATION AND CRYOGENICS

(Programme Elective – III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to learn the

1. Importance of selection of refrigerant,
2. Utility of simple vapour compression refrigeration cycle
3. Working principle of absorption refrigeration cycle,
4. The design principles of components of refrigeration system
5. Working principle of gas liquefaction

Outcomes: At the end of the course, student will be able to

1. Learn the applications of refrigeration and ODP, GWP and related environment issues
2. To design the refrigeration systems for domestic applications
3. Understand absorption refrigeration system and its advantages over vapor compression refrigeration
4. Design equipment needed for refrigeration system like evaporators, condensers.
5. To understand the applications in cryogenics and gas-liquefaction system

UNIT - I

Fundamentals of Refrigeration: Definition of refrigeration, applications of refrigeration, COP, tone of refrigeration, refrigerants and their classification, properties of refrigerants, designation of refrigerants, ozone depletion, eco-friendly refrigerants, Air Refrigeration, Bell Coleman cycle, air craft refrigeration, classification

UNIT - II

Vapor Compression Refrigeration System: Actual cycle, theoretical cycle, flash chamber, accumulator, sub-cooling, superheating, cascade refrigeration, wet compression, dry compression, improvements in the performance of cycle, multi-stage compression with Intercooling, multi-evaporator system

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT- III

Vapor Absorption Refrigeration System: Absorption Refrigeration, Simple and Practical NH3 refrigeration, Electrolux refrigeration, LiBr refrigeration system, Efficiency of absorption refrigeration system, steam jet refrigeration, merits and demerits of steam jet refrigeration over simple vapour compression cycle

UNIT - IV

Refrigeration Applications and Psychrometry: Design, selection of evaporators, condensers, control systems, motor selection, Refrigeration applications, food preservation, transport, Introduction to psychrometry, psychrometric processes, humidifiers, de-humidifiers, filters, ducts

UNIT - V

Cryogenics: Application of cryogenics, Gas liquefaction systems - Linde-Hampson, Linde dual pressure, Claudecycle, merits of one system over other system, Production of liquid air, Production of liquid nitrogen and production of liquid oxygen.

Text Books

1. C. P.Arora, "Refrigeration and Air-conditioning", Tata McGraw-Hill, 2000.
2. Stoecker & Jones, "Refrigeration and Air-conditioning", McGraw Hill Book Company,1992.
3. Bailey, "Advanced Cryogenics", Plenum Press, London, 1971.

Suggested Books.

1. Jordan & Priester, "Refrigeration and Air-conditioning", Prentice-Hall, 2/e, 1957.
2. G.G. Hasseldon, "Cryogenic Fundamentals", Academic Press,1992.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E208

DESIGN OF HEAT EXCHANGERS
(Programme Elective – III)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: To make the students to learn the
1. Importance of heat exchanger in engineering application
2. Various co-relations for forced convection heat transfer coefficients for differentgeometries
3. Importance of pressure drop and its effect on heat transfer rate
4. Working principle of hair pin heat exchanger
5. Design concepts of condensers and heat pipe

Outcomes: At the end of the course, student will be able to
1. Explain different types of heat exchangers, LMTD method and NTU methods
2. List out co-relations for forced convection heat transfer coefficient for various geometries
3. Estimate the pressure drop in laminar and turbulent flow in heat exchangers
4. Determine pressure drop in hair pin and finned tube heat exchangers
5. Explain design and operational considerations in condensers and heat pipes

UNIT - I

Heat Exchanger Types and Design Methods: Tubular heat exchangers, plate heat exchangers, extended surface heat exchangers, flow arrangements, applications, overall heat transfer coefficient, multi-pass and cross flow heat exchangers, LMTD method, NTU method for heat exchanger analysis

UNIT – II

Forced Convection Heat Transfer Coefficient: Laminar forced convection in ducts and concentric annuli, turbulent forced convection in ducts and circular pipes, heat transfer in helical coils, and spirals and heat transfer in bends.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT – III

Pressure Drop and Fouling: Tube side pressure drop in laminar and turbulent flows, pressure drop in bends and fittings, Fouling of heat exchangers, basic considerations, effect of fouling on heat transfer and pressure drop.

UNIT - IV

Hair Pin and Finned Heat Exchangers: Pressure drop-hydraulic diameter, hair pin heat exchanger, parallel and series arrangements of hairpins, total pressure drop, compact heat exchangers, plate-fin heat exchangers, tube fin heat exchangers, pressure drop for fin tube heat exchanger

UNIT - V

Condensers: Horizontal shell and tube condensers, plate condensers, air cooled condensers, design and operational considerations, Heatpipe, workingprinciple, heat pipe components and materials

Text Books:

1. Donald Q. Kern, "Process Heat Transfer", TMH Publications, 1963.
2. Sadik Kakac and Hongtan Liu, "Heat Exchangers-Selection,Rating and Thermal Design", 3/e, CRC Press, 2012.
3. David Reay and Peter Kew, "Heat Pipes, Theory, design and Applications", Butterworth-Heinemann (Elsevier), 5/e, 2006.

Suggested Reading:

1. S. Kakac, A. E. Bergles and F. Mayinger, "Heat Exchangers, Thermal, Hydraulic Fundamentals and Design", Hemisphere Publications, 1981.
2. "Standards of Tubular Exchangers Manual Association (TEMA)", 7/e, 1988.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E209

TURBO MACHINES
(Programme Elective – IV)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand

1. Principles and equations of turbo machinery
2. Velocity triangle and power developed by steam turbines
3. Working principles of Pelton, Francis and Kaplan turbines
4. Working principles of axial flow compressor and centrifugal compressor and their performance
5. Power required for rotary compressors and power developed bygas turbines

Outcomes: At the end of the course, student will be able to

1. Apply gas dynamics equations depending upon applications
2. Estimate the power developed by steam turbines
3. Calculate hydraulic efficiency of impulse and reaction turbines
4. Find the efficiency, pressure rise, degree of reaction, slip factor and performance of axial flow and centrifugal compressors
5. Understand cycles and improve the cycle efficiency in gas turbines

UNIT - I

Fundamentals of Turbo Machines: Classifications, Applications, Isentropic flow, Energy transfer, Efficiencies, Static and Stagnation conditions, Fluid equations - continuity, Euler's, Bernoulli's equation and its applications. Euler's flow through variable cross sectional areas.

UNIT - II

Steam Turbines: Convergent and Convergent-Divergent nozzles, Energy Balance, Effect of back pressure, Design of nozzles. Steam Turbines: Impulse turbines, Work done and Velocity triangle, Efficiencies, Compounding

UNIT- III

Hydraulic Turbines: Introduction, Classification of turbines, Impulse and reaction turbines, construction, working and performance of Pelton, Francis and Kaplan Turbines, Selection of turbines: specific speed, unit quantities.

UNIT - IV

Axial Flow Compressors and Centrifugal Compressors: Work and velocity triangles, Efficiencies, Stage pressure rise, Degree of reaction, Performance of compressors, Velocity triangles and efficiencies; slip factor, performance of compressors.

UNIT - V

Gas Turbines: Principle of working – Classification – Joule's cycle – work done and efficiency – Brayton Cycle – Optimum Pressure ratio for maximum power and maximum efficiency – P_{max} and η_{lmax} – Improvement in cycle performance – Intercooling, Reheating and Regeneration (Heat exchanging) – Problems using these principles.

Text Books:

1. S. M. Yahya, "Turbines, Compreessors and Fans", 4/e, Tata McGraw-Hill Education Pvt. Ltd., 2010.
2. G.Gopalakishnan and D. Prithvi Raj, "Atreatise on Turbomachines", Scitec Publications, Chennai, 2002.
3. Seppo. A. Korpela, "Principles of Turbomachinery", John Wiley & sons Inc. Publications, 2011.

Suggested Reading:

1. R. K. Turton, "Principles of Turbomachinery", E & F N Spon Publishers, London & New York,2004.
2. Dennis G. Shepherd, "Principles of Turbomachines", Macmillan, 2007.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E210

GAS TURBINES
(Programme Elective – IV)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand
1. Adiabatic energy equation ofnozzle.
2. Thermodynamic cycle of gas turbine
3. Working principle of rotarycompressors.
4. Working principle of gas turbine power plant.
5. Working principle of jets and propulsions.

Outcomes: At the end of the course, student will be able to
1. Design nozzle with known inlet conditions
2. Evaluate thermal efficiency of gas turbines and its improvement
3. Determine overall efficiency of Axial flow compressor and Centrifugal compressors
4. Design combustion system for gas turbine plant
5. Determine thrust and propulsive force developed by jets and rockets.

UNIT - I

Gas Dynamics Fundamentals: Conservation Lawsand governing equationsfor Mass, Momentum and Energy for Compressible flows; Basic definitions for Static and Stagnation Pressure, Mach Wave, Mach Angle and Over expanding Nozzle, Adiabatic Flow through Converging-Diverging Nozzle, Adiabatic Flow through a constant area duct, Phenomenon of Shock, Rayleigh Lines, Fanno Lines in ductflows

UNIT - II

Gas Turbines: Relative merits over conventional IC Engines, Introduction to Brayton and Atkinson cyclefor Gas turbines, Pressure Ratio, Thermal Efficiency, Specific Output, optimum pressure ratio, Enhancement of Thermal Efficiency and/or specificpower outputusing inter cooling, heatexchangers, reheatburners

UNIT- III

Compressors: Centrifugal Compressor-Major components – Inducer, Impeller, Vaneless Diffuser, Vaned Diffuser, Volute Casing, Velocity & Pressure variation in a stage, Degree of Reaction, Prewhirl and Surging. Axial Flow Compressor : Stage consisting of a Rotor and a Stator, Pressure Rise in a Stage, Polytropic Efficiency, Losses in a Compressor stage, Phenomenon of Blade Stall & Surging and Phenomenon of Chocking, Performance Curves

UNIT - IV

Gas Turbine Power Plants: Fuel and fuel feed systems; combustion systems-design considerations and flame stabilization; regenerator types and design; gas turbine power; plant performance. Application of airfoil theory to the study of flow through turbine blades; aerodynamic and thermodynamic design considerations; blade materials; blade attachments and blade cooling.

UNIT - V

Jets and Propulsion: Concept of Propulsion and Thrust, Variety of Propulsion systems for flying vehicles – Turboprop, Turbojet, Ram Jet, Pulse Jet, Analysis of propulsion cycle. Thrust Augmentation: Water Injection, Liquid Injection, Afterburning, Bleed Air system

Rocket Propulsion: Distinction between Turbojets and Rockets, Rocket Thrust, Specific Impulse, Total Impulse, Thermal Efficiency, Rocket Equation and applications.

Text Books:

1. H. I. H. Saravanamuttoo, G. F. C. Rogers, H. Cohen , Paul Straznicky, "Gas Turbine Theory", Pearson education. Ltd, 6/e, 2009.
2. V.Ganesan, "Gas Turbines", Tata McGraw-Hill Education, 3/e, 2010.

Suggested Reading:

1. S. M. Yahya, "Turbines, Compressors and Fans", Tata McGraw-Hill Education, 1992.
2. Vincent, "The Theory and design of Gas Turbines and Jet Engines", McGraw-Hill Education,1950.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME E211

POWER PLANT CONTROL AND INSTRUMENTATION
(Programme Elective – IV)

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Objectives: Student will understand

1. Principles of static and dynamic characteristics ofinstruments
2. Working principles of feedback control concepts of electrical parameters
3. Create awareness of the importance of working principles of various measuring instruments, their applications in engineering industry and understand characteristics of instruments
4. Familiarize the principles of data acquisition along influence of electrical parameters on instrumentation
5. Understand the principles of modeling of power systems

Outcomes: At the end of the course, student will be able to

1. Estimate static and dynamic characteristics ofinstruments
2. Estimate the influence of electrical parameters on measurements
3. Understand theory on stability of instruments used for thermal systems and model power systems using various numerical methods
4. Estimate the role of computers for data acquisition
5. Represent various types of process control system

UNIT - I

Static & Dynamic Characteristics of Instruments: Static & dynamic characteristics of instruments, sensors, signal processing & data transmission elements, indicating & recording elements

UNIT - II

Data Acquisition: Use of computers for data acquisition & instrumentation for measuring temperature, pressure flow, speed, vibration & noise

UNIT- III

Electrical Parameters: On-lineprocessinstruments. Automaticprocesscontrol systems Representation. Feedback control concepts. Transient & Frequency response. Types of controllers

UNIT - IV

Stability Of Instruments: Stability, Digital Control System Modern Control theory. Boiler Control, Governing & Control of turbo-machines

UNIT – V

Computer Aided Power Systems Analysis: Modelling of power system, components, Formation of bus admittance and impedance matrices, Power flow solution Gauss-Seidel, Newton Raphson, and fast de-coupled load flow, Short Circuit studies, Static equivalents of power system, Basic concepts of security analysis and state estimation.

Text Books:

1. T.G.Beckwith and N. Lewis Buck, "Mechanical Measurements". Wesley Publishing, 1961.
2. K. Tayal, "Instruments and Mechanical Measurements", Galgotia Publications.
3. Mc Cloy and H.R. Martin, "The Control of Fluid Power", Longman Publication, 1973.
4. D.A. Williams and G. James, "Liquid Fuels", London Pergamon, 1963.

Suggested Reading:

1. David Lindsley, "Power-Plant Control and Instrumentation", IEE Control Engineering Series 585.
2. W.Bolton, "Instrumentation and Control Systems", 1/e, Elsevier, 2004.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EE A101

SANSKRIT FOR TECHNICAL KNOWLEDGE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives:

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. To explore the huge knowledge from ancient Indian literature

Outcomes: At the end of the course the students are able to

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT-I

Introduction to Sanskrit Language: SanskritAlphabets-vowels-consonants-significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic Sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).
Themeasurementsystem-time-mass-length-temp,Matterelasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):

Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures, Chemical laboratory location and layout-equipment-distillation vessel-kosthi yanthram

Text Books:

1. M Krishnamachariar, "History of Classical Sanskrit Literature", TTD Press, 1937.
2. M.R. Kale, "A Higher Sanskrit Grammar: For the Use of School and College Students", Motilal Banarsidass Publishers, ISBN-13: 978-8120801783, 2015

Suggested Reading:

1. Kapail Kapoor, "Language, Linguistics and Literature: The Indian Perspective", ISBN-10: 8171880649, 1994.
2. "Pride of India", Samskrita Bharati Publisher, ISBN: 81-87276-27-4, 2007
3. Shri RamaVerma, "Vedas the source of ultimate science", Nag publishers, ISBN:81-7081-618-1,2005

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20EC A101

VALUE EDUCATION

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: This course aims to:
1. Understand the need and importance of Values for self-development and for Nationaldevelopment.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Outcomes: After completion of the Course, students will be able to:
1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Valuesfor self-development, Socialvalues, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, Truefriendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books : Self-management and Good health; internal & external cleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasic gunas.

Text Books:

1. Chakroborty, S.K. "Values & Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1998.

Suggested Reading:

1. Jaya Dayal Goyandaka, "Srimad Bhagavad Gita with Sanskrit Text, Word Meaning and Prose Meaning", Gita Press, Gorakhpur, 2017.

Preddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20IT A101

PEDAGOGY STUDIES

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	———
Credits	0

Course Objectives:

1. To present the basic concepts of design and policies of pedagogy studies.
2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. To familiarize various theories of learning and their connection to teaching practice.
4. To create awareness about the practices followed by DFID, other agencies and other researchers.
5. To provide understanding of critical evidence gaps that guides the professional development.

Course Outcomes: Upon completing this course, students will be able to:

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare", 31 (2): 245 – 261, 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance of evaluation", Journalof Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Reading:

1. Akyeampong K, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)", Country Report 1.London: DFID,2003.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33(3):272-282,2013.
3. Alexander R J, "Culture and Pedagogy: International Comparisons in Primary Education", Oxford and Boston: Blackwell, 2001.
4. Chavan M, "Read India: A mass scale, rapid, 'learning to read' campaign", 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

20EG A103

STRESS MANAGEMENT BY YOGA

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	————
Credits	0

Objectives: The Course will introduce the students to

1. Creating awareness about different types of stress and the role of yoga in the management of stress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3. Prevention of stress related health problems by yoga practice.

Outcomes: After successful completion of the course, the students will be able to

1. Understand yoga and its benefits.
2. Enhance Physical strength and flexibility.
3. Learn to relax and focus.
4. Relieve physical and mental tension through asanas
5. Improve work performance and efficiency.

UNIT - I

Meaning and Definition of Yoga- Historical perspective of Yoga- Principles of Astanga Yoga by Patanjali.

UNIT - II

Meaning and Definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT- III

Concept of Stress According to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress

UNIT - IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation Techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Text Books:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Rajayoga or Conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.

Suggested Reading:

1. Nagendra H.R nad Nagaratna R, "Yoga Perspective in Stress Management", Swami Vivekananda Yoga Prakashan, Bangalore,

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C108

COMPUTER AIDED ENGINEERING LAB

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Objectives: To make the students

1. Model one and two-dimensional elements in ANSYS
2. Understand vibration, harmonic and transient analysis
3. Carry out buckling analysis
4. Analyze forming and sheet metal operations by FEA
5. Model crackelement

Outcomes: At the end of the course, student will be able to

1. Understand the applications of one and two-dimensional elements
2. Solve engineering problems
3. Find buckling factors
4. Understand industrial applications of forming and sheet metal operations
5. Find fracture toughness

List of Exercises:

1. Introduction to Finite Element Analysis Software
2. Statically indeterminate reaction force analysis and determination of Beam stresses and Deflection
3. Static analysis of a corner bracket
4. Analysis of cylindrical shell under pressure
5. Bending of a circular plate using axisymmetric shell element.
6. Vibration analysis of a simply supported beam
7. Harmonic analysis of plates and shells
8. Transient analysis of vehicle crash
9. Buckling analysis of shells
10. Analysis of forming
11. Analysis of sheet metal operation
12. Stress intensity factor in cracked plates

__Note:__ Out of the above 12 experiments, any **ten (10)** experiments have to be carried out.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Text Books:

1. R. Tirupathi, Chandrupatla and B.D. Ashok, "Introduction of Finite Element in Engineering", Prentice Hall of India, 2004
2. David.V.Hutton, "Fundamentals of Finite Element Analysis", Tata McGrawHill,2003

Suggested Reading:

1. Robert Cook , "Concepts and applications of finite element analysis", 4/e, JohnWiley and sons,2009
2. S.S. Rao, ,"The Finite Element Methods in Engineering", 2 /e, Pergamon Press,2001.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C206

COMPUTATIONAL FLUID DYNAMICS LAB

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Objectives: To acquaint the student with

1. Basic steps in a CFD simulation: ANSYS Workbench design modular and meshing
2. Simulation of laminar, turbulent, internal flow, steady and unsteady problems
3. Simulation of steady and unsteady problems
4. Physics setup involves boundary conditions
5. Solution of thermal related problems

Outcomes: At the end of the course, student will be able to

1. Analyze laminar flow problems in plates and pipes
2. Solve steady and unsteady flow past a cylinder
3. Perform analysis for free and forced convection
4. Evaluate the effect of angle of attack and velocity on NACA aerofiol
5. Simulate compressible flow in a nozzle, premixed combustion

List of Experiments:

1. Laminar Flow over Flat plate
2. Laminar PipeFlow
3. Steady Flow past aCylinder
4. Unsteady Flow past a Cylinder
5. Two Dimensional Steady Free Convection
6. Forced Convection for pipe cross section
7. Study of Hot & Cold Fluid Mix
8. Flow analysis of Aerofoil.
9. Study of compressible flow through a nozzle
10. Partially premixed combustion analysis
11. Supersonic flow over a wedge
12. Study of flow over wind turbine blade/flow through bifurcation artery

<u>Note</u>: Out of the above 12 experiments, any **ten (10)** experiments have to be carried out.

PROFESSOR & HEAD
epartment of Mechanical Engineering
haitanya Bharathi Institute of Technology (A)
andipet, Hyderabad-500 075. Telangana

Text Books:

1. John D Anderson, "Computational Fluid Dynamics", Mc Graw Hill, Inc., 2015.
2. H.K. Versteeg and Malala Shekara, "Introduction to Finite Volume Method", Pearson, 2015

Suggested Reading:

1. J.H. Ferziger and M. Peric, "Computational Methods for Fluid Dynamics", Springer.
2. K. Muralidhar and T. Sundararajan T, "Computational Fluid flow and Heat transfer", Narosa Publishing House, 2003

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

20ME C207

MINI PROJECT WITH SEMINAR

Instruction	4 Hours per week
Duration of SEE	---
SEE	---
CIE	50 Marks
Credits	2

Outcomes: Students are able to

1. Formulate a specific problem and give solution
2. Develop model/models either theoretical/practical/numerical form
3. Solve, interpret/correlate the results and discussions
4. Conclude the results obtained
5. Write the documentation in standard format

Guidelines:

1. As part of the curriculum in the II- semester of the progarmme each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
2. Eachstudentwillbeallottedtoafacultysupervisorformentoring.
3. Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
4. Miniprojectsshallhaveinterdisciplinary/ industryrelevance.
5. The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
6. All the investigations are clearly stated and documented with the reasons/explanations.
7. The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks:50		
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEE 212

ADVANCES IN IC ENGINES (Programme Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand

1. Importance of combustion phenomena and various injection systems in SI engines
2. Combustion phenomena and increasing methods of power output in CI engine
3. Concept of formation of pollutants from IC engines along with pollutant control and measurement techniques
4. Concept of alternative fuel technologies to improve the performance of the engine
5. Concepts of recent trends with changes in engine configuration

Outcomes: At the end of the course, student will be able to

1. Describe the phenomena of combustion and knock in SI engines
2. Combustion phenomena of CI engines and various power boosting techniques
3. Understand how undesirable pollutants can be measured and controlled
4. Demonstrate an understanding of technological, environmental and social impact of alternative fuels
5. Explain modern concepts like lean burn, stratification, HCCI and GDI techniques

UNIT - I

Spark Ignition Engines: Spark ignition engine mixture requirements – Fuel – Injection systems – Monopoint, Multipoint injection, Direct injection – Stages of combustion – Normal and abnormal combustion – Factors affecting knock – Combustion chambers

UNIT - II

Compression Ignition Engines: Stages of combustion in C.I. Engine – Direct and indirect injection systems – Combustion chambers – Normal and Abnormal

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Combustion – Knock in C.I Engines-Basic Concepts and Study of Fuel Spray – Supercharging and Turbocharging methods

UNIT - III

Pollutant Formation and Control: Pollutant – Sources – Formation of carbon monoxide, Unburnt hydrocarbon, Aldehydes, NOx, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters and Particulate Traps-Methods of measurements and Introduction to emission norms

UNIT - IV

Alternative Fuels: Alcohol, Hydrogen, Natural Gas, Biogas and Liquefied Petroleum Gas- Properties, Suitability, Merits and Demerits as fuels, Engine Modifications

UNIT - V

Recent Trends: Lean Burn and Adiabatic concepts, Rotary engines, – Stratified charge Engines – homogeneous charge compression ignition (HCCI) engines and GDI concepts

Text Books:

1. V. Ganeshan, "Internal Combustion engines", Tata McGraw Hills Publishing Co. Ltd, New Delhi
2. J.B. Heywood, "Internal Combustion engine fundamentals", McGrave Hills, Book Co., New York.

Suggested Reading:

1. M.L. Mathur, and R.P. Sharma, "Internal Combustion Engine", Dhanpat Rai & Sons, Delhi
2. E.F. Obert, "Internal Computation Engines", Harper & Row Publishers N.Y
3. P.W. Gill, and J.H. Smith(Jr), "Fundamentals of Internal combustion Engines", Oxford & IBH publishing Co. New Delhi,

PROFESSOR & HEAD
epartment of Mechanical Engineering
aitanya Bharathi Institute of Technology (A)
dipet, Hyderabad-500 075. Telangana

19MEE 213

CONVECTIVE HEAT TRANSFER (Programme Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand

1. Different types of convection heat transfer and their equations to apply for various engineering applications
2. To familiarize the concept of forced convection and its behavior in pipes
3. To familiarize the concept of natural convection and its behavior in pipes
4. To familiarize the concept of combination of natural convection and forced convention in pipes
5. To understand the principles of conjugate heat transfer and its applications in engineering heat transformation

Outcomes: At the end of the course, student will be able to

1. Select the mode of convection heat transfer rate and calculate heat transfer rate depending on the application
2. Determine rate of heat transfer under forced convention phenomena in pipes
3. Determine rate of heat transfer under natural convention phenomena in pipes
4. Calculate the rate of heat transfer with the combination of conduction and convection in applications like heat exchangers
5. Determine heat transfer rate through the porous media

UNIT - I

Introduction To Convective Heat Transfer: Forced, free & combined convection – convective heat transfer coefficient – Application of dimensional analysis to convection – Physical interpretation of dimensionless numbers. Equations of Convective Heat Transfer: Continuity, Navier-Strokes equation & energy equation for steady state flows – similarity – Equations for turbulent convective heat transfer – Boundary layer equations for laminar, turbulent flows – Boundary layer integral equations

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - II

Forced Convection: External Laminar Forced Convection: Similarity solution for flow over an isothermal plate – integral equation solutions – Numerical solutions – Viscous dissipation effects on flow over a flat plate. External Turbulent Flows: Analogy solutions for boundary layer flows – Integral equation solutions – Effects of dissipation on flow over a flat plate. Internal Laminar Flows: Fully developed laminar flow in pipe, plane duct & ducts with other cross-sectional shapes – Pipe flow & plane duct flow with developing temperature field – Pipe flows & plane duct flow with developing velocity & temperature fields. Internal Turbulent Flows: Analogy solutions for fully developed pipe flow –Thermally developing pipe & plane duct flow.

UNIT - III

Natural Convection: Boussineq approximation – Governing equations – Similarity – Boundary layer equations for free convective laminar flows – Numerical solution of boundary layer equations. Free Convective flows through a vertical channel across a rectangular enclosure – Horizontal enclosure – Turbulent natural convection

UNIT - IV

Combined Convection: Governing parameters & equations – laminar boundary layer flow over an isothermal vertical plate – combined convection over a horizontal plate – correlations for mixed convection – effect of boundary forces on turbulent flows – internal flows - internal mixed convective flows – Fully developed mixed convective flow in a vertical plane channel & in a horizontal duct

UNIT - V

Heat Transfer Through Porous Media: Area weighted velocity – Darcy flow model – energy equation – boundary layer solutions for 2-D forced convection – Fully developed duct flow – Natural convection in porous media – filled enclosures – stability of horizontal porous layers

Text Books:

1. Patrick H. Oosthuigen & David Naylor, "Introduction to Convective Heat Transfer Analysis", TMH.
2. Kays & Crawford, "Convective Heat & Mass Transfer", TMH, 2000.

Suggested Reading:

1. Oosthigen, "Convective Heat and Mass Transfer", McGraw Hill, 1998.
2. Adrian Bejan, "Convection Heat Transfer", 2/e, John Wiley, 1984.

19MEE 214

HEAT PIPE (Programme Elective – V)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: To make the students to understand the

1. Importance of heat pipe and its working principle
2. Classification of heat pipe
3. Design concept of heat pipe
4. Testing method of heat pipe
5. Different types of Modeling of heat pipe

Outcomes: At the end of the course, student will be able to

1. Understand the physics of heat pipe
2. Calculate the heat load on heat pipe
3. Design of heat pipe
4. Test the heat pile
5. Model different types of heat pipes under different conditions

UNIT - I

Background and Historical Development of Heat Pipe: Operating Principle-Limits of Heat Transport Capacity-Advantages of Heat Pipes-Physics of Heat Pipe- Vaporization & Condensation-Wettabilty-Capillarity-Surface Tension

UNIT - II

Limiting Heat Loads: Capillary, Viscous and Boiling Limits- Dry out and Rewetting, Classification of Heat Pipes- Thermo-siphon Heat Pipes- Wick Heat Pipes- Rotating Heat Pipes- Micro Heat Pipes- Cryogenic Heat Pipes-Variable Condensation Heat Pipes-Thermal Switches and Diodes

UNIT - III

Design and Manufacturing of Heat Pipes: Working Fluids-Components-Wick Structures-Design Criteria- Fabrication and Fluid Charging-Reliability Tests

UNIT - IV

Heat Pipe Testing: Testing Methods- Start up Methods

Heat Pipe Applications: Electronic, Power Plant, Space and Industry Applications

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

UNIT - V

Modeling of Heat Pipes- Steady State Modeling-Transient Modeling-Start up Characteristics-

Text Books:

1. Dunn & Reay, "Heat Pipes", Pergamon Press, 1994.
2. Rice Graham, "Heat Pipes", Academic Publishers, 1995.
3. Faghri, "Heat Pipe Science and Technology", Taylor & Francis, 1995.

Suggested Reading:

1. Bahman Zohuri, "Heat Pipe Design and Technology: A Practical Approach", CRC Publishing Company, 2011.
2. G. P. Peterson, "Introduction to Heat Pipes: Modeling, Testing, and Applications", John Wiley & Sons, 1/e, 1994.
3. David Reay, Peter Kew, and Ryan McGlen, "Heat Pipes: Theory, Design and Applications", 6/e, Elsevier Ltd, 2013.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

19CEO 101

COST MANAGEMENT OF ENGINEERING PROJECTS

(Open Elective)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To enable the students to understand the concepts of Project management.
2. To provide knowledge on concepts of Project Planning and scheduling.
3. To create an awareness on Project Monitoring and Cost Analysis
4. To provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis
5. To train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

Outcomes: At the end of the course, student will be able to

1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and leveling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT-I:

Project Management: Introduction to project managements, stakeholders, roles, responsibilities and functional relationships, Principles of project management, objectives and project management system, Project team, organization, roles, and responsibilities, Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT-II:

Project Planning and Scheduling: Introduction for project planning, defining activities and their interdependency, time and resource estimation. Work break

Reddy
PROFESSOR & HEAD
~~Department of Mechanical~~ Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT-III:

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost, Project direct and indirect costs.

UNIT-IV:

Resources Management and Costing-Variance Analysis: Planning, Enterprise Resource Planning, Resource scheduling and leveling, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis: Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing, Costing of service sector. Just-in-time approach, Material Requirement

UNIT-V:

Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets, Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management: Linear Programming, PERT/CPM, Transportation Assignment problems, Simulation, Learning Curve Theory.

Text Books:

1. Charles T Horngren "Cost Accounting A Managerial Emphasis", Pearson Education; 14 edition (2012),
2. Charles T. Horngren and George Foster, "Advanced Management Accounting" Prentice-Hall; 6th Revised edition (1 February 1987)
3. Robert S Kaplan Anthony A. Atkinson, "Management & Cost Accounting" , Pearson; 2 edition (18 October 1996)

Suggested Reading:

1. K. K Chitkara, "Construction Project Management: Planning, scheduling and controlling", Tata McGraw-Hill Education. (2004).
2. Kumar Neeraj Jha "Construction Project Management Theory and Practice",Pearson Education India; 2 edition (2015)

Reddy

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19EEO 101

WASTE TO ENERGY (Open Elective)

Instruction	3 Theory Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives:

1. To know the various forms of waste
2. To understand the processes of Biomass Pyrolysis.
3. To learn the technique of Biomass Combustion.

Outcomes: At the end of the course, student will be able to

1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Chose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT - I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT – II

Biomass Pyrolysis: Pyrolysis – Types, slow, fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT – III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT–IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT – V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Text Books:

1. V. Ashok V., "Non Conventional Energy", Desai, Wiley Eastern Ltd., 1990.
2. K.C. Khandelwal and Mahdi, S. S., "Biogas Technology - A Practical Hand Book" - Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Suggested Readings:

1. D.S. Challal,"Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.
2. C. Y. WereKo-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1996.

19MEO 101

INDUSTRIAL SAFETY (Open Elective)

Instruction	3 Theory Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: The students will be able to understand

1. Causes for industrial accidents and preventive steps to be taken.
2. Fundamental concepts of Maintenance Engineering.
3. About wear and corrosion along with preventive steps to be taken
4. The basic concepts and importance of fault tracing.
5. The steps involved in carrying out periodic and preventive maintenance of various equipments used in industry

Outcomes: At the end of the course the students will be able to

1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipments like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipments like motors, pumps and air compressors and machine tools etc

UNIT - I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT – II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT – III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT–IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT – V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication

Suggested Readings:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
2. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

19MEO 102

INTRODUCTION TO OPTIMIZATION TECHNIQUES (Open Elective)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: The students will

1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignment techniques
3. Come to know the procedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques

Outcomes: At the end of the course, student will be able to

1. Formulate a linear programming problems (LPP)
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully
4. Apply queing and inventory concepts in industrial applications
5. Apply sequencing models in industries

UNIT - I

Operations Research: Definition, scope, Models, Linear programming problems (LPP), Formulation, Graphical Method, and Simplex Method

UNIT - II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT - III

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

path, Determination of critical path, duration of the project, Free float, Independent float and Total float

UNIT - IV

Queuing Theory and Inventory:: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT - V

Sequencing Models: Introduction, Objectives, General assumptions, processing 'n' jobs through two Machines, processing 'n' jobs through three machines

Text Books:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008

Suggested Reading:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub. 2009
2. Pannerselvam, "Operations Research", Prentice Hall of India 2010
3. Harvey M Wagner, "Principles of Operations Research", Prentice Hall of India 2010

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEO 103

COMPOSITE MATERIALS (Open Elective)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Objectives: Student will understand

1. Composite materials and their constituents.
2. Classification of the reinforcements and evaluate the behavior of composites.
3. Fabrication methods of metal matrix composites.
4. Manufacturing of Polymer matrix composites.
5. Failure mechanisms in composite materials.

Outcomes: At the end of the course, student will be able to

1. Classify and characterize the composite materials.
2. Describe types of reinforcements and their properties.
3. Understand different fabrication methods of metal matrix composites.
4. Understand different fabrication methods of polymer matrix composites.
5. Decide the failure of composite materials.

UNIT - I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepegs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V

Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength

Text Books:

1. R.W.Cahn – VCH , "Material Science and Technology", Vol 13, Composites, West Germany.
2. WD Callister, Jr., Adapted by R. Balasubramaniam , "Materials Science and Engineering, An introduction"., John Wiley & Sons, NY, Indian edition, 2007.

Suggested Readings:

1. Ed-Lubin, "Hand Book of Composite Materials"
2. K.K.Chawla, "Composite Materials".
3. Deborah D.L. Chung, "Composite Materials Science and Applications"
4. Daniel Gay, Suong V. Hoa, and Stephen W. Tsai, "Composite Materials Design and Applications"

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEC 208

DISSERTATION PHASE - I

Instruction	20 Hours per week
CIE	100 Marks
Credits	10

Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, national/ international refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.

- Seminar should be based on the area in which the candidate has undertaken the dissertation work.

- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.

- The preliminary results (if available) of the problem may also be discussed in the report.

- The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.

- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 100		
Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note: Department committee has to assess the progress of the student for every two weeks.

Reddy
PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

19MEC 209

DISSERTATION PHASE - II

Instruction	32 Hours per week
Duration of Semester End Examination	Viva
SEE	100 Marks
CIE	100 Marks
Credits	16

Outcomes: At the end of the course:

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipments and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

- It is a continuation of Project work started in semester III.
- The student has to submit the report in prescribed format and also present a seminar.
- The dissertation should be presented in standard format as provided by the department.
- The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
- The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.
- The candidate has to be in regular contact with his/her guide/co-guide.

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075, Telangana

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 100		
Evaluation by	**Max . Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report standard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE (Semester End Examination): Max. Marks: 100		
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

PROFESSOR & HEAD
Department of Mechanical Engineering
Chaitanya Bharathi Institute of Technology (A)
Gandipet, Hyderabad-500 075. Telangana

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of I Semester of B.Tech. – Biotechnology as per AICTE Model Curriculum 2020-21

DEPARTMENT OF BIOTECHNOLOGY

SEMESTER – I

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
3 WEEKS COMPULSORY INDUCTION PROGRAM									
	THEORY								
1	20MT C21/ 20BT C01	Mathematics-I/ Basics of Biology-1	3	1	-	3	40	60	4
2	20 EG C01	English	2	-	-	3	40	60	2
3	20PY C02	Physics	3	–	-	3	40	60	3
4	20CS C01	Programming for Problem Solving	2	1	-	3	40	60	3
	PRACTICALS								
5	20PY C04	Physics lab	-	-	4	3	50	50	2
6	20EG C02	English lab	-	-	2	3	50	50	1
7	20CS C02	Programming for Problem Solving lab	-	-	4	3	50	50	2
8	20ME C01	CAD & Drafting	-	1	3	3	50	50	2.5
9	20MBC02	Community Engagement	30 field + 2P/W			-	50	-	1.5
Total			**10**	**3**	**13**		**410**	**440**	**21**
Clock Hours Per Week –28									

L: Lecture **T: Tutorial** **P: Practical**

CIE- Continuous Internal Evaluation **SEE- Semester End Examination**

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075

with effect from the Academic Year 2020-21

20MT C21

MATHEMATICS– I

(for BiPC Stream of Bio-Tech)

Instruction:	3 L+1T Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	4

Course Objectives:

1. To discuss elementary transformations of trigonometric functions.
2. To explain basics of limit and continuity of the functions.
3. To explain differentiation of the basic functions
4. To discuss matrix methods to solve system of linear equations.
5. To discuss the exact roots of Cubic and Bi-quadratic equations.

Course Outcomes:

On successful completion of this course the students shall be able to

1. Calculate the elementary transformations of trigonometric functions.
2. Evaluate the limit and Continuity of the functions
3. Calculate the differentiation of functions.
4. Apply the matrix methods to solve the system of linear equations.
5. Solve the Cubic and Bi-quadratic equations.

UNIT-I

Trigonometry: Review of basics of Trigonometry, Compound angles and multiple and sub multiple angles, Transformations-sum and product rules, Hyperbolic and Inverse Hyperbolic functions.

UNIT-II

Function, Limits and Continuity: Functions ($Sinx, Cosx, e^x, log$

of a limit. Standard limits and related problems.

UNIT-III

Differentiation: Derivatives of a function, Elementary properties. Derivatives of Trigonometric, Inverse Trigonometric, Hyperbolic and inverse Hyperbolic functions, Methods of differentiation, second and higher order derivatives.

UNIT-IV

Matrices: Types of matrices, multiplication of matrices, scalar multiplication, Inverse of matrix-determinant, singular, non-singular, minor, cofactors, adjoint, Rank-Echelon form, consistency and inconsistency Solutions of simultaneous linear equations.

UNIT-V:

Theory of Equations: Relation between roots and the co-efficient in an equation, solution of the equation when two or more of its roots are connected by certain relations.

Text Books:

1. Shanti Narayan and Mittal P.K. ,“ Differential Calculus” , 30th edition, S Chand publishers, 2005.
2. A.R.Vasistha, “Matrices”,43rd edition, Krishna Prakashan Media (P) Ltd. 2014.
3. Hall and Knight “Higher Algebra” Arihant Publications, 2016.

Suggested Reading:

1. N P Bali and Manish Goyal, “A Text Book of Engineering Mathematics”, 9th Edition, Laxmi publishers, 2016.
2. Joseph Edwards, “Differential Calculus for Beginners”, arihant publishers, 2016.
   Kanti B.Datta, “Mathematical Methods of Science and Engineering”, CENGAGE Learning publishers

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

With effect from the Academic Year 2020-21

20BT C01

BASICS OF BIOLOGY - I
(for MPC Stream of Bio-Tech)

Instruction:	3 L+1T Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	4

Course Objectives :
1. To give understanding of fundamentals of origin of life and various theories of evolution.
2. To give an insight of plant cell and its organelles
3. To provide a knowledge on classification of plants and their propagation mode.
4. To give the students an understanding of knowledge on microbes and their economic importance.
5. To impart theoretical knowledge on various physiological aspects of plants.

Course Outcomes:
At the end of the course student will be able to
1. Explain the theories behind the origin of life and evolution studies (BL2).
2. Describe the structure and functions of plant cell and its organelles (BL1)
3. Relate the plants based on the habit and habitat and mechanism of seed development in plants (BL1).
4. Explain the different classification, mode of reproduction, economic importance of microbes (BL2)
5. Describe the basic physiological processes in plants and various methods of crop improvement (BL1).

UNIT-I
History of Life and Evolution: History of earth, evolutionary concepts of origin of life. Experimental verification of chemical origin of life - Miller's Experiment. Darwinism, Natural selection, Sexual selection, Artificial selection, Mendelism, Hugo de Vries mutation theory, Neo-Darwinism.

UNIT-II
Cell Structure and Internal Organization of Plants: Cell as basic unit of life, overview of the plant cell, cell cycle, cell division, mitosis and meiosis. Concept of Growth, meristems (apical, intercalary and lateral) their functions. Simple tissue (parenchyma, collenchyma and sclerenchyma), complex tissues (xylem and phloem). Tissuesystems (epidermal, ground and vascular)

UNIT-III
Plant Systematic and Reproduction: Plant kingdom, salient features of classification. Alternation of generation of the plants. Type studies of Algae (Spirogyra), Fungi (Rhizopus), Bryophytes (Pteris), Gymnosperms (Cycas) and general characteristics and life cycle of Angiosperms. Overview of modes of reproduction-Asexual: vegetative propagation, budding, sporulation, binary fission; Sexual reproduction: pollination, fertilization, development of embryo, endosperm, fruit and seed formation. Apomixes, parthenocarpy, polyembryony type of reproduction.

UNIT-IV
Introduction to Microbial World: Introduction and importance of classification-five kingdoms (Protista, Fungi, Plantae and Animalia). General account of prokaryotes. Concept of species and strains. Sterilization and media compositions. Bacterial viruses - T4, plant viruses – TMV, animal viruses – HIV. Reproduction in bacteria (asexual - binary fission and sexual - conjugation) and viruses (lytic and lysogenic). Economic importance of beneficial bacteria (agriculture, industry, medicine and biotechnology).

UNIT-V

Plant Physiology and Concepts in Plant Biotechnology: Absorption of water – soil water, water potential, diffusion, imbibitions, osmosis, plasmolysis, absorption of water, ascent of sap, transportation. Crop improvement - Heterosis and mutation breeding. Plant tissue culture techniques and their applications. Plant growth regulators.

Text Books:

1. Ray F. Evert, Susan E. Eichhorn "Raven Biology of Plants ": W. H. Freeman 2012. Tata McGraw Hill Publishing Co. Pvt. Ltd 9th edition, (2010).
2. Campbell, N.A., Reece, J.B., Urry, Lisa, Cain, ML., Wasserman, S.A., Minorsky, P.V., Jackson, R.B. "Biology: A Global Approach", 11th edition, Pearson Education Ltd. (2017)

Suggested Reading:

1. Willey, J. M., Sherwood, L., Woolverton, C. J., Prescott, L. M., & Willey, J. M. "Prescott's microbiology". New York: McGraw-Hill. 6th Edition (2011).

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

20EG C01

ENGLISH
(Common to all branches)

Instruction:	2L Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	2

Course Objectives:
This course will introduce the students:

1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal e mails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

Course Outcomes:
After successful completion of the course the students will be able to:

1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques

UNIT-I
Understanding Communication in English:
Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.
Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT-II
Developing Writing Skills I:
Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.
Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT-III
Developing Writing Skills II:
Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response
Vocabulary and Grammar: Subject-verb agreement.
Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

Y Rajasri

UNIT-IV

Developing Writing Skills III:

Report writing – Importance, structure, elements of style of formal reports; Writing a formal report.

Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT-V

Developing Reading Skills:

The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.

Vocabulary and Grammar: Words often Confused ; Use of standard abbreviations.

Text Books:

1. Language and Life: A Skills Approach, Board of Editors, Orient Black Swan, 2017.
2. Swan Michael, Practical English Usage.OUP. 1995.

Suggested Readings:

1. Wood F.T, Remedial English Grammar, Macmillan, 2007
2. Zinsser William, On Writing Well, Harper Resource Book, 2001
3. Sanjay Kumar and PushpLata, Communication Skills. Oxford University Press, 2011.

Y Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

With effect from the Academic Year 2020-21

20PY C02

PHYSICS

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives:

The objectives of the course is to make the student

1. Learn the basic concepts of wave nature of light
2. Know about the properties of magnetic and dielectric materials
3. Understand the basics of nanomaterials
4. Familiarize with fundamental ideas of quantum mechanics

Course Outcomes:

At the end of the course, the student will be able to

1. Demonstrate the physical properties of the light.
2. Find the applications of lasers and optical fibers in engineering and technology.
3. Identify different types of magnetic and dielectric materials.
4. Recall the fundamentals of nanomaterials.
5. Apply the ideas of quantum mechanics for related problems

UNIT-I

Wave Optics: Huygens' principle – Superposition of waves – Interference of light by splitting of wavefront and amplitude – Fresnel's biprism – Interference in thin films (reflected light) – Newton's rings – Fraunhofer diffraction from a single slit – Double slit diffraction – Concept of N-slits – Diffraction grating and its resolving power. Polarization: Introduction – Malus's law – Double refraction – Nicol's prism – Quarter-wave plate and half-wave plate – Optical activity – Laurent's half shade polarimeter.

UNIT-II

Lasers: Characteristics of lasers – Einstein's coefficients – Amplification of light by population inversion – Ruby laser – He-Ne laser – Semiconductor laser – Applications of lasers in engineering and medicine.

Introduction – Construction – Principle – Propagation of light through an optical fiber – Numerical aperture and acceptance angle – Step-index and graded-index fibers – Pulse dispersion – Fiber losses – Fiber optic communication system – Applications.

Dielectric Materials: Introduction – Dielectric polarization – Types of dielectric polarization: electronic &ionic polarizations (quantitative); orientation & space-charge polarizations (qualitative) – Frequency and temperature dependence of dielectric polarization – Determination of dielectric constant (Schering bridge method) – Ferroelectricity – Barium titanate – Applications of ferroelectrics.

Magnetic Materials: Origin of magnetism – Magnetic moment - Bohr magneton – Classification of magnetic materials: dia, para, ferro, anti-ferro and ferrimagnetic materials – Weiss molecular field theory – Domain theory – Hysteresis curve – Soft and hard magnetic materials – Applications.

UNIT-IV

Nanomaterials: Properties of materials at reduced size – Surface to volume ratio – Quantum confinement – Preparation of nanomaterials: bottom-up approach (sol-gel method) and top-down approach (ball milling method) – Elementary ideas of carbon nanotubes – Applications of nanomaterials.

UNIT-V:

[illegible]: Introduction – Planck's' law of black body radiation – Wien's law and Rayleigh-Jean's law from Planck's law – Photoelectric effect – Compton effect – de-Broglie hypothesis – Wave-particle duality – Physical significance of ψ – Born's interpretation of the wave function – Verification of matter waves by Davisson- Germer's experiment – Uncertainty principle – Schrodinger wave equation (time-dependent and time-independent) – Particle in infinite square well potential.

Text Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

Suggested Reading:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013.
3. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

Y Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

20CS C01

PROGRAMMING FOR PROBLEM SOLVING
(Common to All Programs)

Instruction:	2L+1T Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives:
The objectives of this course are

1. Identification of computer components, Operating environments,IDEs.
2. Understandingthestepsinproblemsolvingandformulationofalgorithms toproblems.
3. Developprogrammingskillsasameansofimplementinganalgorithmic solution with appropriate control and datastructures.
4. Developintuitiontoenablestudentstocomeupwithcreativeapproaches toproblems.
5. Manipulation of text data usingfiles.

Course Outcomes:
On Successful completion of the course, students will be able to:

1. Identify and understand the computing environments for scientific and mathematical problems.
2. Formulate solutions to problems with alternate approaches and represent them using algorithms / Flowcharts.
3. Choose data types and control structures to solve mathematical and scientific problem.
4. Decompose a problem into modules and use functions to implement the modules.
5. Apply arrays, pointers, structures, and unions to solve mathematical and scientific problems.
6. Develop applications using file I/O.

UNIT -I
Introduction to computers and Problem Solving: Components of a computer, Operating System, Compilers, Program Development Environments, steps to solve problems, Algorithm, Flowchart / Pseudocode withexamples.

Introduction to programming: Programming languages and generations, categorization of high-level languages.

Introduction to C: Introduction, structure of C program, keywords, identifiers, Variables, constants, I/O statements, operators, precedence, and associativity.

UNIT – II
Introduction to decision control statements: Selective, looping and nested statements.
Functions:Introduction,usesoffunctions,Functiondefinition,declaration,passing parameters to functions, recursion, scope of variables and storageclasses,
Case study using functions and control statements.

UNIT – III
Arrays: Introduction, declaration of arrays, accessing and storage of array elements, 1-dimensional array, Searching (linear and binary search algorithms) and sorting (Selection and Bubble) algorithms, 2-D arrays, matrix operations.
Strings: Introduction, strings representation, string operations with examples.
Case study using arrays.

UNIT – IV
Pointers: Understanding computer's memory, introduction to pointers, declaration pointer variables, pointer arithmetic, pointers and strings, array of pointers, dynamic memory allocation, advantages, and drawbacks of pointers.
Structures: Structure definition, initialization and accessing the members of a structure, nested structures, structures and functions, self- referential structures, unions, and enumerated data types.

UNIT-V

Files: Introduction to files, file operations, reading data from files, writing data to files, error handing during fileoperations.

Pre-processor Directives: Types of pre-processor directives, examples.

Suggested Reading:

1. M.T. Somashekar “Problem Solving with C”, 2nd Edition, Prentice Hall India Learning Private Limited 2018
2. AK Sharma “Computer Fundamentals and Programming”, 2nd Edition, University Press, 2018
3. Pradeep Deyand Manas Ghosh, “Programming in C”, Oxford Press, 2nd Edition, 2017

References:

1. Byron Gottfried, Schaum’s “Outline of Programming with C”, McGraw- Hill.
2. BrianW.KernighanandDennisM.Ritchie,TheCProgrammingLanguage, Prentice Hall ofIndia.
3. E. Balaguruswamy, Programming in ANSIC, Tata McGraw-Hill.
4. Reema Tharaja “Introduction to C Programming”, Second Edition, OXFORD Press, 2015.
5. https://www.tutorialspoint.com/cprogramming/index.htm.
6. https://onlinecourses.nptel.ac.in/noc18-cs10/preview.

Y Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

With effect from the Academic Year 2020-21

20PY C04

PHYSICS LAB

Instruction:	4P Hours per week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives:
The objectives of the course is to make the student
1. Apply theoretical physics knowledge in doing experiments
2. Understand the behaviour of the light experimentally
3. Analyze the physical properties of magnetic and dielectric materials
4. Familiarize with motion of electrons in electric and magnetic fields

Course Outcomes:
At the end of the course, the student will be able to
1. Interpret the errors in the results of an experiment.
2. Demonstrate the wave nature of light experimentally
3. Utilize physical properties of magnetic and dielectric materials for various applications
4. Make use of lasers and optical fibers for engineering applications
5. Explain light induced phenomenon and motion of electrons in electric and magnetic fields

Experiments

			pendulum
2.	Fresnel's Biprism	:	Determination of wavelength of given monochromatic source
3.	Newton's Rings	:	Determination of wavelength of given monochromatic source
4.	Single Slit Diffraction	:	Determination of wavelength of given monochromatic source
5.	Diffraction Grating	:	Determination of wavelengths of two yellow lines of light of mercury lamp
6.	Malus's Law	:	Verification of Malus's law
7.	Double Refraction	:	Determination of refractive indices of O-ray and E-ray of given calcite crystal
8.	Polarimeter	:	Determination of specific rotation of glucose
9.	Laser	:	Determination of wavelength of given semiconductor laser
10.	Optical Fiber	:	Determination of numerical aperture and power losses of given optical fiber
11.	Dielectric constant	:	Determination of dielectric constant of given PZT sample
12.	M & H Values	:	Determination of magnetic moment M of a bar magnet and absolute value H of horizontal component of earth's magnetic field
13.	B-H curve	:	Determination of hysteresis loss of given specimen
14.	Planck's constant	:	Determination of Planck's constant using photo cell
15.	e/m of an Electron	:	Determination of specific charge of an electron by J.J. Thomson method

NOTE: A minimum of TWELVE experiments should be conducted

Y Rajasri
HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

20EG C02

ENGLISH LAB

(Common to all branches)

Instruction:	2P Hours per week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	1

Course Objectives:

This course will introduce the students

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behaviour while developing their ability to discuss in groups and making oral presentations.

Course Outcomes:

After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context, speak and write appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

Exercises

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics; Organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds; Introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm &Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material.
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** Weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given
10. **Poster presentation –** Theme, poster preparation, team work and presentation.

Suggested Reading

1. T Balasubramanian. A Textbook of English Phonetics for Indian Students, Macmillan, 2008.
2. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall India, 2005.
3. Priyadarshi Patnaik. Group Discussions and Interviews, Cambridge University Press Pvt Ltd 2011
4. Aruna Koneru, Professional Speaking Skills, Oxford University Press, 2016

Y Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

With effect from the Academic Year 2020-21

20CS C02

PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to All Programs)

Instruction:	4P Hours per week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives:

The objectives of this course are

1. Setting up programmingenvironment.
2. Develop Programming skills to solveproblems.
3. Use of appropriate C programming constructs to implementalgorithms.
4. Identification and rectification of coding errors inprogram.
5. Develop applications in a modularfashion.
6. Manage data usingfiles.

Course Outcomes:

On Successful completion of the course students will be able to:

1. Identify and setup program development environment.
2. Design and test programs to solve mathematical and scientific problems.
3. Identify and rectify the syntax errors and debug program for semantic errors
4. Implement modular programs using functions.
5. Represent data in arrays, pointers, structures and manipulate them through a program.
6. Create, read, and write to and from simple text files.

Lab experiments

1. Familiarization with programmingenvironment.
2. Simple computational problems using arithmeticexpressions.
3. Problems involving if-then-elsestructures.
4. Iterative problems e.g., sum ofseries.
5. 1D Arraymanipulation.
6. 2D arrays andstrings.
7. Matrix problems, Stringoperations.
8. Simplefunctions.
9. Recursivefunctions.
10. Pointers andstructures.
11. Dynamic memory allocation and errorhandling.
12. Filehandling:

Design the experiments in such a way that the students will be able to end up the solution for a real world problem that uses most of the concepts of C programming language. For example: A banking application where it uses the concepts of operators, control structures, switch case for menu, structures, functions, error handling, files etc.

Suggested Reading:

1. Pradeep Deyand Manas Ghosh,"Programming in C", Oxford Press, 2nd Edition, 2017.
2. Reema Tharaja "Introduction to C Programming", Second Edition, OXFORD Press, 2015.

References:

1. https://www.tutorialspoint.com/cprogramming/index.htm
2. https://www.w3resource.com/c-programming/programming-in-c.php
3. https://www.w3schools.in/c-tutorial/

Y Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

With effect from the Academic Year 2020-21

20ME C01

CAD AND DRAFTING

Instruction:	1T + 3P Hours per week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2.5

Course Objectives:

1. To get exposure to a cad package and its utility
2. Understanding orthographic projections
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice

Course Outcomes:

At the end of the course, the Students are able to

1. Become conversant with appropriate use of CAD software for drafting
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

List of exercises:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice versa.

Text Books:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt.Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

Suggested Reading:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L.Narayana and P.K.Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

Y Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (AUTONOMOUS)

Scheme of Instructions of II Semester of B.Tech. - Biotechnology as per AICTE Model Curriculum 2020-21

B.TECH. - BIOTECHNOLOGY

SEMESTER – II

S. No	Course Code	Title of the Course	Scheme of Instruction: Hours perweek L	T	P/D	Scheme of Examination: Duration of SEE inHours	Maximum Marks CIE	SEE	Credits
	THEORY								
1	20MT C22/ 20BT C02	Mathematics –II/ Basics Of Biology-II	3	1	-	3	40	60	4
2	20CY C01		3	0	-	3	40	60	3
3	20EE C01	Basic Electrical Engineering	3	-	-	3	40	60	3
4	20BT C03	Process Principles and Reaction Engineering	3	-	-	3	40	60	3
	PRACTICALS								
5	20CY C02	Chemistry lab	-	-	4	3	50	50	2
6	20EE C02	Basic Electrical Engineering lab	-	-	2	3	50	50	1
7	20ME C02	Workshop/Manufacturing Practices	-	-	5	3	50	50	2.5
8	20ME C03	Engineering Exploration	90 Hours / 4P			-	50	-	1.5
		Total	**12**	**1**	**11**	**-**	**360**	**390**	**20**
Clock Hours Per Week 26									

L: Lecture **T: Tutorial** **P: Practical**

CIE-Continuous Internal Evaluation **SEE-Semester End Examination**

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

20MT C22

MATHEMATICS– II
(for BiPC Stream of Bio-Tech)

Instruction:	3 L+1T Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	4

Course Objectives:
1. To discuss the basic operations in Vector Algebra.
2. To discuss Physical interpretations on Scalars and vector functions.
3. To explain various methods of partial fractions.
4. To explain various techniques of integration.
5. To discuss the solutions of first order differential equations.

Course Outcomes:
On successful completion of this course the students will be able to
1. Apply the basic operations on Scalar and Vectors.
2. Apply the vector differential operators to Scalars and Vector functions.
3. Solve partial fractions by various methods.
4. Evaluate definite and indefinite Integral.
5. Solve the first order ordinary differential equations.

UNIT-I: Vector Algebra
Addition of vectors, scalar multiplication, angle between two non-zero vectors, linear combination of vectors, component of vectors in three dimensions, scalar productgeometrical interpretations, orthogonal projections, properties of dot product, angle between two vectors, vector product of two vectors and properties, scalar triple product, vectortriple product.

UNIT-II: Vector Calculus
Definitions, scalar and vector point functions, vector differential operator, Gradient, Divergence and Curl, Solenoidal and Irrotational vectors, properties of gradient, divergence and curl (vector identities)

UNIT- III
Partial Fractions: Resolving f(x)/g(x) in to partial fractions, g(x) contains non repeated linear factors, g(x) contains repeated and non-repeated linear factors, g(x) contains non repeated irreducible factors, g(x) contains repeated and not repeated irreducible factors.
UNIT - IV
Integration: Simple integrations of algebraic, trigonometric and exponential. Methods of integration, integration by parts, integration of rational, irrational and Trigonometric functions, definite integrals.
UNIT- V
Differential Equations: Formation of Differential equations, Solutions of First order and first degree differential Equations, Variable Separable, Homogeneous, Linear, Bernoulli and Exact differential Equations.

Text Books:
1. Shanti Narayan "vector Calculus", S.Chand publishers, 2003.
2. B.S.Grewal, "Higher Engineering Mathematics", 43rd edition, Khanna Publishers, 2014.

Suggested Reading:
1. William E.Boyce /Richard C.Dip, "Elementary differential equations", 9th Edition, wiley publishers, 2008.
2. Joseph Edwards, "Differential Calculus For Beginners", Arihant publishers, 2016.

Y. Rajani

20BT C02

BASICS OF BIOLOGY - II
(for MPC Stream of Bio-Tech)

Instruction:	3 L +1T Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	4

Course Objectives :

1. To impart theoretical knowledge on animal cell, tissues their types and level organization
2. To provide knowledge on basic concepts of Biology and basis of animal kingdom classification.
3. To provide knowledge on various parasites, lifecycle and diseases caused by them.
4. To impart knowledge on ecology, environment and biotic interactions in nature
5. To give an insight on genes, chromosome, blood grouping system, and gene expression

Course Outcomes:

By the end of the course students be able to

1. Identify the basic structure, function of various animal cell organelles, level of organization and types of tissues in animals (BL4).
2. Explain the criteria for classification of various organisms in animal kingdom (BL2).
3. Explain the lifecycles, diseases and preventive measures of human pathogens (BL2)
4. Outline various biotic and abiotic interactions in nature (BL1).
5. Explain the basic information on gene, alleles and its inheritance (BL2).

UNIT- I

Animal Cell, Tissues and Level of Organization: Structure of animal cell and its organelles. Differences between plant and animal cell. Level of organization, multicellularity, diploblastic and triploblastic conditions. Asymmetry, symmetry: radial symmetry and bilateral symmetry. Acoelomates, pseudocoelomates and coelomates in brief. Animal tissues structure and functions. Different types of animal tissues and their functions. Epithelial, Connective, Muscular and Nervous tissues in brief

UNIT- II

Animal Kingdom Classification: Classification of animal kingdom. Phylogeny of invertebrate and vertebrate phyla. Salient features of non-chordates up to phyla, and chordates up to class level. Binomial and trinomial nomenclature. Concept of species and genus

UNIT- III

Parasitology: Parasitism and Parasitic Adaptation: Health and disease: introduction, life cycle, pathogenicity, treatment and prevention; Entamoeba histolytica, Plasmodium vivax, Ascarislum bricoides and Wuchereria bancrofti. Brief account of pathogenicity, treatment and prevention of typhoid, pneumonia, common cold and ring worm.

UNIT - IV

Ecology and Environment: Organism and environment, habitat and niche. Population and ecological adaptations, population interactions. Abiotic environmental factors – light, temperature, water and radiation. Biotic environmental factors –neutralism, competition, mutualism, commensalism, parasitism, predation. Attributes, growth, birth rate and death rate, age distributions.

UNIT – V

Genetics: Structure and Functions of chromosome. Concept of gene and alleles, multiple alleles, ABO blood groups. Sex chromosomes, Sex determination, Sex linked inheritance, gene expression and regulation in prokaryotes and eukaryotes.

Text Books:

1. Campbell, N.A., Reece, J.B., Urry, Lisa, Cain, ML., Wasserman, S.A., Minorsky, P.V., Jackson, R.B. “Biology: A Global Approach”, 11th edition, Pearson Education Ltd. (2017)
2. Beginning Science: Biology. B.S. Beckett. Oxford University Press.1st edition, 1983.

Suggested Reading

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. & J.I., Spicer “The Invertebrates: A New Synthesis”.III Edition, Blackwell Science(2002)
2. K Vaidhyanath, K Pratap Reddy and K Sathya Prasad, “Introduction to Applied Biology and Biotechnology”. BS Publications, India, 2004.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

with effect from the Academic Year 2020-21

20CY C01

CHEMISTRY
(Common to all branches)

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

Course Outcomes

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

UNIT-I Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2, He_2^+, N_2, O_2, O_2^-, CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction-Characteristics: units of first order rate constant & its half-life period, second order reaction-Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT-II Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, – Reference electrodes (NHE, SCE)-electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel

UNIT- III Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism -

Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid)&Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.
Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)
Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)
Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides)
Cyclization (Diels - Alder reaction)

UNIT–IV Water Chemistry:
Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process),ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT-V Engineering Materials and Drugs:
Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.
Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography.
Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle).

Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

Text Books

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Mali, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7thedition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla ,Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C. Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

Suggested Readings

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8thedition (2006).

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

20EEC01

C ELECTRICAL ENGINEERING

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives:
1. To understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. To understand the basic principle of operation of AC and DC machines
3. To know about different types of electrical wires and cables, domestic and industrial wiring. safety rules and methods of earthing

Course Outcomes:
After the completion of this course, the student will be able to
1. Understand the concepts of Kirchhoff's laws and to apply them in superposition, Thevenin's and Norton's theorems to get the solution of simple dc circuits
2. Obtain the steady state response of RLC circuits with AC input and to acquire the basics, relationship between voltage and current in three phase circuits.
3. Understand the principle of operation, the emf and torque equations and classification of AC and DC machines
4. Explain various tests and speed control methods to determine the characteristic of DC and AC machines.
5. Acquire the knowledge of electrical wiring, types of wires, cables used and Electrical safety precautions to be followed in electrical installations.
6. Recognize importance of earthing, methods of earthing and various low-tension switchgear used in electrical installations

UNIT-I
DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltagelaws, analysis of simple circuits with dc excitation, Superposition, Thevenin and Norton Theorems, Time-domain analysis of first-order RL and RC circuits.

UNIT-II
AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power,reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-III
Transformers: Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalentcircuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation

UNIT-IV
DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification,Characteristics of shunt, series and compound generators.
DC Motors: Classification, Torque equation, Characteristics, Efficiency, Speed Control of Series and Shunt Motors.
Three - Phase Induction Motors: Principle of operation, Applications,

UNIT-V
Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handlingelectrical appliances, electric shock, first aid for electric shock, safety rules.

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption

Text Books:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989
3. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill,2009
4. P.V. Prasad, S. sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

20BT C03

PROCESS PRINCIPLES AND REACTION ENGINEERING

Instruction:	3 L Hours per week
Duration of SEE:	3 Hours
SEE:	60 Marks
CIE:	40 Marks
Credits:	3

Course Objectives:

1. The aim of the course is to impart knowledge of the basic chemical engineering principles and techniques used in analyzing a biochemical process.
2. The course aims to provide the students an understanding of how to represent experimental data in graphical form.
3. This course also aims to enable the students to evaluate material balances in different units.
4. The course aims at enabling the students to learn calculations regarding enthalpy and heat of reactions
5. The aim of the course is to impart knowledge of biochemical reactors and enhance skill to formulate and analyze different types of reactors used in biochemical engineering

Course Outcomes:

At the end of the course student are able to

1. To analyze, interpret and solve the problems encountered in the preparation of material and energy balances of different processes.
2. To analyze and present experimental data in the form of graphs.
3. To calculate Material balances and analyze the applications of transport phenomena in Bioprocess.
4. To calculate enthalpy changes associated during various processes
5. To compute and compare the basic design calculations of various reactors.
6. To predict growth kinetics and analyze substrate utilization and product formation.

UNIT-I

Dimensions And System Of Units: Fundamental quantities, derived quantities and conversions; SI and MKS system of Units; Basic Chemical Engineering calculations-Atomic, Molecular and Equivalent weights, molar concept, Concentration units for pure components, Vapor pressures, Moles, Mixers and solutions, Morality, Molality, Normality and Partial pressures; Definition of Stochiometry; Composition of mixers and solutions; Weight fraction; Mole fraction; Volumetric composition; Density and Specific gravity, Ideal gas law; Ideal mixtures and solution;

UNIT-II

Presentation and Analysis of data: Presentation and Analysis of Data, Errors in Data and Calculations, SignificantFigures, Types of Error, Statistical Analysis, Presentation of Experimental Data, Data Analysis, Graph Paper With Logarithmic Coordinates, General Procedures For Plotting Data

UNIT-III

Operations In Bioprocesses and Material balances: Application of principles of unit operations and unit processes in biotech Industries, Application of principles of transport phenomenon (momentum, mass and heat transfer) in bioprocessing. Outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets.

Steady state and Equilibrium, Laws of conservation of mass, Types of material balances, General procedure for solving material balances, Material and energy balances for nonreactive systems; Recycle, bypass and purge processes

UNIT-IV

Energy Balances: Basic Energy concepts, General energy balance equations, Enthalpy calculation procures, Enthalpy Change in Non-Reactive Processes, Procedure for Energy-Balance Calculations, Enthalpy Change Due to Reaction, Heat of Reaction for Processes with Biomass Production, Energy-Balance Equation For Cell Culture

UNIT-V

Introduction To Bioreaction Engineering: - Rate law, zero and first order kinetics; Batch, fed-batch and continuous processes; Growth Kinetics: Batch growth quantifying cell concentration, substrate utilization and product formation; Structured and unstructured models , Chemostat growth, Differences and similarities between chemical and bioreactors; Classification of bioreactors and Reactor configurations; Description of a conventional bioreactor with all aspects; Design and construction criteria of a bioreactor, Ideal reactors - batch, mixed flow and plug flow; diffusion effects - Thiele modulus, effectiveness factor, Damkoehler number

Text Books:

1. Pauline M.Doran, 2013,Bio-process Engineering Principles, 2^{nd} Edition, Academic press
2. Hougen and Watson K M and Ragatz R A,1959, Chemical Process Principles, 2^{nd} Edition ,Wiley.
3. Bhatt B I and S M Vora, Stoichiometry**,** 2006, 4^{th}Edition ,Tata McGraw Hill.
4. Chemical Reaction Engineering , Octave Leven Spiel, 3^{rd} Edition ,Wiley.

Suggested Reading:

1. David M. Himmelblau, James B. Riggs, “Basic Principles and Calculations in Chemical Engineering”, 8/e, Prentice Hall, 2012.
2. James E Bailey, David F Ollis, “Biochemical Engineering Fundamentals: Solutions Manual” McGraw-Hill Education, 1979.
3. Harvey W Blanch, Douglas S Clark “Biochemical Engineering”, 1^{st} Edition, 1997

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

20CY C02

CHEMISTRY LAB

(Common to all branches)

Instruction:	4P Hours per week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2

Course Objectives

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes

At the end of the course student will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively and qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

Chemistry Lab

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2}& Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

Text Books

1. J. Mendham and Thomas,"Vogel' s text book of quantitative chemical analysis", Pearson education Pvt. Ltd. New Delhi, 6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, A.Ghulati, V.C.Garg; R.Chand and CD New Delhi

Suggested Readings

1. Dr.Subdharani , "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara, "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

20EE C02

BASIC ELECTRICAL ENGINEERING LAB

Instruction:	2P Hours per week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	1

Course Objectives:

1. To acquire the knowledge of different types of electrical elements and to verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil, calculate the time and frequency responses of RLC circuits and to familiarize with measurement of electric power &energy.
3. To determine the characteristics of Transformers, dc, ac machines and switchgear components

Course Outcomes:

At the end of the course, the students are expected to

1. Get an exposure to common electrical components, their ratings and basic electrical measuring equipment.
2. Make electrical connections by wires of appropriate ratings and able to measure electric power and energy.
3. Comprehend the circuit analysis techniques using various circuital laws and theorems.
4. Determine the parameters of the given coil and calculate the time response of RL & RC series circuits.
5. Recognize the basic characteristics of transformer and components of switchgear.
6. Understand the basic characteristics of dc and ac machine by conducting different types of tests on them.

List of Laboratory Experiments/Demonstrations:

1. Demonstration of Measuring Instruments and Electrical Lab components.
2. Verification of KCL and KVL.
3. Time response of RL and RC series circuits.
4. Determination of parameters of a choke or coil by Wattmeter Method
5. Verification of Thevenin's and Norton's theorems
6. Turns ratio /voltage ratio verification of single phase Transformers
7. Open Circuit and Short Circuit tests on a given single phase Transformer
8. Observation of Excitation Phenomenon in Transformer
9. Measurement of three phase power in a balanced system using two Wattmeter method.
10. Measurement of 3-Ph Energy by an Energy Meter (Demonstration of Principle)
11. Load test on DC Shunt motor
12. Speed control of DC Shunt motor
13. Demonstration of Low Tension Switchgear Equipment/Components
14. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

20ME C02

WORKSHOP / MANUFACTURING PRACTICES

Instruction:	5P Hours per week
Duration of SEE:	3 hours
SEE:	50 Marks
CIE:	50 Marks
Credits:	2.5

Course Objectives:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive & team work attitude to get things right the first time.
3. To provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. To advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes:

At the end of the course, the students are able to

1. Understand safety measures to be followed in workshop to avoid accidents
2. Identify various tools used in fitting, carpentry, tin smithy, house wiring, welding, casting and machining processes
3. Make a given model by using workshop trades including fitting, carpentry, tin smithy and House wiring.
4. Perform various operations in welding, machining and casting processes
5. Conceptualize and produce simple device/mechanism oftheir choice

List of Exercises

CYCLE 1

Exercises in Carpentry

1. To plane the given wooden piece to required size
2. To make a lap joint on the given wooden piece according to the given dimensions.
3. To make a dove tail-joint on the given wooden piece according to the given dimensions.

Exercises in Tin Smithy

4. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
5. To make a scoop.
6. To make a pamphlet box.

Exercises in Fitting

7. To make a perfect rectangular MS flat and to do parallel cuts using Hack saw
8. To make male and female fitting using MS flats-Assembly1
9. To make male and female fitting using MS flats-Assembly2

Exercises in House Wiring

10. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch, and wiring of one buzzer controlled by a bell push
11. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs.Wiring of two light points connected in parallel from two single pole switches and a three pin socket
12. Stair case wiring-wiring of one light point controlled from two different places independently using two 2-way switches.

CYCLE 2

Exercises in Casting

1. Study of Sand casting process and its applications.
2. Green sand moulding practice for a single piece pattern
3. Green sand moulding practice for a split pattern with a horizontal core

Exercises in Welding

4. Study of gas welding equipment and process. Identification of flames, making of Butt joint with gas welding.
5. Study of Arc welding process, making Butt joint with DCSP, DCRP
6. Study of Arc welding process, making Lap joint with A.C

Exercises in Machine shop

7. Study of Machine Tools like Lathe, Drilling, Milling and Shaper.
8. Facing, Plain turning and Step turning operations on Lathe machine.
9. Knurling and Taper turning on Lathe machine

Open ended Exercise:

1. Student should produce a component /mechanism by applying the knowledge of any one trade or combination of trades.

TextBooks:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I, 2008 and Vol. II, 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. And Steven S. Schmid, “Manufacturing Engineering and Technology”,4th edition, Pearson Education India Edition, 2002.
3. Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, “Manufacturing Technology – I”, Pearson Education, 2008.
2. Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

CHAITANYABHARATHIINSTITUTEOFTECHNOLOGY(A)
Department of Bio-Technology
Scheme of Instructions of III & IV Semesters of B.Tech Bio-Technology as per AICTE Model Curriculum 2019-20
B.Tech (Bio-Technology)

SEMESTERIII

S.No	Course Code	Title of the Course	Scheme of Instruction Hours Per week L	T	P	Scheme of Examination Duration of SEE in Hours	Maximum Marks CIE	SEE	Credits
	THEORY								
1	18MTC06	Engineering Mathematics-III	3	-	-	3	30	70	3
2	18BT C03	Cell and Molecular Biology	3	-	-	3	30	70	3
3	18BT C04	Biochemistry	3	-	-	3	30	70	3
4	18BT C05	Microbiology and Industrial Biotechnology	3	-	-	3	30	70	3
5	18BT C06	Process Principles and Reaction Engineering	3	-	-	3	30	70	3
6	18BT C07	Genetics	3	-	-	3	30	70	3
7	18EG M01	Indian Constitution	2	-	-	2	-	50	Non-Credit
8	18EE M01	Indian Traditional Knowledge	2	-	-	2	-	50	Non-Credit
	PRACTICALS								
9	18BT C08	Biochemistry Lab	-	-	2	2	15	35	1
10	18BT C09	Microbiology Lab	-	-	2	2	15	35	1
Total			22	-	4	-	210	590	20
Clock Hours Per Week -26									

L: Lecture T: Tutorial P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

18MT C06

ENGINEERINGMATHEMATICS-III
(For Bio-Technology)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
To learn
1. To solve linear system of equations using Matrix Methods.
2. Understand the basic concept of continuity, differentiability and geometric interpretation of mean value theorems.
3. Concept of partial differentiation, maximum and minimum.
4. Identifying vector, scalar addition, multiplication, geometrical interpretation in 2D, 3D space.
5. Understand the concept of scalar and vector point functions of divergence and curl of vector functions and its physical interpretations.

Course Outcomes: At the end of the course students will be able to
1. Solve system of linear equations and identify the Eigen values and Eigen vectors in engineering problems.
2. Solve the problems based on Mean value theorems
3. Solve maxima and minima problems.
4. Solve vector and scalar triple product related problems.
5. Solve divergence and curl related problems.

UNIT-I
Matrices: Rank of the matrix, Echelon form, System of Homogeneous and Non-Homogeneous linear equations, Linearly dependence and independence of vectors, Eigen values and Eigenvectors. Quadratic forms, Reduction of quadratic form to canonical form by linear transformation.

UNIT-II

[Author]

Y. Rajasri
HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075

Calculus: Rolle's Theorem, Lagranges Mean value theorem, Cauchy's mean value theorem (without proofs). Taylor's series and Maclaurin's series for single variable. Curvature, radius of curvature and Evolutes (Cartesian form only),

[Author]

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

UNIT-III

Partial differentiation: Homogeneous functions-Euler's theorem on homogeneous functions, higher order partial derivatives, Derivatives of composite and implicit functions, Taylor's series of two variables.

UNIT-IV

Vector Algebra: Addition of vectors, scalar multiplication, angle between two non zero vectors, linear combination of vectors, component of vectors in three dimensions, scalar product-geometrical interpretations- orthogonal projections, properties of dot product, angle between two vectors, vector product of two vectors and properties, scalar triple product, vectors triple products-results.

UNIT-V

Vector Calculus: Definitions- scalar and vector point functions, vector differential operator, Gradient, Divergence and Curl, Solenoidal and Irrational vectors, properties of gradient, divergence and curl (vector identities)

Text Books:

1. Grewal BS, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, 2015.
2. Jain ARK, Iyenger SRK, "Advance Engineering Mathematics", 3rd edition, Narosa publications, 2007.
3. Narayan Shanti, Mittal PK, " Differential Calculus" , 30th edition, S Chand publishers, 2005.

Suggested Reading:

1. Vasistha AR, "Matrices", 43rd edition, Krishna Prakashan Media (P) Ltd. 2014.
2. Edwards J, "Differential Calculus For Beginners", Arihant publishers, 2016
3. Kreyszig E, "Advanced Engineering Mathematics", 10th edition, Wiley publishers, 2015
4.
5.

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

18BT C03

CELL AND MOLECULAR BIOLOGY

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives

1. Student is made to understand the basics of cell biology i.e. concept of cellular organelles and their functions.
2. Students are taught the structure of cytoskeleton, and how it maintains the cell structure integrity.
3. Student is made to understand the basics of molecular biology, and the central dogma of the genetic material

Course Outcomes: At the end of the course students will be able to

1. Recognize the structure and functions of cell organelles.
2. Interpret the knowledge of transport of metabolites and cell cycle checkpoints in their experimental work.
3. Distinguish the organization and Replication of DNA, damages and repairs
4. Identify the structure and function of transcripts and mechanism of transcription by RNA polymerases.
5. Illustrate the mechanism of translation and post translation mechanism

UNIT-I

Cell Structure, Organelles and their Functions: Cell structure and organization in bacteria, plants and animal cells; structure and functions of cell wall, lysosomes, ribosomes, golgi complex, peroxisomes, glyoxysomes, mitochondria, plastids, endoplasmic reticulum, vacuoles, centrioles; cytoskeleton - composition, structure and functions of microtubules, microfilaments and intermediate filaments; nucleus, its ultra structure, (nuclear envelope, nucleoplasm, chromatin fibers).

UNIT-II

Membrane Transport and Cell Cycle: Biomembrane – lipid composition and structural organization, protein components and basic function, transport across membrane – passive diffusion, facilitated diffusion, osmosis, active transport (Na+ /K+ Pump), cotransport; uniport, antiport, symport. Cell cycle: Different phases of cell cycle; check points of cell cycle; Regulation of cell cycle - cyclins and cyclin dependent kinases

UNIT-III

Organization and Replication of DNA: Structure of DNA – Watson and Crick's model; role of histone and non histone proteins in structural organization of chromosomes; telomere and its importance; DNA Replication: Experimental evidences, enzymology of replication, complex replication apparatus; unidirectional, bi-directional and rolling circle replication; DNA damage and repair: Types of DNA damages- deamination, alkylation, pyrimidine dimmers; DNA Repair mechanisms- photo reactivation, Excision repair, mismatch repair.

UNIT-IV

Mechanism of Transcription: Structure of promoters- RNA polymerases of prokaryotic and eukaryotic organism; transcription- initiation, elongation and termination; post transcriptional processes of eukaryotic RNA: structure and functions of RNA- (rRNA, mRNA, tRNA, snRNA), prokaryotic and eukaryotic transcription. Processing of t-RNA, r-RNA, m-RNA splicing; concept of ribozyme, inhibitors of transcription.

UNIT-V

Mechanism of Translation: Ribosome- structural features; features of genetic code, wobble hypothesis; protein synthesis: translation in prokaryotes and eukaryotes- initiation of translation, elongation of polypeptide chain, termination of translation; Post translation modification, inhibitors of protein synthesis.

Text Books:

1. Geoffrey M. Cooper and Robert E. Hausman, "The cell: A molecular approach", 6th edition, Sinauer Associates, 2013.
2. Gerald Karp, "Cell and Molecular Biology": concepts and experiments, 6th edition, John Wiley & sons, 2009
3. David Freifelder, "Molecular Biology", 2nd edition, Narosa Publication, 2007.

Suggested Reading:

1. Rastogi S.C., "Cell and Molecular Biology", 2nd edition, New Age International, 2006.
2. Benjamin Lewin, Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick, "Lewin's Genes XI", Jones and Bartlett publishers, 2014.

18BT C04

BIOCHEMISTRY

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. Students will learn structure of carbohydrates, lipids, proteins and nucleic acids
2. Students will learn functions of carbohydrates, lipids, proteins and nucleic acids
3. Students will learn metabolism of different biomolecules.

Course outcomes: At the end of the course students will be able to

1. Recognize different biomolecules structure and describe the functions of various biomolecules.
2. Evaluate the energy yield from the catabolism of carbohydrates and explain the steps in anabolism.
3. Evaluate the energy yield from lipids and reconstruct lipids.
4. Outline steps involved in catabolism and anabolism of proteins.
5. Summarize steps involved in catabolism and anabolism of nucleic acids.

UNIT-I

Biomolecules: Carbohydrates- classification; Glycoproteins; glycolipid; Classification and nomenclature of lipids; Amino acid – Classification and its structure, peptide bond- structure; Proteins-classification and Biological functions; Forces stabilizing protein structure; Protein structure - primary structure, secondary structure (á-helical, â-pleated sheets), super secondary structures, Ramachandran Plot, tertiary and quaternary structure; Enzymes – properties.

UNIT-II

Metabolism of Carbohydrates: Carbohydrate Metabolism: Glycolysis – Preparatory phase and Payoff phase, substrate level Phosphorylation, regulation of glycolysis, HMP Shunt, Citric Acid Cycle, anaplerotic reactions, Electron Transport System and Oxidative Phosphorylation, Mitchell's chemiosmotic hypothesis; Gluconeogenesis; Glycogen metabolism – Glycogenolysis and Glycogenesis.

UNIT-III

Metabolism of Lipids: Lipid Metabolism: â - Oxidation of saturated, unsaturated fatty acid; Cholesterol Metabolism; Metabolic Pathways- Biosynthesis of Saturated and Unsaturated Fatty Acids, synthesis of Triglycerol; Metabolism of Phospholipids and Sphingolipids.

UNIT-IV

Metabolism of Proteins: Amino acids metabolism- Biosynthesis of aromatic amino acids, Peptides; Metabolic fate of Amino group; Nitrogen Excretion and Urea Cycle; Catabolism of aromatic and branched chain amino acids; Transamination, Oxidative Deamination and Oxidative Decarboxylation.

UNIT-V

Metabolism of Nucleic Acids: Structure of nucleotides, nucleosides and nitrogenous bases; chemical structure of DNA and RNA; Nucleic Acid Metabolism- De nova synthesis of Purine and Pyrimidine, salvage pathway, Ribonucleotides, synthesis of Deoxyribonucleiotides; Degradation of Purine and Pyrimidine Nucleotides.

Texts Books:

1. Eric E.Conn, Paul K Stumpf, George Bruening, Roy H Doi, "Outlines of Biochemistry", 5//E, John Wiely and Sons, 2006.
2. David Lee Nelson and Michael M. Cox, Lehninger "Principles of Biochemistry", 6th edition, W. H. Freeman, 2013.

Suggested Reading:

1. Donald Voet and Judith G. Voet, "Biochemistry", 4th edition, John Wiley & Sons, New York, 2011.
2. Reginald Garrett and Charles Grisham, "Biochemistry", 5th edition, Cengage Learning, 2012.
3. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "Biochemistry", 6th Edition. W. H. Freeman and Company, 2010.

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

18BT C05

MICROBIOLOGY AND INDUSTRIAL BIOTECHNOLOGY

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Understand historical perspectives important in development of microbiology.
2. Describe prokaryotic cell structure with functions.
3. Classification of different groups of microorganisms.
4. Concepts of culture media preparation sterilization techniques and microbial growth.
5. Concepts of fermentation process and examples of industrially important products.

Course Outcomes: At the end of the course students will be able to:

1. Outline the historical aspects of microbiology and structure of prokaryotic cell.
2. Identify major characteristics and classification of microorganisms.
3. Describe importance of culture media and microbial growth.
4. Compare physical and chemical sterilization methods.
5. Apply theoretical knowledge for production of microbial metabolites.

UNIT-I

History and Introduction to Microbiology: History and scope of microbiology, contributions of Antony van Leuwenhoek, Louis Pasteur, Robert Koch, Iwanowskii, Edward Jenner; prokaryotic cell structure – plasma membranes, cytoplasmic matrix – inclusion bodies, ribosome, bacterial chromosome and plasmids, cell wall, components external to cell wall – capsule, slime layer, pili, fimbriae, flagella, bacterial endospores and their formation.

UNIT-II

Classification of Microorganisms: General and colony characters of major groups of microorganisms - algae, fungi, protozoa, bacteria and virus; Identification of microorganisms by major taxonomical characteristics (morphological, physiological, ecological, cultural, metabolic/biochemical, immunological and genetic); Classification of microorganisms - Haeckel's three kingdom concept, Whittaker's five kingdom concept, Three domain concept of Carl Woes.

UNIT-III

Microbiological Techniques and Growth: Methods of culturing of microorganisms - culture media, (liquid, semi-solid and solid media, synthetic media and complex media), Isolation of pure cultures (streak, spread and pour plate methods); Concept of sterilization - methods and their application- physical methods (heat, filtration and radiation), chemical methods (phenolics, alcohols, halogens, heavy metals, dyes, quaternary ammonium compounds, aldehydes, gaseous agents); Methods of preservation of microorganisms and their importance (Bacterial cultures); Microbial growth - growth curve, mathematical expression of growth, measurement of microbial growth (cell numbers and cell mass).

UNIT-IV

Production of Microbial Metabolites: Types of fermentation processes: aerobic and anaerobic processes, production of anaerobic fermentation products alcohols (ethanol and n-butanol), Production of beverages (beer and wine), Production of organic acid (citric acid); Production of aerobic fermentation products: classification of antibiotics, production of penicillin.

UNIT-V

Production Of Microbial Enzymes And Specialty Products: Production of commercially important industrial enzymes - proteases, amylases, lipases, cellulase, pectinase, and isomerase, bio-fertilizers and plant growth factors (Gibberellins); natural biopreservatives (Nisin); biopolymers (PHB); high fructose corn syrup.

Text Books:

1. Pelczar Michael J., Krieg Noel R., Chan, E.C., "Microbiology", 5th edition, McGraw Hill higher education1993.
2. Crueger W and Crueger A, Biotechnology: Text Book of Industrial microbiology. 2nd edition, Panima Publisher, 2005.
3. Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A-Stahl and Clark, "Brock Biology of Microorganisms", 13th edition, Prentice Hall International Inc, 2010.

Suggested Reading:

1. Powar C.B. and Daginawala H.F., "General Microbiology – Vol I & II", 2nd edition, Himalaya publishing house, 2005.
2. Arti Kapil, Ananthanarayan and Paniker's "Text book of Microbiology", 9th edition, Orient Blackswan, 2013.
3. Roger Y Stanier, "General Microbiology", 5th edition, Palgrave Macmillan Limited, 1999.

18BT C06

PROCESS PRINCIPLES AND REACTION ENGINEERING

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. The aim of the course is to impart knowledge of the basic chemical engineering principles and techniques used in analyzing a chemical process.
2. This course also aims to enable the students to evaluate material and energy balances in different units.
3. Through this course the students are given an understanding of application of principles of unit operations and unit processes in biotech Industries.
4. This course aims at analyzing the kinetics of chemical reactions.
5. The aim of the course is also to give the students an understanding of the theory of biochemical reactors and enhanced skill in formulation and analysis of different types of reactors used in biochemical engineering

Course Outcomes: At the end of the course student are able to

1. To analyze, interpret and solve the problems encountered in the preparation of material and energy balances of the process.
2. To predict the flue gas composition from fuel composition and vice versa.
3. To design and use the generalized flow sheets for different chemical processes.
4. To evaluate and assess the rate equations for any given chemical reaction
5. To compute and compare the basic design calculations of various reactors.

UNIT-I

Dimensions and System of Units: Fundamental quantities, derived quantities and conversions; SI and MKS system of Units; Basic Chemical Engineering calculations-Atomic, Molecular and Equivalent weights, molar concept, Concentration units for pure components, Vapor pressures, Moles, Mixers and solutions, Morality, Molality, Normality and Partial pressures; Laws of Chemical Combination; Definition of Stochiometry; Composition of mixers and solutions; Weight fraction; Mole fraction; Volumetric composition; Density and Specific gravity, Ideal gas law; Ideal mixtures and solution; Dalton's law of additive pressures; Amagats law of additive volumes.

UNIT-II

Operations in Bioprocesses: Application of principles of unit operations and unit processes in biotech Industries, Application of principles of transport phenomenon (momentum, mass and heat transfer) in bioprocessing. Outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets. Laws of conservation of mass, meaning of material balance and its applications, Process flow sheet, Drawing material balance on non reacting steady system, Conversion, yield, Limiting reactants, Excess reactants, Recycling, By-passing, Material balances on steady state reacting systems with recycling and By-passing.

UNIT-III

Material Balances: Law of conservation of energy, Meaning of energy balance and its importance, Inputs of energy balance, Specific heat and sensible heat, Latent heat and heats of transition, Sublimation, Enthalpy of solutions, Standard heats of formation, Standard heats of combustion, Standard heats of reaction, Bess's law, Kirchoffs law, Determination of heat of reaction at temperature other than standard temperature using specific heat relationships, Combustion calculations, Combustion air requirements, determination of flue gas composition from fuel composition and vice versa.

UNIT-IV

Introduction to Reaction Kinetics: Concepts of Reaction Kinetics, Types of reaction, order of reaction, The effect of temperature and pH on reaction rate. Rate equations and Reaction mechanisms; Interpretation of batch reactor data, constant volume batch reactor, integral method of analysis of data for reversible and irreversible reactions. Searching for mechanism - Arrhenius equation - Growth Kinetics: Batch growth quantifying cell concentration, chemostat growth.

UNIT-V

Introduction To Bioreaction Engineering: Definitions, Differences and similarities between chemical and bioreactors; Classification of bioreactors; Reactor configurations; Description of a conventional bioreactor with all aspects; Design and construction criteria of a bioreactor; Residence time distributions, concentration, and temperature distributions; Models of non-ideal reactors. Animal and plant cell reactor technology- Environmental requirements for animal

cell cultivation, reactors for large-scale production using animal cells, plant cell cultivation.

Text Books:

1. Hougen and Watson. K.M., and Ragatz R A, "Chemical Process Principles", 2 nd Edition, Wiley, 1959.
2. Bhatt B I and S M Vora, "Stoichiometry", 4/ e, Tata McGraw Hill, 2006.

Suggested Reading:

1. David M. Himmelblau, James B. Riggs, "Basic Principles and Calculations in Chemical Engineering", 8/e, Prentice Hall, 2012.
2. Swamy AVN, "Fundamentals of Biochemical Engineering", BS Publications, 2007.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

18BT C07

GENETICS

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives

1. Student is made to understand the basics of genetics, ie. Concept of how genes are responsible for inheritance of characteristics.
2. Students are taught the structure of chromosome, and how it stores genetic information.
3. Importance of chromosome taught by showing the effects of mutations on chromosomes.
4. Students are enlightened about crossing over being the basis of genetic diversity.
5. Students are made aware of chromosome related genetic disorders.

Course Outcomes: At the end of the course students will be able to

1. Apply to real life situations, the principles of human heredity.
2. Be able to describe the chromosomal basis of inheritance arised due to abberations in chromosomal structure and number.
3. Be able to map understand the organization of genes due to linkage and crossing over mechanism.
4. Be able to predict the chromosomal basis of mendelism, in sex linked genes and sex determination.
5. Able to analyze concept of non mendelian maternal inheritance and population level genetic processes.

UNIT-I:

Physical Basis Of Heredity: Mendel's laws of inheritance – segregation, independent assortment, modification of mendelian principles: Dominance and recessive genes, co-dominance, incomplete dominance, Gene and Alleles, multiple alleles, gene interactions, epistatic interactions, pleotropism.

UNIT-II

Chromosome Structure and Abberations: Prokaryotic and eukaryotic genome; karyotyping; specialized chromosomes: gaint chromosomes – polytene and lamp brush chromosomes; chromosomal aberrations- structural aberrations (deletions,

UNIT-III

duplication, inversion and translocation), numerical aberrations (aneuploidy, euploidy, auto polyploidy and allopolyploidy). Mutations – spontaneous, induced; physical and chemical mutagens; lethal mutation (characteristics and types), AMES test, applications of mutations.

Linkage And Crossing Over: Concept of linkage and crossing over, cytological basis of crossing over (in Drosophila and Maize), factors affecting recombination frequency, linkage maps; mechanism of recombination – model involving single strand breaks and double strand break in DNA duplex, significance of Crossing over. Two point and three point test cross. Interference. Tetrad analysis.

UNIT-IV

Sex Determination, Sex Linked And Genetic Disorders: Sex chromosomes, sex determination mechanism in animals (insects and humans) and plants, sex determination by genic balance and Y-linked genes. Dosage compensation, Maryleon's hypothesis; sex linkage and its disorders; autosomal disorders in human beings. Garrod's inborn errors of metabolism.

UNIT-V

Extra Chromosomal Inheritance and Quantitative Genetics: Extra chromosomal inheritance – inheritance of mitochondrial and chloroplast genes, maternal inheritance (CMS, nuclear petites in yeast, Mirabilus jalapa). Transgressive segregation, quantitative characters, Gene frequency, gene pool, Hardy- Weinberg Law, equilibrium, Fitness and selection Goodness of fit: Chi-square-test.

Text Books:

1. Snustad, D.Peter, Simmons Michael, "Principles of Genetics 6th edition", John Wiley& Sons publication, 2012.
2. Singh, B.D. "Genetics - 3rd edition", Kalyani Publications, 2004.
3. Gardner, E. J., Simmons, M. J., Snustad, D. P. and Snustad, "Principles of Genetics", John Wiley and Sons, Inc. 1985.

Suggested Reading:

1. Verma PS, Agrawal VK, "Cell Biology, Genetics, Molecular Biology, Evolution and Ecology". S. Chand & Company Ltd., New Delhi, 2004.
2. Gupta PK, "Genetics", 4th Rev Edition (2nd Reprint) Rastogi Publications, 2011.

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075

Code: 18EG M01

INDIAN CONSTITUTION

(BE/BTech III/IV Semester - Common to all branches)

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	0

Course Objectives

The course will introduce the students to :

1. The history of Indian Constitution and how it reflects the social, political and economic perspectives of the Indian society.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes

After successful completion of the course the students will be able to:

1. Understand the making of the Indian Constitution and its features.
2. Have an insight into various Organs of Governance - composition and functions.
3. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies.
4. Be aware of the Emergency Provisions in India.
5. Understand the Right To equality, the Right To freedom and the Right to Liberty.

Unit-I

Constitution of India: Introduction and salient features. Constitutional history. Directive Principles of State Policy - Its importance and implementation.

Unit-II

Union Government and its Administration: Structure of the Indian Union: Federalism, distribution of legislative and financial powers between the Union and the States.

Parliamentary form of government in India. President: role, power and position.

Unit-III

Emergency Provisions in India: National emergency, President rule, Financial emergency

Unit IV

Local Self Government: District's Administration Head: Role and Importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

Panchayati Raj: Introduction, Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments). Village level: Role of Elected and officials.

Unit V

Scheme Of The Fundamental Rights & Duties: Fundamental Duties - the legal status.

Scheme Of The Fundamental Rights - To Equality, to certain Freedom Under Article 19, to Life And Personal Liberty Under Article 21.

Suggested Reading:

1. **The Constitution of India**, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, **Framing of Indian Constitution**, 1st Edition, 2015.
3. M. P. Jain, **Indian Constitution Law**, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu**, Introduction to the Constitution of India**, Lexis Nexis, 2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

18EE M01

INDIAN TRADITIONAL KNOWELDGE

Instruction	2 Hours per week
Duration of SEE	2 Hours
SEE	50 Marks

Course Objectives:
1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Course Outcomes: After completion of this course, students will be able to:
1. Understand philosophy of Indian culture
2. Distinguish the Indian languages and literature
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India
5. Know the contribution of scientists of different eras.

UNIT-I

Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India

UNIT-II

Indian Languages, Culture and Literature:

Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India.

Indian Languages and Literature-II: Northern Indian languages & literature

UNIT-III

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT-IV

Fine arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India .

UNIT-V

Education system in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Text Books:

1. Kapil Kapoor, Text and Interpretation: The India Tradition,ISBN: 81246033375, 2005.
2. Science in Samskrit, Samskrita Bharti Publisher, ISBN-13: 978-8187276333, 2007.
3. S. Narain, Examinations in ancient India, Arya Book Depot, 1993.
4. Satya Prakash, Founders of Sciences in Ancient India, Vijay Kumar Publisher, 1989.
5. M. Hiriyanna, Essentials of Indian Philosophy, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990, 2014.

Suggested Reading:

1. Kapil Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
2. Karan Singh, A Treasury of Indian Wisdom: An Anthology of Spiritual Learn, ISBN: 978-0143426158, 2016.

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

18BT C08

BIOCHEMISTRY LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course objectives:

1. Students will learn the laboratory safety and standard operating procedures
2. Students will learn how to estimate and analyze different biomolecules

Course outcomes: At the end of the course students will be able to

1. Apply the laboratory safety and standard operating procedures and prepare the solutions and biological buffers
2. Estimate and analyze carbohydrate by different methods
3. Estimate and analyze amino acids and proteins by different methods
4. Estimate and analyze lipids and compare the acid value, Saponification value and iodine valve of various lipids.
5. Estimate and analyze nucleic acids

List of Experiments:

1. Introduction to Biochemistry Lab: Units, Volume / Weight measurements, concentration units
2. Preparation of Solutions – percentage solutions, molar solutions, normal solutions and dilution of stock solution
3. Measurement of pH
4. Preparation of buffers and reagents
5. Titration curve of amino acid and calculation of pK and pI values
6. Estimation of Carbohydrates by Anthrone method
7. Estimation of Amino acids by Ninhydrin method
8. Estimation of Proteins by Biuret method
9. Estimation of Proteins by Lowry method
10. Determination of Acid value, Saponification value and Iodine Number of Fat
11. Estimation of Cholesterol by Liebermann Burchard method
12. Estimation of DNA by Diphenyl amine method
13. Estimation of RNA by Orcinol method

Suggested Reading:

1. David, T. Plummer, "An introduction to Practical Biochemistry", 3rd edition, Tata McGraw Hill, 1988.
2. Beedu Sashidhar Rao, Vijay Deshpande, "Experimental Biochemistry – A student companion", Anshan Pub, 2006.

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

18BT C09

MICROBIOLOGY LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

Students are made to understand the following experiments during their course of time:

1. Proper handling and focusing of Bright Field microscope
2. Physical and chemical sterilization methods for control of microorganisms
3. Preparation of culture media
4. Techniques for the isolation of pure cultures
5. Simple and Gram staining techniques

Course Outcomes: At the end of the course students will be able to

1. Outline of Magnification, Resolution, Refractive index of Microscope
2. Operate the physical sterilization equipments
3. Prepare the basic culture media for the growth of microorganisms
4. Perform streak plate, spread plate and pour plate techniques.
5. Identify type of bacteria (Gram positive or Gram negative)

List of Experiments:

1. Calibration of Microscope and Measurement of Microorganisms-Microtome.
2. Staining and Identification of microorganism: (a) Simple and Differential staining techniques.
3. Sterilization techniques (Autoclaving, Hot Air Oven, Radiation and Filtration).
4. Preparation of culture media (a) broth type of media (b) Agar.
5. Culturing of microorganism (a) broth (b) pure culture techniques-Streak plate, Pour plate.
6. Antibiotic tests- Disc diffusion method, minimum inhibitory concentration.
7. Biochemical tests- IMIVC test, Catalase, Coagulase test, Gelatinase test, Oxidase.
8. Factors affecting the bacterial growth and study of growth curve.

9. Measurement of Microbial Growth by Turbidometry and enumeration of bacterial numbers by serial dilution.
10. Measurement of Microbial Growth by Viable Count.
11. Production of Beer and Wine
12. Coliform test

Suggested Reading:

1. Gopal Reddy M, M.N. Reddy, D.V.R. Sai Gopal and K.V. Mallaiah , “Laboratory Experiments in Microbiology”,3rd edition, Himalaya Publishing House Pvt Ltd, 2008,
2. Gunasekaran P., “Laboratory manual in Microbiology”, 3rd edition, New Age International Publ., New Delhi, 2007.
3. Kannan N., “Laboratory manual in General Microbiology”, 1st edition, Panima Publishing Corp., New Delhi, 2002.

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
Department of Bio-Technology
B.Tech (Bio-Technology)

SEMESTER IV

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
	THEORY								
1	18CS C05	Basics of Data Structures	2	-	-	2	20	50	2
2	18BT C10	Immunology	4	-	-	3	30	70	4
3	18BT C11	Instrumental Methods in Biotechnology	4	-	-	3	30	70	4
4	18BT C12	Chemical and Biochemical Thermodynamics	3	-	-	3	30	70	3
5	18ME C09	Principles of Management	3	-	-	3	30	70	3
6	18CE M01	Environmental Science	2	-	-	2	-	50	Non-Credit
	PRACTICALS								
7	18CS C06	Basics of Data Structures	-	-	2	2	15	35	1
	18BT C13	Immunology Lab	-	-	2	2	15	35	1
8	18BT C14	Instrumentation Lab	-	-	2	2	15	35	1
9	18EG C03	Soft Skills Lab	-	-	2	2	15	35	1
Total			18	-	8	-	200	520	20
Clock Hours Per Week -26									

L: Lecture T: Tutorial P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

18CS C05

BASICS OF DATA STRUCTURES
(Common for other Programmes)

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	20 Marks
Credits	2

Pre-requisites: Basic knowledge of programming language such as C or C++ is preferred (but not mandatory) and some mathematical maturity also will be expected.

Course Objectives:
To introduce
1. Basic linear and non-linear data structures.
2. Analyzing the performance of operations on data structures.
3. Different sorting and searching techniques and their complexities.

Course Outcomes: At the end of the course students will be able to
1. Understand the basic concepts of data structures.
2. Understand the notations used to analyze the performance of algorithms.
3. Choose and apply an appropriate data structure for a specified application.
4. Understand the concepts of recursion and its applications in problem solving.
5. Demonstrate a thorough understanding of searching and sorting algorithms.

UNIT-I
Introduction: Data Types, Data structures, Types of Data Structures, Operations, ADTs, Algorithms, Comparison of Algorithms, Complexity, Time- space tradeoff. **Recursion**: Introduction, format of recursive functions, recursion Vs. Iteration, examples.

UNIT-II
Linked Lists: Introduction, Linked lists and types, Representation of linked list, operations on linked list, Comparison of Linked Lists with Arrays and Dynamic Arrays.

UNIT-III

Stacks and Queues: Introduction to stacks, applications of stacks, implementation and comparison of stack implementations. Introduction to queues, applications of queues and implementations, Priority Queues and applications.

UNIT-IV

Trees: Definitions and Concepts, Operations on Binary Trees, Representation of binary tree, Conversion of General Trees to Binary Trees, Representations of Trees, Tree Traversals, Binary search Tree.

UNIT-V

Graphs: Introduction, Applications of graphs, Graph representations, graph traversals, Minimal Spanning Trees.

Searching and Sorting: Linear searching, binary Searching, sorting algorithms-bubble sort, selection sort, quick sort, heap sort.

Text Books:

1. Narasimhaarumanchi, Data Structures and Algorithms Made Easy, CareerMonk Publications, 2017
2. S. Sahni and Susan Anderson-Freed, Fundamentals of Data structures in C,E.Horowitz, Universities Press, 2nd Edition.
3. ReemaThareja, Data Structures using C, Oxford University Press.

Suggested Reading:

1. D.S.Kushwaha and A.K.Misra, Data structures A Programming Approach with C, PHI.
2. Seymour Lipschutz, Data Structures with C, Schaums Outlines, Kindle Edition

Online Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.edx.org/course/foundations-of-data-structures
3. https://sites.google.com/site/merasemester/data-structures/data-structures-1#DS

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

18BT C10

IMMUNOLOGY

Instruction	4 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

1. Students learn about the basic components and responses of Immune system
2. Knowledge of Antigen and antibody and the application of Antigen and antibody reaction
3. Importance of Antigen Processing and Presentation is emphasized.
4. Students understand significance of complement system and hypersensitivity
5. The immunological basics for diseases is taught to the students

Course Outcomes: At the end of the course students will be able to

1. Identify Immune system components and how they work in a coordinated way.
2. Apply the application of antigen-antibody interactions in development of medical diagnostic kits.
3. Analyze the Immune system related underlying causes in Allergies, Asthma and other hypersensitive reactions.
4. Acquainted with the diseases caused due to Immune system malfunctioning.
5. Explain the Immune system related medical complications in transplantation and Cancers.

UNIT-I

Immune System: Introduction to immunity, types of immunity – innate and adaptive immunity, humoral and cell mediated immune response, hematopoiesis, cells of the immune system, organs of immune system – primary (bone marrow and thymus) and secondary (lymph node, spleen, MALT, GALT), molecules of immune system (cytokines, interleukins, interferons, chemokines).

UNIT-II

Antigen, Antibody and its Interaction: Antigen – immunogenicity and antigenicity, factors influencing immunogenicity, haptens and adjuvants, epitopes; Immunoglobulin – structure, classes and function, antigenic determinants of immunoglobulin – isotype, allotype, idiotype, generation of antibody diversity, production of monoclonal antibodies by hybridoma technology and its applications. Strength of antigen antibody interaction, affinity, avidity, cross reactivity, precipitation, agglutination, immunoelectrophoresis, RIA, ELISA, western blotting, immunofluorescence, FACS.

UNIT-III

Antigen Processing and Presentation: Major histocompatibility complex (MHC) – organization, classes and function; Antigen processing and presentation – role of antigen presenting cells, endogenous antigens (cytosolic pathway), exogenous antigens (endocytic pathway), presentation of nonpeptide antigen.

UNIT-IV

The Complement System and Hypersensitivity: Complement system – components, function, activation (classical and alternative pathway); Hypersensitive reactions – Type I (IgE mediated hypersensitivity), type II (antibody mediated cytotoxic hypersensitivity), type III (Immune complex mediated hypersensitivity), type IV (delayed type hypersensitivity).

UNIT-V

Medical Applications Of Immunology: Autoimmunity – organ specific (insulin dependent diabetes mellitus, Graves' disease, myasthenia gravis) and systemic (systemic lupus erythematosus, multiple sclerosis, rheumatoid arthritis) autoimmune diseases, treatment of autoimmune diseases; Transplantation – immunological basis of graft rejection, immunosuppressive therapy (general and specific), immunoprophylaxis (attenuated, inactivated and DNA vaccines), immunology of cancer- tumour antigens, immune response to tumour, cancer immunotherapy

Text Books:

1. Judith A. Owen, Jenni Punt, Sharon A.Stranford, "Kuby Immunology", 7th edition, W.H. Freeman, 2013.
2. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt, "Roitt's Essential Immunology", 12th edition,John Wiley & Sons, 2011.

Suggested Reading:

1. Kenneth Murphy, "Janeway's Immunobiology", 8th edition, Garland Science, 2011.
2. Abdul K. Abbas, Andrew H. Lichtman, Shiv Pillai, "Cellular and Molecular Immunology 7th edition", Elsevier Health Sciences, 2011.
3. Sunil Kumar Mohanty and K. Sai Leela, "Text book of Immunology", 2nd edition, JP Medical Ltd, 2014.

18BT C11

INSTRUMENTAL METHODS IN BIOTECHNOLOGY

Instruction	4 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	4

Course Objectives:

Students are made to understand the following concepts during their course of time:

1. Types of Analytical methods and Instruments used for Analysis, Importance of microscopy
2. Types of Instruments used for isolation of Biomolecules and Sub cellular organelles
3. Types of centrifuges like low speed, high speed, ultra centrifuges
4. Types of Chromatographic Techniques
5. Charge based separation Techniques

Course Outcomes: At the end of the course students will be able to

1. Solve the Analytical problems in instruments by Detection & sensitivity limits.
2. Assess the merits and demerits of instruments
3. Discuss Principle, procedure and applications of different types of centrifugation
4. Summarize Principle, Procedure and applications of chromatography's like TLC, paper
5. Explain Principle procedure and applications of different electrophoresis like SDS, Agarose

UNIT-I

Analytical Methods And Microscopy: Types of Analytical Methods - Instruments for Analysis (Types)- Uncertainties in Instrumental measurements - Sensitivity and detection limit for instruments; principle, procedure, and applications of Bright field. Dark field, fluorescent and electron microscopy.

UNIT-II

Instruments For Isolation Techniques: Cell disruption by French press, Sonification, freeze thaw technique; use of liquid N2 and chemical approaches involved in cell disruption; Isolation of Biomolecules and cell organelles: centrifugation; basic principles of sedimentation, sedimentation coefficient, Svedberg Unit; various types of centrifuges, their uses, rotors, fixed angle, vertical, swing out, zonal rotors; preparative centrifugation, differential density gradient centrifugation, analytical ultra centrifugation; Materials used in preparation of density gradient- sucrose & cesium chloride; Isolation of sub cellular organelles and Biomolecules. Determination of molecular weight and purity of Biomolecules by analytical ultra centrifugation.

UNIT-III

Separation Techniques: Partition coefficient, partition chromatography, counter current distribution, adsorption chromatography,Paper, TLC& GLC, adsorption media, solvent, continuous and gradient elution, fraction collection and detection of pure molecules. Methods based on size: Gel permeation chromatography, principle application- Molecular weight determination. Dialysis and its significance. Affinity chromatography, application & technique for purification of proteins and nucleic acids.

UNIT-IV

Charge Based Separation Techniques: Principle and application of Ion exchange chromatography, use of ion exchange- cation & anion exchangers, pH and salt gradients for elution of proteins, amino acids and nucleotides. Electrophoresis: Migration of charged molecules in electric field-moving boundary, paper, cellulose acetate, starch gel electrophoresis, SDS PAGE, Determination molecular weight, iso-electric focusing and its significance. Identification of specific proteins by western blotting. Agarose gel electrophoresis-separation of DNA & RNA, by agarose gel electrophoresis, recovery of DNA fragments from agarose gels, southern & northern blot techniques and their significance, pulse field gel electrophoresis.

UNIT-V

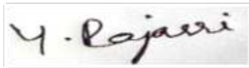
Spectrometric Identification Techniques: Basic concepts of spectroscopy, Visible & UV spectroscopy & Explain Beer lamberts law; Principles and application of Colorimetry & Flame photometry, Nephlometry; Principles and applications of Atomic absorption Spectrophotometry; Principles & applications of IR, ESR NMR & Mass spectroscopy; Explains the laws of photometry.

Text Books:

1. Keith Wilson and John Walker, Principles and Techniques of Biochemistry and Molecular Biology, 6th edition, Cambridge University Press, 2005.
2. Sivasankar, Instrumental Methods of Analysis, Oxford higher education, OUP, India, 2012.

Suggested Reading:

1. GW Ewing, Instrumental Methods of Chemical Analysis, 4th edition, Mc Graw Hill, 1985.
2. Hobert H Willard D.L.Merritt and J.R.J.A.Dean, Instrumental Methods of Analysis, CBS publishers & Distributors, 1992.
3. Skoog DA, Fundamentals of Analytical Chemistry, Thomson Brooks/ Cole, 2004.



HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

18BT C12

CHEMICAL AND BIOCHEMICAL THERMODYNAMICS

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Course aims at developing to reason so that students can apply thermodynamic principles in the solution of practical problems.
2. The aim of the course is also to give students an understanding of equilibrium conditions of chemical and biochemical extractions.
3. The course aims to give students the concepts of the transfer of chemical species between phases.
4. The course aims to facilitate students to apply I and II law of thermodynamics to open and closed systems to turbines and heat engines.
5. The course aims to give students the knowledge to calculate oxygen consumption and heat evolution in aerobic cultures.

Course Outcomes: At the end of the course students will be able to

1. Measure heat and work increments for closed systems and cyclic processes.
2. Evaluate nozzle, turbine and compressors based on the principles of I-law of thermodynamics.
3. Calculate the coefficient of performance of heat engines and heat pump
4. Predict the extent of various reactions by Gibbs and Duhem equation.
5. Calculate separation processes like distillation based on vapour liquid equilibrium for binary systems and calculate equilibrium conversions.

UNIT-I

Introduction To Thermodynamics: System Definition and Classification of system – closed and open system based on number of components, exchange of mass and heat. State and Path Functions, equilibrium, Phase rule. Thermodynamic Properties of fluids. Forms of energy, classification of properties. I-Law of Thermodynamics, application of I-law to closed.

Volumetric Properties of Fluids: PVT behavior of pure fluids. Real and Ideal Gas. Equations of state – Ideal gas law, Virial equations of state (restricted to first two terms). Cubic equations of state – Vander Waals and Redlich kwong. Processes involving ideal gases (isochoric, isobaric, isothermal, adiabatic, polytropic – simple applications)

UNIT-II

The Second Law Of Thermodynamics: Limitations to I-law, qualitative statement of Kelvin Plank and Clausius versions of II-law, entropy – definition, entropy and heat calculations for ideal gases. Maxwell relations – problems not included, Residual properties – definition (VR, HR, SR , GR – basic property relations for ideal gases, problems not included)

UNIT-III

Solution Thermodynamics: Partial molar properties – definition and simple applications involving calculation of partial molar properties for binary systems using analytical methods (no graphical method). Concepts of Chemical potential and fugacity (for pure species and species in solution). Lewis Randall rule, Raoult's law, Henry's law – Definition and simple applications. Excess properties – definition and fundamental relation for excess Gibbs free energy, (problems not included). Activity and activity coefficients, correlations to calculate activity coefficients – Margules, Van Laar and applications involving binary systems.

UNIT-IV

Topics In Phase Equilibria And Chemical Reaction Equilibria: Vapor-liquid equilibrium calculations for binary systems – P-x-y ,T-x-y diagrams, using simple Raoult's law to binary mixture. Chemical Reaction Equilibria: Equilibrium criteria for homogenous chemical reactions. Standard Gibbs energy change of reaction, **Reaction co-ordinate** –definition. Evaluation of equilibrium constant – numerical problems not included. Effect of pressure and temperature on equilibrium constant – qualitative treatment, simple problems involving temperature dependence of equilibrium constant. Calculation of equilibrium conversions and yields for single reactions.

UNIT-V

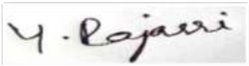
Bioenergetics: Energetics of Metabolic Pathways, Energy coupling (ATP & NADH). Stoichiometry and energetic analysis of Cell Growth and Product Formation. Thermodynamics of microbial growth. Oxygen consumption and heat evolution in aerobic cultures. Energy balance equation for cell culture

Text Books:

1. J.M.Smith, H.C.Van Ness and M.M.Abbott, "Introduction to Chemical Engineering Thermodynamics", 6th ed, TMH, 2003.
2. J.A.Roels, "Energetics and kinetics in biotechnology" , Elsevier, 1983.
3. Y.V.C.Rao , Revised edition , "An introduction to thermodynamics", Universities Press, 2004.

Suggested Reading:

1. Robert A.Alberty, "Biochemical Thermodynamics: Applications of Mathematica", John Wiley and Sons, 2006.
2. Stanley I. Sandler, "Chemical and Engineering Thermodynamics", 3rd Edition, Wiley, 1999.
3. K.V.Narayanan, "A Textbook of Chemical Engineering Thermodynamics", PHI Learning Pvt. Ltd, 2004.



HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

18ME C09

PRINCIPLES OF MANAGEMENT

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
To make the students to

1. Understand basic fundamentals and insides of management
2. Understand the nature and purpose of planning
3. Gain the knowledge about the frame work organizing
4. Understand the essence and significance of directing
5. Recognize the importance of controlling and its outcomes

.

Course Outcomes: At the end of the course students will be able to

1. Identify and evaluate the principles of management
2. Demonstrate the ability to have an effective and realistic planning
3. Identify the nature and the type of organization
4. Apply the tools and techniques of directing
5. Explain and evaluate the necessity for controlling and further refinement of an organization.

UNIT-I

Management: Definition of management, science or art, manager vs entrepreneur; managerial roles and skills; Evolution of management, Basic management theories by FW Taylor, Henry Fayol, Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT-II

Planning: Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Planning plant location and layout, Decision making steps & processes.

UNIT-III

Organizing: Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management

UNIT-IV

Directing: Individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.

UNIT-V

Controlling: system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. S.P. Robins and M. Couiter, “Management”, 10/e., Prentice Hall India, 2009.
2. JAF Stoner, RE Freeman and DR Gilbert, “Management”, 6/e., Pearson Education, 2004.

Suggested Reading:

1. P.C. Tripathy & P.N. Reddy, “Principles of Management”, Tata McGraw Hill, 1999
2. Harold Koontz and Cyril O’Donnell “Principles of Management’’, Tata McGraw Hill, 2017.

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

18CE M01

ENVIRONMENTAL SCIENCE
(MANDATORY COURSE)

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	0 Marks
Credits	0

Course Objectives: To enable the student:

1. Identify environmental problems arising due to engineering and technological activities and the science behind those problems.
2. Become aware about the importance of eco system and biodiversity for maintaining ecological balance
3. To identify the importance of interlinking of food chain
4. Learn about various attributes of pollution management and waste management practices.
5. To make the students contribute for capacity building of nation for arresting and/or managing environmental disasters.

Course Outcomes: At the end of the course, the student should have learnt

1. To define environment, identify the natural resources and ecosystems and contribute for the conservation of bio-diversity.
2. To suggest suitable remedial measure for the problems of environmental pollution and contribute for the framing of legislation for protection of environment.
3. To relate the social issues and the environment and contribute for the sustainable development.
4. To follow the environmental ethics.
5. To contribute for the mitigation and management of environmental disasters.

UNIT–I:

Environmental Studies: Definition, Scope and importance, need for public awareness.

Natural resources: Use and over utilization of Natural Resources - Water resources, Food resources, Forest resources, Mineral resources, Energy resources, Land resources.

UNIT–II:

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, role of producers, consumers and decomposers, energy flow in an ecosystem, food chains, food webs, ecological pyramids, Nutrient cycling, Bio-geo chemical cycles, Terrestrial and Aquatic ecosystems.

UNIT–III:

Biodiversity: Genetic, species and ecosystem biodiversity, Bio-geographical classification of India, India as a Mega diversity nation. Values of biodiversity, hot-spots of biodiversity, threats to biodiversity, endangered and endemic species of India, methods of conservation of biodiversity.

UNIT–IV:

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution, marine pollution, soil pollution, noise pollution and Solid waste management, nuclear hazards

Environmental Legislations: Environment protection Act, Air, Water, Forest & Wild life Acts, issues involved in enforcement of environmental legislation, responsibilities of state and central pollution control boards

UNIT–V:

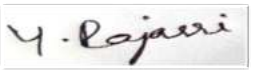
Social issues and the environment: Water conservation methods: Rain water harvesting and watershed management, Environmental ethics, Sustainable development and Climate change: Global warming, Ozone layer depletion, forest fires, and Contemporary issues.

Text Books:

1. Y. Anjaneyulu, "*Introduction to Environmental Science*", B S Publications, **2004**.
2. Suresh K. Dhameja, "*Environmental Studies*", S. K. Kataria& Sons, **2009**.

Suggested Reading:

1. C. S. Rao," *Environmental Pollution Control Engineering*", Wiley, **1991**.
2. S. S. Dara, "*A Text Book of Environmental Chemistry &Pollution Control*", S. Chand Limited, 2006



HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

18CS C06

BASICS OF DATA STRUCTURES LAB
(Common for other Programmes)

Instruction	2 L Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Pre-requisites: Any Programming Language(C)

Course Objectives:

1. Design and construct simple programs by using the concepts of Data structures as abstract data type.
2. To have a broad idea about how efficiently pointers can be used in the implement of data structures.
3. To enhance programming skills while improving their practical knowledge in data structures.
4. To strengthen the practical ability to apply suitable data structure for real time applications.

Course Outcomes: At the end of the course students will be able to

1. Implement the abstract data type.
2. Implement linear data structures such as stacks, queues using array and linked list.
3. Understand and implement non-linear data structures such as trees, graphs and its traversal techniques.
4. Implement various kinds of searching, sorting techniques.
5. Develop the suitable data structure for real world problem.

List of Experiments

1. Implementation of operations on arrays.
2. Implementation of Stack.
3. Implementation of Queue.
4. Implementation of basic operations on Single Linked List.
5. Implementation of Searching techniques.
6. Implementation of Sorting techniques.
7. Case study like Banking System, Students Marks Management, Canteen Management etc.

Text Books:

1. Brian W Kernighan, Dennis Ritchie, C Programming Language, PH PTR, 2nd Edition.
2. Richard M Reese, Understanding and Using C Pointers, O'Reily , 2013.

WebLinks:

https://nptel.ac.in/courses/106102064/

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

18BT C13

IMMUNOLOGY LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

Students identifies significance of blood grouping

1. The applications of Antigen antibody agglutination are demonstrated.
2. The applications of Antigen antibody Precipitation are demonstrated.
3. Students learn about diagnostic kits based on immunology
4. Students learn to interpret results

Course Outcomes: At the end of the course students will be able to

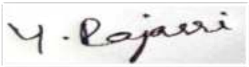
1. Demonstrate how Antigens and Antibody interact.
2. Identify agglutination and precipitation reactions.
3. Interprets the results based on the results of the antigen-antibody interaction.
4. Analyze the importance of different Immunological techniques developed.
5. Outline the importance of blood group matching in blood transfusions and other cases are practically demonstrated.

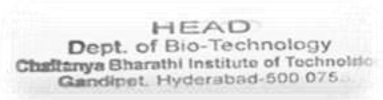
List of Experiments:

1. ABO Blood Grouping and Identification of Rh typing
2. Rocket immuno electrophoresis
3. Ouchterlony Double Diffusion for Antigen Antibody Patterns (ODD)
4. Immuno-electrophoresis (IEP)
5. Radial Immune Diffusion test (RID)
6. Widal test
7. VDRL tests
8. Total and Differential count of RBC & WBC by Micropipette method
9. Erythrocyte sedimentation rate
10. Enzyme Linked Immunosorbent Assay (ELISA) for Antigen capture and Antibody capture.
11. Estimation of Immunoglobullins by Precipitation with Saturated Ammonium Sulphate.

Suggested Reading:

1. Arti Nigam and Archana Ayyagari, Lab Manual in Biochemistry, "Immunology and Biotechnology", Tata McGraw Hill Education, 2007.
2. S. Ramakrishna and K.N. Sulochana, "Manual of Medical Laboratory Techniques", 1st edition, J.P. Medical Ltd, 2013.
3. Kanai L. Mukherjee and Swarajith Ghosh, "medical Laboratory Techniques, (Vol-I): Procedure Manual for Routine Diagnostic tests", 2nd edition, Tata McGraw Hill education.





18BT C14

INSTRUMENTATION LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

With help of this course Students are expected to

1. Understand the basic concepts for the operation of Ph and spectrophotometer.
2. Estimate the micro and macro molecules by using chromatography techniques.
3. Separate the biomolecules with the application of different methods of electrophoresis.

Course Outcomes: At the end of the course students will be able to

1. Relate the instrumentation techniques to their real life applications.
2. Demonstrate their knowledge on different Spectrophotometers.
3. Identify and solve the problems associated with determination of molecular weights by chromatography and electrophoresis techniques.
4. Compare and analyze different biomolecules by using flame photometry and fluorometry.
5. Justify their results on separation of biomolecules by differential centrifugation methods.

List of Experiments:

1. The calibration of pH meter and measurement of pH for different solutions
2. Estimation of Ascorbic acid by colorimetric assay
3. Estimation of unknown samples by using conductivity meter
4. Estimation of different macromolecules by visible spectrophotometer
5. Verification of Lambert - Beers law by UV -VIS spectrophotometer
6. Estimation of proteins and nucleic acids by U.V method

7. Estimation of turbidity using Nephlometer
8. The separation of different macromolecules by Paper, Thin layer chromatography
9. The separation of different macromolecules by Paper, PAGE, SDS-PAGE
10. Estimation of minerals by Flame photometry
11. Estimation of Thiamine and Riboflavin by Fluorimetry
12. Preparation of Standard curve using UV-VIS & Flame Photometry
13. Fractionation of Plasma Proteins by Electrophoresis
14. Sub-cellular fractionation studies by differential centrifugation

Suggested Reading:

1. Sivasankar, Instrumental Methods of Analysis, Oxford higher education, OUP, India, 2012.

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

18EG C03

SOFT SKILLS LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives: The course will introduce the students to:
1. Imbibe an impressive personality, etiquette, professional ethics & values, effective time management & goal setting.
2. Understand the elements of professional update & upgrade through industry exposure in a mini-live project. Understand confidence building strategies and thereby to make effective presentations through PPTs.
3. Learn what constitutes proper grooming and etiquette in a professional environment. Acquire the necessary skills to make a smooth transition from campus to corporate.

Course Outcomes: At the end of the course students will be able to
1. Be assertive and set short term and long term goals. Also learn to manage time effectively and deal with stress.
2. Win in professional communication situations and participate in group discussions with confidence. Write abstracts.
3. Write effective resumes. Plan, prepare and face interviews confidently.
4. Adapt to corporate culture by being sensitive - personally and sensible - professionally. Draft an SOP.
5. Apply the soft skills learnt in the mini-live project, by collecting and analyzing data and making oral and written presentations on the same.

Exercise-1
Main Topics: Thinking Skills, Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.
Flipped Sessions: Personal Sensitivity & Professional Sensibility (Reading & Discussion)
Writing Input: Writing to Express - Drafting & Delivering a Speech (Free Writing Exercise)

Exercise-2
Main Topics: Advanced Group Discussion with Case studies : Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.

Flipped Sessions: Importance of Professional Updating & Upgrading (Reading & Discussions)
Writing Input: Writing with Precision - Writing Abstracts
Exercise-3
Main Topics: Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews. Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skills.
Flipped Sessions: Mock Interviews (Video Sessions & Practice)
Writing Input: Writing to Reflect - Resume Writing
Exercise-4
Main Topic: Corporate Culture – Grooming and etiquette, communication media, academic ethics and integrity
Flipped Sessions: Corporate Culture, Etiquette & Grooming (Video Sessions & Practice through Role-play)
Writing Input: Writing to Define - Writing an effective SOP.
Exercise-5
Main Topic: Mini Project – General/Technical. Research, developing a questionnaire, data collection, analysis, written report and project seminar. Elements & Structure of effective presentation. Presentation tools – Body language, Eye-contact, Props & PPT.
Flipped Sessions: Effective Presentations (Video & Writing Sessions, Practice through Emulation)
Writing Input: Writing to Record - Writing minutes of meeting.

Suggested Reading:

1. Madhavi Apte , "A Course in English communication", Prentice-Hall of India, 2007
2. Dr. Shalini Verma, "Body Language- Your Success Mantra", S Chand, 2006
3. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010
4. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004

* Flipped Class-room: Students explore the concept first and then trainer explains it, students work on their own.

Web Resources:
1. https://www.goskills.com/Soft-Skills
2. https://www.trainerbubble.com
3. https://www.skillsconverged.com

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

With effect from the Academic Year 2020-21

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instructions of V Semester of B.Tech Bio-Technology as per AICTE Model Curriculum 2020-21

B.Tech (Bio-Technology)

SEMESTER V

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
	THEORY								
1	18BT C15	Fluid Mechanics and Heat Transfer	3	-	-	3	30	70	3
2	18BT C16	Enzyme Technology	3	-	-	3	30	70	3
3	18BT C17	Genetic Engineering and rDNA Technology	3	-	-	3	30	70	3
4		**Core Elective I**	3	-	-	3	30	70	3
5		**Core Elective II**	3	-	-	3	30	70	3
6	18MB C01	Engineering Economics and Accountancy	3	-	-	3	30	70	3
	PRACTICALS								
7	18BT C18	Fluid Mechanics and Heat Transfer Lab	-	-	2	2	15	35	1
8	18BT C19	Enzyme Technology Lab	-	-	2	2	15	35	1
9	18BT C20	Genetic Engineering Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**6**	**-**	**225**	**525**	**21**
Clock Hours Per Week -24									

L: Lecture T: Tutorial P: Practical

CIE – Continuous Internal Evaluation SEE - Semester End Examination

CORE ELECTIVE-I	
18BT E01	Virology
18BT E02	Phytochemicals and Herbal Products
18BT E03	Introduction to Anatomy and Physiology of Humans

CORE ELECTIVE-II	
18BT E04	Environmental Biotechnology
18BT E05	Developmental Biology
18BT E06	Metabolic Engineering

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075

With effect from the Academic Year 2020-21

18BT C15

FLUID MECHANICS AND HEAT TRANSFER

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. This course aims at providing knowledge on basic concepts in flow of fluids, flow field, flow past immersed bodies.
2. The course is designed to give an understanding on measurement of viscosity, flow measuring devices.
3. The course also deals with basic concepts in heat transfer, evaporation and condensation.

Course Outcomes:

At the end of the course students will be able to

1. Measure the viscosity of different fluids in bio processing.
2. Derive a relation between pressure drop and viscosity.
3. Compare and contrast the merits and demerits of different flow measuring devices.
4. Explain the concepts of heat transfer with and without phase change.
5. Calculate the heat transfer area, overall heat transfer co-efficient required for various processes and explain the operation of various evaporators, condensers and heat exchange equipment.

UNIT-I

Basic Concepts in Flow of Fluids: Introduction, Nature of fluid, Rheology of fluids -Newton's law of viscosity; Concept of Newtonian and non-Newtonian fluids-Different types of non-Newtonian fluids with examples in bioprocessing; Measurement of viscosity using extrusion rheometer, plate and cone viscometer, coaxial cylinder viscometer etc.

UNIT-II

Flow Field: Friction losses in laminar flow through a circular tube (Hagen-Poiseuille equation), Friction losses in turbulent flow (Fanning equation), Pumping of fluids flow through pipes, average velocity, flow regimes, boundary layer concept. Laminar and turbulent flow -characterization by Reynold's number, pressuredrop due to skin friction and form friction, friction factor chart, Hagen - Poiseuille equation.

UNIT-III

Flow Past Immersed Bodies: Definition of drag and drag coefficient; Friction in flow through beds of solids; Brief introduction to flow of compressible fluids; Flow measuring and monitoring systems- valves, bends, elbows, prevention of leaks, mechanical seals, stuffing box; Flow measuring devices-manometers, orifice-meter, venturimeter and rotameter; Brief description of Pumps and Blowers.

UNIT-IV

Basic Concepts in Heat Transfer: Introduction and Mechanisms of heat transfer; Conduction heat transfer (through slab, cylinder & Sphere); Conduction through solids in series, Forced convection heat transfer inside pipes, Introduction to radiation heat transfer, Chilling and freezing of food and Biological materials; Heat transfer correlations and calculations, basic heat exchange equipment.

UNIT-V

Basic Concepts in Evaporation and Condensation: Introduction, Types of evaporation equipment and operation methods; Overall heat transfer coefficients in evaporators; simple material balances; Calculation methods for single effect evaporators, Evaporation of biological materials; Types of condensation, numerical problems and condensation equipment.

Text books:

1. W L McCabe and JC Smith, "Unit operations in Chemical Engineering", 6th edition, cGraw Hill Intl.

HEAD
Dept. of Bio-Technology

Ed, 2005.
2. Christie J. Geankoplis, “Transport Processes and Unit Operations”, 3rd edition, Prentice Hall India Pvt. Ltd. 1993

Suggested Reading:

1. Kothandaraman CP, Rudramoorthy R, “Basic Fluid Mechanics”, New Age International Publishers, New Delhi,1998.
2. Sachdeva RC, “Fundamentals of Engineering Heat and Mass Transfer”, New Age International Publishers, New Delhi, 1996.

HEAD
Dept. of Bio-Technology

With effect from the Academic Year 2020-21

18BT C16

ENZYME TECHNOLOGY

HEAD
Dept. of Bio-Technology

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To learn about basic aspects of enzymes.
2. To understand the catalytic strategies and mechanism of enzyme action.
3. To learn the role of enzyme kinetics and its action.
4. To understand the methods of enzyme immobilization
5. To study about mass transfer kinetics of immobilized enzymes.

Course Outcomes:

At the end of the course students will be able to

1. Discuss the nomenclature and classification, properties, isolation and purification of enzymes.
2. Describe the catalytic strategies and mechanism of enzyme action
3. Explain the kinetics of enzyme action and inhibition.
4. Compare various enzyme immobilization techniques and analyze the mass transfer effects in immobilized enzyme systems.
5. Outline the applications of enzymes in different fields.

UNIT-I

Introduction to Enzymes: Enzyme, coenzymes, cofactor; general properties of enzymes; Classification of enzymes, Enzyme nomenclature; Factors affecting the rates of chemical reactions - Collision theory, transition state theory, Mechanism of catalysis; isolation and purification of crude enzyme extracts from plant, animal and microbial sources; Development of enzymatic assays.

UNIT-II

Catalytic strategies and Mechanisms of Enzyme Action: Catalytic strategies – Lysozyme, Ribonuclease A, Caraboxypeptidase A, chymotrypsin; Mechanisms of enzyme action; Concept of active site and energetics of enzyme substrate complex formation; Specificity of enzyme action.

UNIT-III

Kinetics of Enzyme Action and Enzyme Inhibition: Kinetics of single substrate reactions; Turn overnumber; Derivation of Michaelis -Menten equation; Kinetics of Multi-substrate reaction ; Types of Enzyme Inhibition - Reversible inhibition and Irreversible inhibition ; Allosteric enzymes.

UNIT-IV

Enzyme Immobilization and Mass Transfer Effects in Immobilized Enzyme Systems: Physical and chemical techniques for enzyme immobilization - adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding; Overview of applications of immobilized enzyme systems; Analysis of Film and pore Diffusion Effects on kinetics of Immobilized Enzyme Reactions; Formulation of dimensionless groups and calculation of Effectiveness Factors.

UNIT-V

Applications of Enzymes: Applications of commercial enzymes; Proteases; Amylases; Lipases; Cellulases; Pectinases; Isomerases in food, pharmaceutical and other industries; Enzymes for analytical and diagnostic purposes; Design of enzyme electrodes and their application as biosensors in industry, health care and environment.

Text Books:

1. Trevor Palmer, Philip Bonner, “Enzymes”, 2nd edition, Woodhead Publishing, 2007.

HEAD
Dept. of Bio-Technology

2. Andreas S. Bommarius, Bettina R. Riebel, “Biocatalysis - Fundamentals and Applications”, Wiley-VCH, 2004.

Suggested books:

1. Shanmugan, S., “Enzyme technology” I. K. International Pvt Ltd, 2009.
2. Voet and Voet J.G, “Biochemistry”, 4th edition, John C.Wiley and Sons, 2010.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

With effect from the Academic Year 2020-21

18BT C17

GENETIC ENGINEERING AND rDNA TECHNOLOGY

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To provide theoretical concepts, basic principles and tools used in rDNA technology.
2. To learn essential features and various vectors used in gene cloning and rDNA technology.
3. To learn the principle, methodology and applications of PCR and molecular markers.
4. To learn the range of cloning strategies those are employed to clone a DNA sequence.
5. To know how rDNA technology is used to produce proteins.

Course Outcomes:

At the end of the course, students will be able to

1. Explain the basic principles and tools used in rDNA research starting from the isolation of nucleic acid, enzymes etc.
2. Compare various types of cloning vectors and expression vectors and their use in rDNA technology.
3. Discuss the principle, types and applications of PCR and molecular markers.
4. Describe the cloning strategies and sequencing methods.
5. Summarize the high-level expression of proteins in different hosts and production of recombinant proteins for the human welfare

UNIT-I

Isolation and Purification of DNA and Enzymes Used in Cloning: Isolation and purification of DNA; Host controlled restriction and modifications; Enzymes used in cloning - Restriction endonuclease, Polymerases, Ligase, Phosphatase, Kinase, Nuclease; Restriction mapping; Blotting techniques – Southern, Northern and Western Blotting.

UNIT-II

Cloning Vehicles: Essential features of cloning vectors; Cloning vectors - Plasmid vectors - pBR 322, pUC 18/19; Phage vectors – λZAP, λEMBL4; M13 derived vectors –M13mp18; Phagemid- Blue script vectors; Cosmid- pJB8; Artificial chromosomes - BAC, YAC; Expression vectors - pET vectors.

UNIT-III

Polymerase Chain Reaction and Molecular Markers: PCR – Principle, Designing of primers, PCR Methodology, RT-PCR, Multiplex PCR, PCR for site-directed mutagenesis, Applications of PCR; Molecular marker – RFLP, RAPD, AFLP.

UNIT-IV

Cloning Strategies and DNA sequencing: Construction of genomic and cDNA libraries; the Basic concept of blunt end and cohesive end ligation, homopolymer tailing, use of linkers, adaptors; Introduction of cloned genes into hosts- Transformation, Transfection, packaging phage DNA *In vitro*; Detection of clones with the desired gene; Methods of gene sequencing: - Maxam and Gilbert method, Sanger's dideoxy chain termination method, Pyrosequencing, automation of DNA sequencing.

UNIT-V

Expression of Recombinant Proteins and Applications of rDNA Technology: High-level expression of proteins in different host systems in *E. coli,* yeast, insect and mammalian cells; Applications of Gene cloning and rDNA Technology - Recombinant Insulin, Recombinant Factor VIII, Golden rice. Introduction to Gene therapy (*Ex vivo* & *In vivo*), case study of ADA as an example. Safety guidelines for rDNA research.

HEAD
Dept. of Bio-Technology

Text Books:

1. Brown, T.A., "Gene Cloning and DNA Analysis: An Introduction", 7th edition. Wiley Blackwell, A John Wiley & Son Ltd publications, UK, 2015.
2. Primrose, S.B., Twyman, R.M., "Principles of Gene manipulation and Genomics", 7th edition, John Wiley & Sons, 2013.
3. Glick, B.R., Pasternak, J.J., Patten, C.L,, "Molecular Biotechnology: Principles and applications of Recombinant DNA", 4th edition, ASM Press,2010.

Suggested Reading:

1. Desmond S T Nicholl, "An Introduction to Genetic Engineering", 3rd edition, Cambridge End Press, 2008.
2. Richard J. Reece, "Analysis of Genes and Genomes", Wiley, 2004.

HEAD
Dept. of Bio-Technology

With effect from the Academic Year 2020-21

18BT E01

VIROLOGY

(Core Elective - I)

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

Students are made to understand the following concepts during their course of time:

1. To learn the morphology and genetics of viruses.
2. To recognize the procedures for cultivation of plant & animal viruses.
3. To be aware of the characterization of viruses.
4. To elaborate the detailed features of plant viruses and bacteriophages.
5. To learn the life cycles of animal viruses and development of vaccines.

Course outcomes:

By the end of the course the students are able to

1. Explain classification, morphology, and disease prevention measures of viruses.
2. Compare the techniques for cultivation of plant & animal viruses.
3. Outline various characterization techniques for detection of viruses.
4. Illustrate the structural, functional and disease control measures of plant viruses.
5. Describe the classification, pathogenesis of animal viruses and therapeutic strategy for vaccine development.

UNIT-I

Introduction to Virology: Brief outline of discovery of Viruses; Properties of Viruses; Morphology of Viruses-Structure, Capsid Architecture, Envelopes and peplomers; Chemistry of Viruses- Viral Proteins, Genome-Structure and Types; Study of sub viral agents- Brief account on Diseases caused by Viroids- PSTV,Cadang-cadang; Prions- Scrape, Creutzfeldt-jakob; Satellite viruses.

UNIT-II

Cultivation of Viruses I: General methods of cultivation of viruses- in embryonated eggs, cultivation of animal and plant viruses; cultivation of bacteriophages, Isolation and purification of viruses- plant viruses, animal viruses; Criteria of purity, Maintenance and preservation of infectivity; Characterization of viruses- Electron microscopy, X-ray crystallography, sedimentation analysis.

UNIT-III

Characterization of Viruses II: Enumeration of viruses- By electron microscopy, plaque assay, acid end point method, Haemagglutinin assay; Detection of viruses-By serological characterization, detection of viral antigen, detection of viral nucleic acid; chemical determination, Ultra structure and life cycles of Bacteriophages- Ml3, T4 and lambda.

UNIT-IV

Plant Viruses: Taxonomy; Symptoms of diseases caused by plant viruses (Morphological, Physiological and Histological); Ultra structure and life cycles of TMV; transmission of plant viruses- Mechanical and biological (vector and non-vector); Basic control measures of plant diseases- vector and chemical control, biopesticides with examples.

UNIT-V

Animal viruses: Taxonomy; Detailed structure and brief account on life cycles of RNA viruses- Polio, Influenza, Rota virus and HIV; Ultra structure and brief account on life cycles of DNA viruses- Vaccina,SV40 and Hepatitis Virus; Viral vaccines-types and preparation of conventional vaccines.

Text Books:

HEAD
Dept. of Bio-Technology

1. Dimmock NJ and Primrose SB, “Introduction to Modern Virology”, 4th edition, Blackwell Scientific Publications, 1994.
2. Matthews REF “Fundamentals of Plant Virology”. Academic Press, San Diego, 1992.

Suggested books:
1. Carter J and Saunders V “Virology: Principles and Applications” John Wiley and Sons ltd, 2007.
2. Morag C, Timbury M, Chrchill Livingstone, “Medical Virology”, London, 1994.

HEAD
Dept. of Bio-Technology

With effect from the Academic Year 2020-21

18BT E02

PHYTOCHEMICALS AND HERBAL PRODUCTS
(Core Elective - I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

1. To impart knowledge on medicinal plants and extraction of crude drugs.
2. To provide a comprehensive knowledge on detection, extraction and analysis of phytochemicals and adulterants.
3. To impart knowledge on the applications of various phytochemicals and herbal products.
4. To impart theoretical knowledge on various aspects of standard procedures for extracting herbal products

Course outcomes:

At the end of the course the students are able to

1. List the classification and pertinent utilization of important crude drugs.
2. Outline the evaluation and estimation procedures of crude drugsand adulterants.
3. Classify various types and extraction procedures of different plant secondary products.
4. Categorize the applications of phytochemicals.
5. Evaluate the precise extract preparations of herbal products and its licensing issues.

UNIT-I

Crude Drugs, Medicinal and Aromatic Plants: Crude Drugs - Scope and Importance, Classification (Taxonomical, Morphological Chemical, Pharmacological); Collection and processing of Crude Drugs; Utilization of Medicinal and Aromatic Plants in India; Genetics as applied to Medicinal herbs; Biogenesis of Phytopharmaceuticals.

UNIT-II

Analysis of Phytochemicals: Methods of Drug evaluation (Morphological, Microscopic, Physical and Chemical); Preliminary screening, Assay of Drugs - Biological evaluation / assays, Microbiological methods, Chemical Methods of Analysis and Detection of Adulterants: Chemical estimations; Drug adulteration - Types of adulterants.

UNIT-III

Types of Phytochemicals: Carbohydrates and its derived products- Structures, types and extraction methods : Glycosides - Digitalis, Aloe, Dioscorea; Volatile Oils - Clove, Pippermint Oil; Alkaloids - Taxus, Cinchona; Flavonoids-and Resins; Tannins (Hydrolysable and Condensed types).

UNIT-IV

Applications of Phytochemicals: Application of phytochemicals in industry and healthcare; Biocides, Bio-fungicides, Biopesticides.

UNIT-V

Herbal Products: History, Scope, and Current aspects of herbs and herbal medicines; Preparation of standardized extracts of Garcinea, Forskolin, Garlic, Turmeric and Capsicum, issues of licensing of herbal drugs.

HEAD
Dept. of Bio-Technology

Text books:

1. Kokate CK, Purohit AP and Gokhale SB, “Pharmacognosy”, 4th edition, Nirali Prakashan, 1996.
2. Trease and Evans WC Evans, “ Pharmacognosy” , 14th edition, Harcourt Brace & Company. 1989.
3. Hornok L, “Cultivation & Processing of Medicinal Plants” Chichister, U. K: J. Wiley & Sons.1992.

Suggested Reading:

1. Natural Products in medicine: A Biosynthetic approach Wiley. 1997.
2. Chaudhri RD, “Herbal Drugs industry, A practical approach to Industrial Pharmacognosy” Eastern publishers, 2nd reprint, New Delhi. 1999.

HEAD
Dept. of Bio-Technology

With effect from the Academic Year 2020-21

18BT E03

INTRODUCTION TO ANATOMY AND PHYSIOLOGY OF HUMANS

(Core Elective - I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To give an overview to students about human body tissues and endocrine system.
2. To provide knowledge on various organs associated with digestion and excretion.
3. Heart structure and functioning is detailed, including the gaseous exchange occurring through the respiratory system.
4. Knowledge of Spinal cord, the associated nerves and the different sense organs are imparted.
5. To impart knowledge about human reproductive physiology.

Course Outcomes:

At the end of the course the students are able to

1. Outline the structure of the Human body, structure & function of endocrine glands.
2. Discuss the anatomical structures and the physiological functions of Skeletal, digestive and excretory systems.
3. Explain the anatomical structures and the physiological functions of circulatory and respiratory system.
4. Describe the anatomical structures and the physiological functions of nervous system and other sensory systems.
5. Discuss the anatomical structures and the physiological functions of reproductive system and physiology of blood.

UNIT-I

Introduction to Anatomical Terms and Endocrine Glands: Definition of Anatomy and Physiology; Major types of human tissues. Various systems of human body and their general roles; Homeostasis; Types of endocrine glands- anatomy and physiological of pituitary, thyroid, pancreas

UNIT-II

Anatomy and Physiology of Skeletal, Digestive and Excretory Systems: Structure and function of bones and muscles Digestive system- organs and functions; role of liver and pancreas, Excretory system-kidney and urinary bladder; physiology of excretory system- urine formation

UNIT- III

Anatomy and Physiology of Circulatory and Respiratory Systems: Circulatory system- anatomy of heart, heartbeat, blood circulation Anatomy of blood vessels- arteries and veins. Respiratory system-anatomy of lungs and mechanism of respiration

UNIT-IV

Anatomy and Physiology of Nervous System and Other Sensory Systems: Nervous system- peripheral and autonomous nervous system; Spinal nerves and Cranial nerves, transmission of nerve impulse, reflex arc. Special senses- eye, ear, tongue and nose

UNIT-V

Anatomy and Physiology of Reproductive System And Blood Physiology: Mechanism of blood oxygenation, Blood pressure recording and regulating techniques, Reproductive system- male and female reproductive organs and physiology. Menstrual cycle

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

Text Books:

1. Shier, David, Butler, Jackie, Lewis, Ricki., “Hole’s Human Anatomy & Physiology”, 13th edition, McGrawHill 2017.
2. Eric Widmaier, Hershel Raff, Kevin “Vander's Human Physiology: The Mechanisms of Body Function” McGraw-Hill Science/Engineering/Math; 13th edition2013.
3. Anthony A. Goodman –“Understanding the Human Body_ An Introduction to Anatomy and Physiology”-The Teaching Company (2004)

Suggested Reading:

1. Elaine N. Marieb “Essentials of Human Anatomy and Physiology”, 8th Edition, Pearson Education, NewDelhi 2006
2. Charles E. Tobin, “Basic Human Anatomy”, McGraw Hill, 1980.

HEAD
Dept. of Bio-Technology

With effect from academic year 2020-21

18BT E04

ENVIRONMENTAL BIOTECHNOLOGY
(Core Elective - II)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

The course aims

1. To provide theoretical concepts and a comprehensive knowledge on bioremediation methods.
2. To provide knowledge on metal leaching and non-conventional fuels production.
3. To impart theoretical basics on various methods used in treatment of waste water.
4. To provide knowledge on degradation of Xenobiotic compounds.
5. To update the students with the available information on biotechnological applications in hazardous waste management.

Course Outcomes:

At the end of the course students will be able to

1. Describe the process of bioremediation in detail.
2. Explain the use of Microorganisms for metal leaching and biofuels generation.
3. Illustrate different methods of waste water treatment and green energy generation.
4. Categorize different types of wastes and their degradation methods.
5. Evaluate various biotechnological applications for hazardous waste management.

UNIT-I

Bioremediation: Introduction to bioremediation and its types- In situ, Ex situ, Intrinsic and Extrinsic Bioremediation ; Constraints and priorities of Bioremediation, Biostimulation of naturally occurring microbial activities Bio-augmentation;; Solid phase bioremediation- Land farming, composting, Biopile; Phytoremediation techniques, Slurry/Liquid phase bioremediation, Biorestoration

UNIT-II

Metal Biotechnology and Biofuels: Metal Leaching- Bioleaching; Biosorption; Types of microbial leaching; Microbial transformation; Microorganisms and their role in energy requirements of mankind; Production of non-conventional fuels: Methane (Biogas), biohydrogen, bioethanol and Algal biofuels; Application of isolated enzymes versus whole cell systems for remediation and biofuels generation

UNIT-III

Biological Waste Water Treatment: Sources of wastewater and its types, General composition of wastewater; Biological processes for domestic and industrial waste water treatment; Aerobic systems – Activated sludge process, trickling filters, Rotating biological contractors (RBC), Fluidized bed (and biofilm) reactor,; Anaerobic biological treatment-Contact digesters, Packed column reactors, UASB, Other advanced bioreactor configurations

UNIT-IV

Degradation of Xenobiotic Compounds: Definition and examples and sources- Xenobiotics, Recalcitrants, Co-metabolism. Biodegradation of Xenobiotics present in Environment; Degradative plasmids; Oil Pollution and Bioremediation of Contaminated soils; Biological Detoxification-Cyanide, Toxic Organics and Phenols.

UNIT-V

Hazardous Waste Management: Introduction to general Solid and Hazardous Waste management- landfills, recycling and processing of organic residues, minimal national standards for waste/wastewater release into environment, Biotechnological applications to hazardous waste management. Global Environmental problems and Biotechnological approaches for management. Nuclear waste generation and treatment.

HEAD
Dept. of Bio-Technology

Text books:

1. Alan Scragg “Environmental Biotechnology”, 2nd edition , Oxford End Press, 2005.
2. Foster C.F., John Ware D.A., Environmental Biotechnology, Ellis Horwood Ltd., 2007.

Suggested readings:

1. Environmental Biotechnology By Priv.-Doz. Dr.Hans-Joachim Jördening, Prof.Dr. Josef Winter, Wiley-VCH Verlag GmbH & Co. KGaA. 2005.
2. Stanier R. Y., Ingram J.L., Wheelis M.L., Painter R.R., General Microbiology, McMillan Publications, 2009.

HEAD
Dept. of Bio-Technology

With effect from the Academic Year 2020-21

18BT E05

DEVELOPMENTAL BIOLOGY
(Core Elective - II)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To give an insight of the basic concepts of developmental biology.
2. To enable the students learn about early developmental stages in embryogenesis.
3. To understand the developmental patterns in Drosophila.
4. Students are made to learn about the Organogenesis and sex determination in humans.
5. To aware the students about the implications of developmental biology in humans.

Course Outcomes:
At the end of the course the students are able to
1. Relate the overview of developmental biology and mechanism of developmental organization
2. Discuss the structure of gametes, events of fertilization and stages of early embryonic development
3. Explain the developmental stages and the role of genes in body axis formation in drosophila
4. Outline the organogenesis process and sex determination in mammals during development process
5. Relate the medical complications of developmental biology

UNIT-I
Introduction to Developmental Biology: Overview of anatomical approach, Evolutionary embryology, Medical embryology& teratology, Mathematical modeling for development, Cycle of Life - An example: A Frog's life, Development dynamics of cell Specification (Autonomous, Conditional, Syncytial and Morphogenic Gradients), Induction and Competence.

UNIT-II
Gametogenesis, Fertilization and Early development in Mammals: Structure of Gametes: Sperm, Egg, Spermatogenesis and oogenesis in Mammals, Recognition of egg and sperm, Mammalian Fertilization (Fusion of Gametes and prevention of Polyspermy). Cleavage, mammalian gastrulation and mammalian axis formation.

UNIT-III
Drosophila Embryonic Development: Early Drosophila developments: Fertilization, Cleavage, Gastrulation, Segmentation and the Anterior-Posterior body plan, Segmentation genes (Gap Genes, pair rule genes and segment polarity genes), The Homeotic selector genes, Generating Dorsal-Ventral axis.

UNIT-IV
Organogenesis and Sex Determination in mammals : The emergence of Ectoderm-The Central nervous system and epidermis, Mesoderm – Osteogenesis and Myogenesis, Lateral plate mesoderm and endoderm – the Heart, Blood cells, Endoderm - Digestive tube and Respiratory tube, Sex determination in Mammals.

UNIT-V
Ramifications of Developmental Biology: Medical Implications of Developmental biology: Genetic errors of human development, Infertility, *In Vitro* fertilization (IVF) and Teratogenesis (Disruptors of teratogenesis), Developmental biology and future of medicine.

HEAD
Dept. of Bio-Technology

Text Books:

1. Scott F Gilbert, Michael JF Barresi. “Developmental Biology”, 11th edition, Sinauer Associates, Inc, 2013.
2. ManjuYadav, “Molecular Developmental Biology” Discovery Publishing, September, 2008.

Suggested Reading:

1. Snustad P, Simmons and Jenkins, “Principles of Genetics”, 2nd Edition, John Wiley Publications, 1999.
2. P.C.Jain, “Elements of Developmental Biology” International Publications,2013.

HEAD
Dept. of Bio-Technology

With effect from academic year 2020-21

18BT E06

METABOLIC ENGINEERING
(Core Elective - II)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To identify the different metabolic regulations.
2. To outline various pathways of Biosynthesis of secondary metabolic and their applications.
3. To identify factors and criteria for bioconversions
4. To learn the concept of metabolic flux and its application.
5. To compute metabolic pathways and algorithms.

Course Outcomes:

At the end of the course the students are able to

1. Summarize the basic concepts of metabolic engineering.
2. Describe the various biosynthesis of secondary metabolites & their applications in various fields.
3. Discuss the factors influence the bioconversions and genetic manipulations of metabolic pathways.
4. Explain the analysis & applications of metabolic flux.
5. Outline the metabolic pathway modeling synthesis using bioinformatics tools and its applications.

UNIT- I

Introduction: Identification of metabolic regulation: a key point in Metabolic Engineering. Basic concepts of Metabolic Engineering- Overview of cellular metabolism, Different models for cellular reaction, induction, Jacob monad model & its regulation, Different regulation by Isoenzymes, feedback regulation. Amino acid synthesis, pathways with regulation at enzyme & cell level.

UNIT-II:

Biosynthesis Of Secondary Metabolites: Regulation of secondary metabolic pathways, precursor effect, prophase, Idiophase –relationships. Catabolite regulation bypassing control of secondary metabolism, producers of secondary metabolites and their applications.

UNIT-III

Bioconversions: Factors affecting bioconversions, Specificity, Yields, Co metabolism, Product inhibition, mixed or sequential bioconversions, Conversion of insoluble substances. Applications of Bioconversions. Strain selection, Genetic improvement of strains, Gene dosage, metabolic pathway manipulations to improve fermentation. The modification of existing or the introduction of entirely new metabolic pathways.

UNIT-IV

Metabolic Flux: Metabolic flux distribution analysis, Experiments determination method of flux distribution, Metabolic flux analysis and its applications.

UNIT-V

Metabolomics & Applications Of Metabolic Engineering: Metabolic pathway modeling, Analysis of metabolic control and the structure metabolic networks, metabolic pathway synthesis algorithms. Application in pharmaceuticals, chemical bioprocess, food biotechnology, agriculture environmental bioremediation and biomass conversion.

HEAD
Dept. of Bio-Technology

Text Books:

1. Stephanopoulos GN, Aristidou AA and Nielsen J, "Metabolic Engineering Principles & Methodologies", Academic Press-Elsevier,1998.
2. Wand. D.I.C Cooney C.L., Demain A.L., Dunnil.P.Humphrey A.E.Lilly M.D. "Fermentation and Enzyme Technology, John Wiley and sons, 1980.
3. Metabolic engineering Sangy Yuplee and E.T.Pa poutsakis Marcel DekkerInc.

Suggested Reading:

1. Zubay G., Biochemistry, Macmillan Publishers, 1989.
2. Stanbury P.F., and Whitaker A., Principles of Fermentation Technology Pergamon Press, 1984.

HEAD
Dept. of Bio-Technology

18MB C01

Engineering Economics and Accountancy

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

Course Outcomes:

At the end of the course the students are able to

1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make best use of resources available.
4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique.

Unit-I

Introduction to Managerial Economics

Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

Unit-II

Demand and Supply Analysis

Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

Unit-III

Production and Cost Analysis

Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale.

Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

Unit-IV

Accountancy

Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

Unit-V

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

Text books:

1. Mehta P.L.,"Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013.
3. Panday I.M. "Financial Management", 11th edition, VikasPublishing House, 2015.
4. Varshney and K L Maheswari, Managerial Economics, Sultan Chand, 2014.
5. M. Kasi Reddy and S. Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
6. A. R. Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2013.

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

With effect from academic year 2020-21

18BT C18

FLUID MECHANICS AND HEAT TRANSFER LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objective:

This lab course is designed to understand the mechanics of fluid flow, analysis of various processes viz., Flow measuring devices Venturimeter, Mouth piece, and Triangular notch.) and heat exchangers.

Course Outcomes:

At the end of the course the students are able to

1. Evaluate the coefficient of discharge for different flow measuring devices.
2. Determine thermal conductivity of homogeneous wall.
3. Calculate heat transfer coefficient in unsteady state heat transfer.
4. Predict overall heat transfer coefficient in unsteady state heat transfer.
5. Determine friction losses in pipe fittings.

LIST OF EXPERIMENTS

1. Determination of discharge coefficient for orifice meter and venturimeter and their variation with Reynolds number
2. Determination of weir meter constant K for v-notch and rectangular notch
3. Calibration of Rotameter and study of variation of flow rate with tube to float diameter
4. Determination of viscosity of Glycerol - water solutions at different temperatures
5. Determination of friction factor for flow of water through annulus using Fanning's and Davo's equations.
6. Determination of friction factor for flow through straight pipes of different diameters and study of variation of friction factor with Reynolds number.
7. Determination of friction losses in pipe fittings
8. Determination of Thermal conductivity of homogeneous wall insulating powder under steady state conditions.
9. Determination of interface temperatures in composite wall under steady state conditions.
10. Determination of heat transfer coefficient in Natural convection.
11. Determination of overall heat transfer coefficient in unsteady state heat transfer
12. Determination of inside heat transfer coefficient in coil heat exchangers
13. Determination of overall heat transfer coefficient and effectiveness in a Double pipe heat exchange
14. Determination of heat transfer area in a 1-2- shell and tube heat exchanges
15. Determination of heat transfer coefficient on a single tube by film wise and drop wise condensation.

Suggested Reading:

1. W L McCabe and JC Smith, "Unit operations in Chemical Engineering", 6th edition, McGraw Hill Intl. Ed, 2005.

HEAD
Dept. of Bio-Technology

With effect from academic year 2020-21

18BT C19

ENZYME TECHNOLOGY LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

1. To prepare buffers and chemicals used for isolation and extraction of enzyme.
2. To know the optimum ranges of physical parameters for enzyme activity.
3. To learn the Michaelis-Menten and enzyme inhibition kinetics.
4. To observe the growth curve for the determination of substrate utilization.
5. To understand the methods of immobilization of enzymes and their kinetics.

Course Outcomes:

At the end of the course students will be able to

1. Select the suitable buffers for isolation and extraction of enzymes from various sources.
2. Evaluate the optimum enzyme activity at various process parameters.
3. Evaluate Michaelis-Menten kinetic parameters and enzyme inhibition kinetics.
4. Demonstrate the growth curve for the determination of substrate utilization.
5. Compare the methods of immobilization of enzyme and its activity.

LIST OF EXPERIMENTS

1. Preparation of buffers
2. Isolation and extraction of enzymes (Microbial, plant and animal source).
3. Effect of pH on enzyme activity.
4. Effect of temperature on enzyme activity.
5. Effect of substrate concentration on enzyme activity.
6. Effect of time interval on enzyme activity.
7. Development of Enzyme Assay
8. Evaluation of Michaelis-Menten kinetic parameters.
9. Kinetic studies of enzyme inhibition (Open ended Experiment).
10. Determination of growth curve of a supplied microorganism and to determine substrate degradation profile.
11. Studies on immobilization of enzyme/cell by gel entrapment method (Structured Enquiry).
12. Comparative study of activities of free and immobilized enzyme systems.

Suggested Reading:

1. Trevor Palmer, Philip Bonner, "Enzymes", 2nd edition, Woodhead Publishing, 2007.
2. Andreas S. Bommarius, Bettina R. Riebel, "Biocatalysis - Fundamentals and Applications", Wiley-VCH, 2004.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

With effect from academic year 2020-21

18BT C20

GENETIC ENGINEERING LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course objectives:

1. To know the isolation and analysis of DNA.
2. To know the incision of DNA by using the restriction endonucleases.
3. To learn the amplification DNA by polymerase chain reaction
4. To understand the cloning strategies of DNA.
5. To know about DNA sequencing and expression of recombinant protein from transformed bacterial cultures.

Course outcomes:

At the end of the course the students are able to

1. Demonstrate the isolation of nucleic acids.
2. Characterize the DNA by restriction digestion and restriction mapping.
3. Perform the polymerase chain reaction.
4. Plan different steps involved in cloning strategies of DNA
5. Analyze the DNA Sequencing and recombinant protein by using SDS PAGE

LIST OF EXPERIMENTS

1. Isolation of genomic DNA
2. Isolation of plasmid DNA
3. Visualization of Genomic and Plasmid DNA on Agarose gels
4. Restriction digestion
5. Restriction mapping
6. Gel elution.
7. DNA ligation.
8. Preparation of competent cells.
9. Genetic transformation and screening for recombinant bacterial cells.
10. Blotting techniques- southern blotting.
11. Amplification of DNA fragments by Polymerase Chain Reaction (PCR).
12. DNA sequencing- Sanger's Method (Structured enquiry)
13. Analysis of Recombinant Proteins using SDS-PAGE (Open ended experiment)

Suggested Reading:

1. Green MR and Sambrook J, “Molecular Cloning-A laboratory manual”, Vol I, II and III, Cold spring \ Harbor Laboratory Press, 2012

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Scheme of Instructions of VI Semester of B.Tech Bio-Technology as per AICTE Model Curriculum 2020-21
B.Tech (Bio-Technology)

SEMESTER-VI

S. No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per week			Duration of SEE in Hours	Maximum Marks		
			L	T	P		CIE	SEE	
	THEORY								
1	18BT C21	Fermentation Technology	3	-	-	3	30	70	3
2	18BT C22	Bioinformatics	3	-	-	3	30	70	3
3	18BT C23	Mass Transfer Operations	3	-	-	3	30	70	3
4		**Core Elective III**	3	-	-	3	30	70	3
5		**Core Elective IV**	3	-	-	3	30	70	3
6		**Open Elective I**	3	-	-	3	30	70	3
	PRACTICALS								
7	18BT C24	Fermentation Lab	-	-	2	2	15	35	1
8	18BT C25	Bioinformatics Lab	-	-	2	2	15	35	1
		Total	**18**	**-**	**4**	**-**	**210**	**490**	**20**
Clock Hours Per Week – 22									

L: Lecture T:Tutorial P:Practical
CIE – Continuous Internal Evaluation SEE - Semester End Examination

Core Elective III	
18BT E07	Medical Biotechnology
18BT E08	Food Biotechnology
18BT E09	Bioprocess Dynamics and Control
18BT E10	Artificial Intelligence in Biology

Open Elective I	
18MT O01B	Numerical Methods
18EC O02	Biomedical Instrumentation
18ME O03	Research Methodologies

Core Elective IV	
18BT E11	Pharmaceutical Biotechnology
18BT E12	Intellectual Property Rights Regulatory Affairs And Clinical Trials
18BT E13	Nanobiotechnology

Y. Rajani
HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

With effect from academic year 2020-21

18BT C21

FERMENTATION TECHNOLOGY

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Providing knowledge to students on scope and chronological development of fermentation technology.
2. Understanding the types of fermentation process and design of fermentation.
3. Learning about the ancillaries of fermenter and its applications.
4. Determination of the power requirements for operating bioreactors under various conditions
5. Gaining in-depth knowledge about the working principles and operation offer mentors.

Course Outcomes:

At the end of the course the students are able to

1. Apply the knowledge of fermentation processes and aseptic transfer of spore suspension in bioprocess industries.
2. Outline the construction of fermenters, control process parameters and media formulation in bioprocesses.
3. Discuss the concepts of solid state and slurry fermentation processes in bioprocess.
4. Determine the steps involved in oxygen transfer during aerobic fermentation.
5. Assess the power requirements for bioreactors with and without agitation.
6. Interpret the working principles of different bioreactors.

UNIT-I

Introduction to Fermentation Processes: The range of fermentation processes; the chronological development of fermentation industry; Industrial applications; Future trends in fermentations; Aseptic transfer of spore suspension; Transfer of inoculums from seed tank to Fermenter.

UNIT- II

Fermentation Processes and Media Design: General requirements of fermentation processes, Basic design and construction of fermenter and ancillaries, Main parameters to be monitored and controlled in fermentation processes; Typical media, Media formulation, energy resources, carbon and nitrogen components Solid-substrate, slurry fermentation and its applications

UNIT- III

Aeration and Agitation in Fermentations: Basic Mass transfer concepts; Oxygen transfer from gas bubble to cells; Oxygen transfer in fermentations; Bubble aeration and Mechanical agitation; Correlations for mass transfer coefficients; Gas Hold up; Power consumption concepts; Determination of oxygen transfer rates, K_La values; Other Factors affecting the values of mass transfer coefficients in fermentation vessels.

UNIT- IV

Scale Up and Rheology in Fermentations: Scale up of fermentation processes; Principles, theoretical considerations and techniques used; Scale down methods; The Rheology of fermentation broths; Rheological models; Measurement of rheological parameters; Rheological Control of fermentations; Mixing concepts, power requirement for mixing and improvement of mixing in fermentations.

UNIT-V

Fermenters: Batch, Fed-batch and Continuous Fermentation systems; Dual and multiple fermentations; Comparison between batch and continuous fermentations; Steady state, unsteady state continuous fermentation theories; Examples of continuous fermentation; Practical problems with continuous operations. Monitoring and Control of fermentations, behavior of microbes in different reactors (air lift, fluidized, batch, and continuous fed batch condition).

Text Books:

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

1. Stanbury PF, Whitaker A and Hall S J, “Principles of Fermentation Technology” 2nd edition, Elsevier, 2013.
2. Bailey JE and Ollis DF, “Biochemical Engineering Fundamentals”, 2nd edition, McGraw Hill, 1986.
3. Pauline M. Doran, “Bioprocess Engineering Principles”, Academic press, 1995.

Suggested Reading:

1. Shuler M and Kargi F, Bioprocess Engineering, Prentice Hall of India Pvt. Ltd., New Delhi, 2002.
2. Harvey W. Blanch, Douglas S. Clark, “Biochemical Engineering” 1st edition, CRC, 1997.

HEAD
Dept. of Bio-Technology

With effect from the Academic Year 2020-21

18BT C22

BIOINFORMATICS

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To provide elementary knowledge in bioinformatics and biological information available to biologist on the web and learn how to use these resources on their own.
2. To learn fundamentals of biological databases and sequence alignment
3. To learn methods for determining the order of the nucleotide and to predict gene
4. To aid in understanding structural bioinformatics and Human genome project
5. To understand evolutionary relationship among organisms

Course Outcomes:

At the end of the course the students are able to

1. Explain the need of bioinformatics and biological databases are used for the retrieval of information
2. Demonstrate the methods of sequence alignment and its use
3. Discuss about genome sequencing and Human genome project
4. Predict gene sequences and protein structure
5. Describe an evolutionary tree and different methods and software tools used for phylogenetic analysis

UNIT-I

Introduction to Bioinformatics and Biological Databases: Need of Computers in Biotechnology Research, Elementary commands and protocols, ftp, telnet, http; Bioinformatics- Introduction, scope and application of Bioinformatics; Introduction to biological databases, types of biological database, file formats for biological sequence (NCBI, EMBL, SWISSPROT, FASTA); Information retrieval from biological Databases.

UNIT-II

Sequence Alignments: Sequence database search- FASTA, BLAST, various versions of BLAST and FASTA; Amino acid substitution matrices - PAM and BLOSUM. Sequence Alignment - Local, Global alignment; Methods of pair-wise sequence alignment; Multiple Sequence alignment methods.

UNIT-III

Genome Sequencing and Gene Prediction: DNA sequencing, Genome Mapping; Genome sequencing, cDNA sequencing, Genome sequence assembly; Basis of Gene Prediction, Gene Prediction Methods in Microbial genomes and eukaryotes, Other Gene Prediction Tools; Genome Annotation.

UNIT-IV

Structural Bioinformatics and Human Genome project: Protein structure basics, protein structure classification, visualization and comparison, protein secondary structure prediction and protein tertiary structure prediction; Human genome project: Goals, work scope, impact, practical applications and limitations of Human Genome Project.

UNIT-V

Phylogenetic Analysis: Understanding Evolutionary process; Origin of Molecular Phylogenetics; Relationship of phylogenetic Analysis to sequence alignment; Concept of evolutionary trees; Methods of Phylogenetic analysis, Tree Evaluation, Problems in Phylogenetic Analysis, Automated Tools for Phylogenetic Analysis.

HEAD
Dept. of Bio-Technology

Text Books:

1. David Mount, "Bioinformatics Sequence and Genome Analysis", 2nd edition, CBS Publishers and Distributors Pvt. Ltd., 2005.
2. Rastogi SC, Mendiratta N and Rastogi P, "Bioinformatics: Methods and Applications Genomics, Proteomics and Drug discovery", 3rd edition, PHI Learning Private Limited, New Delhi, 2010.

Suggested Reading:

1. Baxebanis AD and Francis Ouellette BF, "Bioinformatics a practical guide the analysis of genes and proteins", 2nd edition, John Wiley and Sons, Inc., Publication, 2001.
2. Vittal R Srinivas, "Bioinformatics: A modern approach. PHI Learning Private Limited", New Delhi, 2009.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

With effect from the Academic Year 2020-21

18BT C23

MASS TRANSFER OPERATIONS

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To provide the students with knowledge about various unit operations such as absorption, distillation, extraction, leaching.
2. To give insight about various membrane separation processes such as adsorption, Ion-exchange, dialysis and the application of these unit operations in commercial aspects of biotechnology.

Course Outcomes:

At the end of the course the students are able to

1. Distinguish between molecular diffusion in solids, liquids and gases.
2. Determine the number of trays needed for the separation.
3. Solve material balance problems for different unit operations.
4. Explain the principles of the various separation processes involved in the downstream processing of products, especially those of biological origin.
5. Explain the principles and application of membrane separation processes and understand the types of adsorbents.

UNIT-I

Principles of Mass Transfer: Introduction to Mass transfer and Diffusion, Molecular diffusion in Gases, Molecular diffusion in Liquids, Molecular diffusion in Biological solutions and gels, Molecular diffusion in Solids, Inter phase mass transfer and Mass transfer coefficients.

Gas-Liquid operations: Equilibrium relations between phases, Mass transfer between phases, Choice of solvent for absorption, Single stage and multi stage co current and counter current operations, Estimation of Mass transfer coefficient, packed columns and plate columns.

UNIT-II

Principles of VLE for Binary System: Phase rule and Raoult's law, Boiling point diagrams and x-y plots, Relative volatility, Flash distillation, Differential distillation, Simple steam distillation. Distillation with reflux and McCabe - Thiele method. Special Cases for rectification using McCabe - Thiele; Stripping column distillation, Enriching Column distillation, Rectification with direct steam injection, Rectification with single side stream.

UNIT-III

Liquid-Liquid Extraction and Leaching: Introduction to Extraction process: Equilibrium relations in extraction, Analytical and graphical solutions for single and multistage operations co-current and counter current operations without reflux. Equipments for liquid-liquid extraction: mixer settlers for extraction, Plate and Agitated Tower Contactors for Extraction, Packed and spray Extraction towers. Introduction to leaching process: Equilibrium diagrams for leaching, analytical and graphical solutions for single and multi-stage counter current operations.

UNIT-IV

Basic Concepts in Drying of Process Materials: Methods of drying, Equipment for drying; Free moisture content of materials; Concept of bound and unbound moisture content of biological materials; Rate of drying curves; Calculation methods for constant-rate & falling rate drying methods; Freeze drying of biological

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

materials.

UNIT-V

Adsorption And Membrane Separation Process: Theory of adsorption, Industrial adsorbents, Adsorption equilibria, Frendlich equation-single and multiple operations- processing variables and adsorption cycles; Introduction and Types of Membrane separation process: Principles of ion exchange. Dialysis, Gas permeation membrane processes, types of membranes and permeability’s for separation of gases, Introduction to types of flow in gas permeation.

Text Books:

1. C J Geankoplis, “Transport Processes in chemical Operations”, 4th edition, Prentice Hall India, 2004
2. Robert E Treybal, “Mass Transfer operations”, 3rd edition. McGraw-Hill, 1981
3. W.L. McCabe, J.C. Smith and P. Harriot, "Unit Operations of Chemical Engineering", 7th Edn., McGraw Hill Book Co., New York, 2004.

Suggested Reading:

1. Jaime Benitez, “Principles and Modern Applications of Mass Transfer Operations”, 2nd edition, 2009.
2. J M Coulson and J F Richardson, “Chemical Engineering”, Vol-II, 3rd edition, Pergamom Press.

HEAD
Dept. of Bio-Technology

With effect from the Academic Year 2020-21

18BT E07

MEDICAL BIOTECHNOLOGY

(Core Elective - III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the scope and importance of medical biotechnology
2. To understand the differences between the normal cells and cancer cells and various diagnostic methods used in cancer detection.
3. To gain the in-depth knowledge about the clinical applications of stems cells & tissue engineering.
4. The course aims at providing knowledge about the working principles and types of advanced materials used in medical field.
5. To learn current molecular therapies and bioethical issues.

Course Outcomes:

At the end of the course the students are able to

1. Outline the various types of genetic disorders.
2. Compare etiology, diagnosis and treatment of Cancer.
3. Explain the concepts of Stem cell therapy and Tissue engineering.
4. Discuss the principle and applications of biomedical devices and molecular diagnostics.
5. Classify the molecular therapies and bioethical issues.

UNIT-I

Introduction To Medical Biotechnology: Introduction, scope and importance of medical biotechnology; The genetic basis of the disease; chromosomal disorders; single gene disorders-modes of inheritance, Thalassemia, sickle cell anaemia, cystic fibrosis, Tay sachs disease, Fragile –X- syndrome; polygenetic disorders; Alzheimers disease,Type-1diabetis and mitochondrial disorders (neurological disorders).

UNIT-II

Medical Oncology: Cancer types; Normal cells vs. cancer cells; cancer genetics; oncogenes and their proteins; tumor suppressor genes and their functions, diagnosis of cancer, Treatment of cancer; Radiation therapy, chemotherapy.

UNIT-III

Stem Cell Treatment and Tissue Engineering: Cellular therapy, stem cells- definition, types, properties and uses of stem cells; sources of embryonic and adult stem cells; concept of tissue engineering; role of scaffolds; clinical applications of stem cells; stem cell banking and ethical issues.

UNIT-IV

Biomedical Instrumentation And Molecular Diagnostics: Concepts in Biomedical Engineering; principle, properties of Biomaterials and applications of different types of biomedical devices; pacemakers, drug coated stents, knee replacement implants, dental implants, prosthetics, Molecular diagnosis by immunological approaches to detect protein biomarkers of the disease (types of ELISA), DNA approaches (Taq MAN approach, RT-PCR, epigenetic markers, detection of SNP by mass spectrometry; Applications of biosensors in medicine.

UNIT-V

Molecular Therapeutics And Bioethical Issues: Types of molecular therapies; protein therapy by recombinant

HEAD
Dept. of Bio-Technology

Monoclonal Antibodies, Enzymes (DNase-1, Alpha -1 antitrypsin), Lactic acid bacteria by Leptin, antisense therapy, recombinant vaccines; Bioethical issues in IVF, surrogacy and cloning technologies.

Text Books:

1. Judith Pongracz, Mary Keen, "Medical Biotechnology", illustrated edition, Elseiver health sciences, 2009.
2. Bernard R Glick, Cheryl L.Patton, Terry L.Delovitch, "Medical biotechnology", 1st edition, ASM press, 2013.

Suggested Reading:

1. Truepenny PD, Emerys "Elemental Medical Genetics", 14th edition, Churchill Livingstone, 2012.
2. R.J.B.King, Robins, "Cancer biology", 3rd edition, Prentice Hall, 2006.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

18BT E08

FOOD BIOTECHNOLOGY
(Core Elective - III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. Student is made to understand the importance of food biotechnology and its nutritive value.
2. Students are taught the types of food available in the nature and its consumption value.
3. Students made to understand the food spoilage.
4. Students are enlightened about the importance of food processing.
5. Students are made aware of chemical and physical methods of food processing.

Course Outcomes:
At the end of the course the students are able to
1. Apply the fundamentals of food biotechnology to their real life situation.
2. Explain the types of food, their consumption value and production process.
3. Outline the types of pathogens and their effect on food.
4. Discuss about the physical and chemical methods of food processing.
5. Describe the methods to preserve the food material to avoid food spoilage.

UNIT-I
Scope and Importance of Food Biotechnology: Introduction to Scope and importance of food biotechnology, Nutritive value of the food ; consumption and structure of foods and the importance of industrial processing of foods, Recent techniques involved in packaging, food grade polymers; Food labeling.

UNIT-II
Food Products: Introduction to Probiotics, Nutraceuticals and GM foods ; Development of Industrial Food products: High Fructose Corn syrup, Single Cell Protein and Fermented foods, Bakery Products, Beverages, Milk Products and Mushroom Development.

UNIT-III
Food Spoilage and Food Microbiology: Food spoilage, Bacterial agents of food borne illness; Clostridium, Salmonella, Vibrio and Shigella, Non bacterial agents; Protozoa, Algae, Fungi and Viruses.

UNIT-IV
Food Processing: Various technologies and methods in food preservation and processing, Enzymes and chemicals used in food processing for flavour development; Processing of meat, fisheries, vegetables, dairy products; Thermal processing of foods; Microwave heating; Thermal inactivation of microorganisms; Freezing and thawing methods of food processing.

UNIT-V
Food Preservation: Food preservation using Irradiation: Characteristics of Radiations of Interest in food preservation, Principles underlying the destruction of microorganisms by irradiation, Processing of foods for Irradiation, Legal status of food irradiation, Effect of Irradiation of Food constituents and Storage Stability; Food Preservation with low and High Temperatures and Preservation of foods by Drying, Equipment for Drying.

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

Text Books:

1. Roger Angold, Gordon Beech & Taggart, “Food Biotechnology” 1/e, Cambridge End Press, 1989.
2. Frazier, William, C.Westhoff, Dennisc, “Food Microbiology” 2/4e, TATA Mcgraw Hill Publishers, 1989.

Suggested Reading:

1. Ashok Pandey, “Biotechnology: Food Fermentation” Asia Tech Publishers Inc, New Delhi,1999.
2. J.M. Jay, M.J.Loessner and D.A.Golden, “Modern food microbiology”, 7/e,Springer, 2006.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

18BT E09

BIOPROCESS DYNAMICS AND CONTROL

(Core Elective - III)

Y. Rajani

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

The course aims at

1. Providing knowledge in basic concepts of transfer function, dynamics of system process, forcing functions
2. Imparting knowledge with respect to various types of controllers and understanding the block diagram for a process.
3. Determination of optimum controller settings
4. Inculcating the concepts of advanced control strategies

Course Outcomes:

At the end of the course the students are able to

1. Explain the response of interacting and non interacting systems by applying the concepts of transfer function.
2. Develop block diagrams with set point and load variable changes.
3. Apply the knowledge of closed loop and open loop tuning methods to fine tune the control parameters.
4. Interpret the knowledge of control valve sizing in the design of control valve system in bioprocess units.
5. Assess the advanced control strategies and perform a case study in Bioprocess.

UNIT-I

Process Dynamics: Laplace transform of simple functions, transforms of derivatives, solutions of differential equations, inversion by partial fractions, Partial fractions. Process variables, Dynamics of simple processes – Flow, level, Temperature, Pressure and Concentration; Transfer function – Properties, response of simple processes for Step, Impulse and Sinusoidal Forcing functions. Concept of Time Constant, Linearization, Response of first order systems in series - Non-interacting and Interacting systems. Physical examples of second order system

UNIT-II

Control Actions And Controllers: Controller and Control system – measuring device and final control elements, Open and Closed loop control, Negative and Positive feedback control, Servo and Regulatory problems. Ideal transfer functions –Control valve, Controllers, Proportional, Integral and derivative actions – PI. PD and PID controls. Block diagram- Development of block diagram, Over all Transfer function for single loop system, overall transfer function for change in set point and load, transportation lag.

UNIT-III

Optimum Controller settings: Controller Tuning – Evaluation criteria with l/4th decay ratio, Criteria for good control- IAE. ISE, ITAE. Controller Tuning – Ziegler –Nicholas and Cohen Coon methods .Continuous cycling method, Control of processes with a time delay.

UNIT-IV

Final Control Element: I/P Converter– pneumatic, electric and hydraulic actuators. Control valves – Construction, valve sizing, valve characteristics, valve positioner. Control of Globe, Butterfly and Diaphragm valves.

UNIT-V

Advanced Control Strategies: Brief description of Cascade control. Feed forward control, Ratio control, with a simple example. Dynamics and Control of pH of a process and Biochemical reactor.

HEAD
Dept. of Bio-Technology

Text Books:

1. Donald R.Coughanowr, Process Systems Analysis and Control, 2nd ed., McGraw Hill Inc., 1991.
2. George Stephanpoulos,"Chemical process control" ,Pearson PrenticeHall,1984.
3. Seborg, Edgar, Mellichamp, Doyle, "Process Dynamics and Control", 3rd edition John Weilyand Sons, 2010.
4. Harriott P, "Process control", Tata McGraw-Hill publishing Co., New Delhi, Reprint1991.

Suggested Reading:

1. Patranabis D, Principles of Process Control by 2nd ed., Tata McGraw-Hill publishing Co., New Delhi, Reprint1997.
2. Eckman D.P., Automatic process control, Wiley Eastern Ltd., New Delhi, 1993.

HEAD
Dept. of Bio-Technology

18BT E10

ARTIFICIAL INTELLIGENCE IN BIOLOGY
(Core Elective - III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives
1. Become familiar with basic principles of AI towards problem solving, inference, perception knowledge representation and learning
2. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
3. To understand the applications of AI, expert systems.

Course Outcomes
At the end of the course, the students are able to:
1. Compare AI with human intelligence and traditional information processing and discuss its strengths and limitations.
2. Apply the basic principle, models and algorithms of AI to recognize, model and solve problems in the analysis and design of information systems and also to solve molecular biology problems.
3. Relate language processing to address the questions related to DNA.
4. Explain the neural networks in biology especially in protein characterization etc.
5. Outline an expert system to for the identification of optimized solutions.

UNIT I
Artificial Intelligence Introduction: Overview of Artificial Intelligence (AI); The AI Problems; AI Techniques; The level of the model; Criteria for success.
Problems, Problem Spaces and Search: Problem as a State Space Search; Production Systems; Problem Characteristics; Production Systems Characteristics; Issues in the Design of Search problems

UNIT II
Heuristic Search Techniques: Generate-and-test; Hill-Climbing; Simulation Annealing; Best-First-Search; Local Search, Greedy Algorithms; Problem Reduction; Constraint Satisfaction; Means-ends Analysis
RNA secondary structure prediction problem (*2°RNA***):** Secondary Structure of RNA; Structure and Free Energy—A Mathematical Model; RNA secondary structure prediction as a Search problem

UNIT III
Computational Linguistics
Formal Language Theory: The Formal Specification of Languages; Chomsky Hierarchy and Subdivisions; Lindenmayer Systems; Properties of Language Families; Parsing. Computational Applications of Language Theory: Natural Language; Computer Languages and Pattern Recognition; Developmental Grammars; Gene Grammars
Structural Linguistics of Nucleic Acids: Properties of Reverse Complementarity; Closure Properties for Nucleic Acids. Structural Grammars for Nucleic Acids: Context-Free and Indexed Grammars;

UNIT IV
Artificial Neural Networks: Introduction: Model of a neuron; Feedback and Feed-forward Networks; Training Procedure; Network Optimization.
Protein Structure Prediction with Neural Networks: a -Helix, b-Strand, and Coil Predictions; b-turn Predictions; Secondary Structure Composition Predictions.

UNIT V

HEAD
Dept. of Bio-Technology

Evolutionary Algorithms: Introduction; Evolution of Solutions; Components in a Genetic Algorithm; Representation of a Solution in the Genetic Algorithm; Operation of the Genetic Algorithm; Evolution; Selection and Crossover Strategies; Encoding; Repairing String Damage; Fine Tuning; Traps; Other Evolutionary Algorithms

Genomic Regulatory Networks and Modeling Development: Description of Sample Problem; Representations of Potential Solutions; Simple Model of Development, Developmental Procedures; Fitness Evaluation; Overall Evolution.

Text Books:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair; Artificial Intelligence; Third Edition; Tata McGraw Hill.
2. Lawrence Hunter; Artificial Intelligence And Molecular Biology; AAAI Press, First Edition
3. Hugh Cartwright , Using Artificial Intelligence In Chemistry And Biology- A Practical Guide, CRC Press, Taylor & Francis Group (2008)

HEAD
Dept. of Bio-Technology

With effect from academic year 2020-21

18BT E11

PHARMACEUTICAL BIOTECHNOLOGY

(Core Elective - IV)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand origin, scope and importance of pharmaceutical biotechnology.
2. To learn ADME properties of drugs, pharmacokinetics, pharmacodynamics and drug delivery systems.
3. To understand the materials and formulations of pharmaceuticals.
4. To learn the collection, processing and storage of blood and plasma substitutes
5. To gain knowledge about the pharmaceutical products and their use in treatment of infectious diseases.

Course Outcomes:

At the end of the course the students are able to

1. Summarize the fundamentals of biopharmaceuticals.
2. Explain the ADME properties of drugs, pharmacokinetics, pharmacodynamics and drug delivery systems.
3. Outline the different manufacturing procedures of drugs.
4. Discuss about blood and plasma substitutes.
5. Describe the therapeutic activity of drugs used for treating diseases

UNIT-I

Fundamentals of Biopharmaceuticals: Pharmaceutical Biotechnology: An introduction, Origin, definition, Scope and Importance. Human protein replacements, Therapeutic agents for human diseases: Tissue Plasminogen activator, Interferon, Recombinant vaccines. Methods of Biotechnology and their applications of Gene transfer.

UNIT-II

Biopharmaceutics and Pharmacokinetics: ADME properties- Physiochemical properties of Drug Absorption, Distribution, metabolism (Biotransformation), bioavailability and Excretion. Pharmacokinetics and Pharmacodynamics. Basic considerations: Drug receptors, Drug interactions, Surgical supplies, Oral, Parenteral, Transdermal, Ophthalmic, Intravaginal and Intrauterine Drug Delivery systems.

UNIT-III

The Drug Manufacturing Practices: Good manufacturing practices and facilities for drug production. Types of Tablets and capsules. Materials and Formulations for Manufacture of Tablets, Capsules. Excipients and its ideal properties, Parenteral solutions, Oral liquids, Emulsions, Ointments, Suppositories, Aerosols.

UNIT-IV

Blood and Plasma Substitutes: Collection, processing and storage of whole human blood, concentrated human RBC, dried human plasma, Human plasma protein fraction, Dried human serum, Human fibrinogen, Human thrombin, Human normal Immunoglobulin, Plasma substitutes- Ideal requirements, PVP, Dextran 40, control of Blood products, Transfusion products

HEAD
Dept. of Bio-Technology

UNIT-V

Pharmaceutical Products: Fundamentals of Therapeutic categories such as Analgesics, Antipyretic, Anti-inflammatory drugs, Anesthetics, Antacids, Alkaloids, Glycosides, Anti-neoclassic drugs, Biologicals (Immunizing agents and allergenic extracts), Chemotherapy of Tuberculosis and Urinary tract infections.

Text books:

1. Purohit SS, Kakrani HN and Saluja AK., “Pharmaceutical Biotechnology”, Student Edition Jodhpur, 2003.
2. Brahmankar, D.M., Sunil, B.Jaiswals - Biopharmaceutics & Pharmacokinetics a Treatise , 2nd edition, M.K.Jain Publication, Delhi,2009.
3. Cooper and Guns, “Pharmaceutics”, CBS publishers, 1989.

Suggested Reading:

1. David B Troy and Paul Beringer, “Remington’s: The Science and practice of Pharmacy”, Vol 1 and 2, Lippincott Williams & Wilkins Publications, 2006.
2. Tripathi, K.D. "Essentials of Medical pharmacology", Jaypee Brothers Medical Publishers 6th Edition, John Wiley, New Delhi, 2000.

HEAD
Dept. of Bio-Technology

With effect from academic year 2020-21

18BT E12

INTELLECTUAL PROPERTY RIGHTS REGULATORY AFFAIRS AND CLINICAL TRIALS
(Core Elective - IV)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To make the students understand about Intellectual property rights and their importance, National and international regulatory affairs, GCP &ICH guidelines.
2. To introduce and provide a comprehensive introduction to Regulatory Affairs as typically practiced by Regulatory Affairs professionals in medical device and bio pharma companies.
3. To enable students to follow the Current trends in Clinical research and regulations.

Course Outcomes:
At the end of the course, the students are able to

1. Explain about the IPR, methods of filing patents and legal implications.
2. Summarize the Government of India rules and regulations about the ICH, GCP, FDA guidelines.
3. Discuss the role of regulatory affairs and their significance globally.
4. Outline the criteria for drug approval related documentation.
5. Discuss the various phases of clinical trials and the basis of approval of new drugs, their outcome in new drug discovery.

UNIT-I
Intellectual Property Rights: Intellectual property rights, and intellectual property protection, patents and methods of application of patents, trade secret, copyrights, trademarks, legal implication, trade-related aspects (TRIPS), farmers rights, plant breeder's rights.

UNIT-II
Regulatory Affairs- India: Indian contest- requirements and guidelines of GMP, understanding of Drugs and Cosmetic Act 1940 and rules 1945 with reference schedule M, U & Y. The Narcotics Drugs and Psychotropic Substances Act Medicinal and Toilet Preparations (Excise Duties) Act, 1955 The Pharmacy Act, 1948 Types of ANDA filing (Para I, II, III, IV filing) Clinical trial approval by Drug Controller General of India (DCGI) Exclusivities (NCE, NS, NP, NDF, PED, ODE, PC)

UNIT-III
Regulatory Affairs- Global: Introduction to FDA, WHO, Code of federal Regulations, ICH Guidelines, Related quality systems- objectives and guidelines of USFDA, WHO & ICH, European Medicines Agency and its responsibility, EU clinical trial directive. Requirement of GLP: Guidance and recommendation on Dissolution and Bio-equivalence requirement. Hatch Waxmann Act.

UNIT-IV
Documentation And Protocols: Documentation: Types related to pharmaceuticals industry, protocols, harmonizing formulation development for global fillings, NDA, ANDA, IND, BLA, CTD, DMF, Dealing with post approval changes- SUPAC, handling and maintenance including electronic documentation, 510K device application.

UNIT-V
Introduction To Clinical Research: History, Importance and Scope, stake holders in clinical research, Framework of clinical research, Declaration of Helenski, 2000 amendment, medical and clinical research

Y. Rajani
HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

terminology, Principles of GCP, Roles and responsibilities in clinical research according to ICH GCP,Sponsor, Investigator, IRB/IEC, Essential documentation, Confidentiality issues. Clinical data management system, Double data entry.

Text Books:

1. Good Clinical Practices, Central Drugs Standard Control Organization, Govt. of India
2. Drugs and Cosmetics Act,1940
3. Dominique PB and Gerhardt Nahler, “International Clinical Trial”, Volume 1&2, , Interpharm Press, Denver,Colorado

Suggested Reading:

1. Code of Federal Regulations by USFDA-Download
2. ICH-GCP Guidelines-Download.
3. Fleming DA, Hunt DL, “Biological Safety Principles and Practices”, 3rdedition, ASMPress, Washington, 2000.

HEAD
Dept. of Bio-Technology

With effect from the Academic Year 2020-21

18BT E13

NANOBIOTECHNOLOGY
(Core Elective - IV)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives

1. To introduce the concept of nanotechnology and nano-size
2. To gain knowledge on the synthesis and characterization of nanomaterials
3. To have awareness about different types of Nanostructures
4. To get familiarize with applications of Nanobiotechnology in different fields

Course Outcomes

At the end of the course, the students are able to:

1. Discuss the multidisciplinary nature of nanotechnology and nanoscale paradigm in terms of properties at the nanoscale dimension.
2. Describe different methods used for the synthesis and characterization of nanomaterials.
3. Explain various types of nanostructures.
4. Summarize general applications of Nanobiotechnology.
5. Outline the current applications of Nanobiotechnology.

UNIT I

Introduction and Significance of Nano Domain: Nanotechnology - A Historical Perspective, definition of nanoscale with special reference to biosystems, scope and future prospects of Nanotechnology, Nanobiotechnology and Bionanotechnology, Opportunities and Challenges of Bionanotechnology; Limitations of micron size, need for nano-size—surface volume ratio significance, significance and key features of nano-size, derivation of Bohr's atomic radius of a hydrogen atom, comparison of particle behavior at nano-size to Macro Size: Gold and Titania, advantages of scaling down—nano-size.

UNIT II

Synthesis and Characterization of Nanomaterials: Synthesis of Nanomaterials – Top-down and bottom up approaches with examples, physical, chemical and biological methods, characterization of nanomaterials- Optical (UV-Visible/fluorescence), X-ray diffraction, Imaging and size- (Electron Microscopy- SEM, TEM), Atomic force microscopy, Scanning tunneling microscopy, Spectroscopy- NMR, Raman FT-IR and Plasma Resonance.

UNIT III

Nanostructures: Smart materials, nanoscale biostructures, carbon nanotubes, nanowires, nanoshells, quantum dots, dendrimers, nanosomes, liposomes, virosomes, polymersomes.

UNIT IV.

General Applications Of Nanobiotechology: Application of nanotechnology in medical diagnosis, drug discovery, drug development, drug delivery, Photodynamic Therapy.

UNIT V

Current applications of Nanobiotechology: Application of nanotechnology in Protein Engineering, Tissue engineering, Agriculture, Environment, food processing, Nanotechnology and Nanoparticles: Clinical, Ethical,and Regulatory Issues.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

Text Books:

1. Christof M. Niemeyer and Chad A. Mirkin, “Nanobiotechnology: Concepts, Applications and Perspectives” Wiley Publishers, April 2004.
2. Mark Ratner and Daniel Ratner, “ Nanotechnology: A Gentle Introduction to Next Big Idea”, Low Price edition, Third Impression, Pearson Education.

Suggested Reading:

1. David S Goodsell, “Bionanotechnology”, John Wiley & Sons, 2004.
2. Debasis Bagchi, Manashi Bagchi, Hiroyoshi Moriyama, Fereidoon S hahidi, “Bio-Nanotechnology: A Revolution in Food, Biomedical and Health Sciences” Wiley -Blackwell, 2013.
3. Elisabeth S P, Aravind P, “Bionanotechnology”, Morgan & Claypool publishers, 2007.

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

18MT O01B

Numerical Methods

(For Bio-Technology only)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Learn interpolation and extrapolation techniques to fit the numerical tabulated data.
2. Numerical integration to get approximate solution of given date using Simpson's $1/3^{rd}$, $3/8^{th}$ Weddle's rules
3. Numerical differentiation to get approximate solution of ODE using Taylor, Picard's , Euler's, modified Euler's , Runge kutta methods.
4. Algebraic and transcendental equations.
5. Solve simultaneous equations when the number of unknown increases by iterative methods and ill condition and well condition equations.

Course Outcomes: On the successful completion of this course, the student shall be able to

1. Compute the interpolation and extrapolation techniques to fit the numerical tabulated date.
2. Apply the numerical integration of given data using Simpson's $1/3^{rd}$, $3/8^{th}$ Weddle's rules
3. Evaluate numerical differentiation to get an approximate solution of ODE using Taylor, Picard's , Euler's, modified Euler's , Runga kutta methods.
4. Solve algebraic and transcendental equations.
5. Solve initial value problems by using Numerical Differential Equations.

UNIT-I: Solutions of Algebraic and Transcendental Equations: Method of Bisection, Regular Falsi Method (method of false position); Newton Raphson Method, Approximate solution of equations by Horner's method.
UNIT-II: Solutions of Simultaneous Equations: Gauss elimination method, Jacobi iteration Method, Gauss Seidel Method of Iteration, Solutions of Non-Linear simultaneous equations by Newton Raphson method.

UNIT III: INTERPOLATION: Finite difference operators, Newton's forward and backward interpolation formulas, Newton's divided difference interpolation for unequal intervals, Lagrange's interpolation, inverse interpolation.

UNIT IV: NUMERICAL DIFFERENTIATION & INTEGRATION: Numerical differentiation using Newton's forward & backward interpolation formulas, and Newton's divided difference interpolation formula. Numerical integration: Simpson's $1/3^{rd}$, $3/8^{th}$ rules. Weddle's rule.

UNIT V: NUMERICAL SOLUTIONS FOR DIFFERENTIAL EQUATIONS: Solution of differential equation: Taylor's method, Picard's method, Euler's method, modified Euler's method, Runga kutta fourth order method.

Text Books:

1. Numerical Methods by S. S. Shastry
2. Numerical Analysis for Scientists and Engineers- by Mittal
3. Numerical and statistical Methods in Computer by V.K.Singh

Suggested Reading:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 35th Edition, 2010.
2. Miller and Freund, "Probability and Statistics for Engineers", PEARSON, 2005.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

HEAD
Dept. of Bio-Technology

18EC O02

BIOMEDICAL INSTRUMENTATION
(Open Elective - I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To understand the physiological systems, present in the human body.
2. To understand the application of electronic systems used in modern healthcare.
3. To acquire, process and analyses Bio medical signals.

Course Outcomes:
At the end of the course, the students are able to:
1. Describe the physiological, physical and chemical background of the most common bioelectrical phenomena.
2. Understand the electrode theory, different types of electrodes and transducers required to detect bioelectric signals.
3. Elucidate cardiovascular system, human assist devices and other physiological measurements.
4. Analyze and compare the different medical imaging systems using computers.
5. Explain patient monitoring systems through bio-telemetry and realize safety requirements of biomedical instrumentation.

UNIT-I
Introduction to Bio Medical Instrumentation: Components of the Man-Instrument system, Physiological systems of the body, Problems encountered in measuring a living system. Sources of Bio electric potentials: Resting and action potentials, propagation of action potentials, Bio electric potentials.

UNIT-II
Basic Transducer Principles: Transducer principles, active and passive transducers, their bio medical applications.
Electrodes: Electrode theory, bio potential electrodes, bio chemical transducers.

UNIT-III
Cardiovascular System: The heart and cardiovascular system, the heart, blood pressure, blood flow, heart sounds, ECG, Measurement of blood pressure, blood flow, cardiac output, and heart sounds and PCG. Patient care and monitoring systems: Elements of Intensive care systems, patient monitoring systems, other instruments, organization of the hospital for patient care monitoring, pace makers, defibrillators.

UNIT-IV
Bio Medical Amplifiers: Basic requirements, differential amplifier, carrier amplifier, chopper amplifier, phase sensitive detector. EEG: Signal sources, EEG recording, applications of EEG. EMG: Surface and needle electrodes, EMG, measurement of conduction velocity, ERG and EOG

UNIT-V
Bio telemetry: Introduction, physiological parameters adaptable to biotelemetry, components of telemetry system, implantable units, applications of telemetry in patient care. Computer in Biomedical instrumentation: digital computer, microprocessor, interfacing computer with other medical equipment, biomedical computer applications, Introduction to CAT scanner. X-Ray: X-ray unit, radiation therapy, Introduction to MRI.

Y. Rajani
HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

Text Books:

1. LeslieCromwell, Fred J Weibell andErich A.P Feiffer,'Bio Medical Instrumentation and Measurements', PHI, 2nd edition, 2003.
2. C Raja Rao and SK Guha, 'Principles of Medical Electronics and Bio Medical Instrumentation', Universities press, 2013.

Suggested Reading:

1. R.S Khandpur, 'Handbook of Biomedical Instrumentation', McGraw-Hill Education, 3rd edition, 2014
2. Andrew G. Webb, 'Principles of Biomedical Instrumentation', Cambridge University Press, 2017

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technology
Gandipet, Hyderabad-500 075.

18ME O03

RESEARCH METHODOLOGIES
(Open Elective - I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design
4. To equip the students with good methods to analyze the collected data
5. To explain how to interpret the results and report writing

Course Outcomes:

At the end of the course, the students are able to

1. Define research problem.
2. Review and assess the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square.
5. Improve the style and format of writing a report for technical paper/ Journal report.

UNIT – I

Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT–II

Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT – III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT – IV

Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT – V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

HEAD
Dept. of Bio-Technology

Text Books:

1. C.R Kothari, “Research Methodology, Methods & Technique”, New Age International Publishers, 2004.
2. R. Ganesan, “Research Methodology for Engineers”, MJP Publishers, 2011

Suggested Reading:

1. Vijay Upagade and Aravind Shende “Research Methodology”, S. Chand &Company Ltd., New Delhi, 2009
2. G. Nageswara Rao, “Research Methodology and Quantitative methods”, BS Publications, Hyderabad, 2012.
3. Naval Bajjai, “Business Research Methods”, Pearson2011.
4. Ratan Khananabis and Suvasis Saha, “Research Methodology”, Universities Press, Hyderabad, 2015

HEAD
Dept. of Bio-Technology

18BT C24

FERMENTATION LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objectives:

To provide the hands on training to students and practically prove the theoretical concepts with respect to integrated bioprocess

Course Outcomes:

At the end of the course the students are able to

1. Demonstrate the working and ancillaries of bioreactor.
2. Examine the favorable conditions for growth of microorganism.
3. Analyze the batch vs fed batch culture techniques.
4. Evaluate the growth kinetics of microorganisms.
5. Develop and Design a statistical method for production process.

LIST OF EXPERIMENTS

1. Bioreactor instrumentation and control.
2. Isolation of microorganisms from soil or water samples for commercially useful ended experiments(open ended)
3. Preparation of Media and measuring viscosity.
4. Sterilization of Media and Air.
5. Estimation of specific growth rate and doubling time of a microorganism
6. Growth of E.coli using Batch fermentation technique
7. Growth of E.coli using Fed batch culture techniques.
8. Optimization of citric acid production from *A.niger* using Plackett-Burman method
9. Estimation of biomass (dry weight), substrate and product analysis post citric acid fermentation.
10. Estimation of Monod parameters for determining growth kinetics.(structured)
11. Production of Lactic acid by using batch reactor.

Suggested Reading:

1. Gopal Reddy M, M.N. Reddy, D.V.R. SaiGopal and K.V. Mallaiah , "Laboratory Experiments in Microbiology",3rd edition, Himalaya Publishing House Pvt Ltd,2008,
2. Gunasekaran P., "Laboratory manual in Microbiology", 3rdedition, New Age International Publ., New Delhi, 2007.
3. Kannan N., "Laboratory manual in General Microbiology", 1st edition, Panima Publishing Corp., New Delhi, 2002.

Y. Rajani

HEAD
Dept. of Bio-Technology

18BT C25

BIOINFORMATICS LAB

Instruction	2 P Hours per week
Duration of SEE	2 Hours
SEE	35 Marks
CIE	15 Marks
Credits	1

Course Objective:

To provide practical instructions to the students on using the specific databases and learn how to use these resources on their own and analysis the output.

Course Outcomes:

At the end of the course the students are able to

1. Retrieve the information from biological databases
2. Utilize BLAST, FASTA and some online tools
3. Use and compare the online sequence alignment tools
4. Construction evolutionary tree by phylogenetic analysis
5. Predict gene and protein structure and design primers and construct restriction map.

LIST OF EXPERIMENTS

1. Searching Bibliographic databases for relevant information.
2. Sequence retrieval from DNA and Protein databases.
3. BLAST services.
4. FASTA services.
5. Pair wise comparison of sequences (Local and global alignment).
6. Multiple Sequence Alignment.
7. Evolutionary studies/Phylogenetic Analysis.
8. Protein Databank retrieval and visualization.
9. Structure Exploration of Proteins.
10. Restriction Mapping (Structured enquiry)
11. Identification of Genes in Genomes.
12. NCBI ORF Finder.
13. Primer Design (Open ended experiment)

Suggested Reading:

1. Baxebanis AD and Francis Ouellette BF, "Bioinformatics a practical guide the analysis of genes and proteins", 2nd edition, John Wiley and Sons, Inc., Publication, 2001.

HEAD
Dept. of Bio-Technology

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

Choice Based Credit System (with effect from 2019-20)

B.Tech (Biotechnology)

SEMESTER – VII

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per week		Scheme of Examination			Credits
					Duration of SEE in Hours	Maximum Marks		
			L/T	P/D		CIE	SEE	
THEORY								
1	16BT C41	Down Stream Processing	3	-	3	30	70	3
2	16BT C42	Plant Biotechnology	3	-	3	30	70	3
3	16BT C43	Animal Biotechnology	3	-	3	30	70	3
4	16BT C44	Bioprocess Dynamics & Control	3	-	3	30	70	3
5	16BT C45	Computer Applications in Bioprocess Industries	3	-	3	30	70	3
6	16BT E46 16BT E47 16BT E48	**Elective-V (Core)** Genomics & Proteomics Cancer Biology Intellectual Property Rights Regulatory Affairs & Clinical Trials	3	-	3	30	70	3
PRACTICALS								
7	16BT C49	Down Stream Processing Lab	-	3	3	25	50	2
8	16BT C50	Tissue Culture Lab	-	3	3	25	50	2
9	16BT C51	Project Seminar	-	3	-	50	-	2
TOTAL			**18**	**9**	**24**	**280**	**520**	**24**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Y. Rajasri

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075

16BT C41

DOWN STREAM PROCESSING

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Student is made to understand the role and, importance of downstream processing.
2. Students are taught the various techniques of cell disruption and the principles of solid liquid separation processes, filtration and centrifugation
3. Students are made to understand the principles of membrane based separations and their applications.
4. Students are enlightened about chromatographic separations, types and their importance in product purification.
5. Students are made to study the principle of crystallization, drying and lyophilisation.

Course Outcomes:

At the end of the course the students are able to

1. Explain the key aspects of Downstream Processing from both a technical and economic perspective.
2. Learn the various techniques of cell disruption and unit operations for separation of insolubles
3. Design mineral water plant
4. Design and select chromatographic separation process for different bioproducts and scale up
5. Learn various techniques of product polishing and formulation.

UNIT-I

Role Of Downstream Processing In Biotechnology: Role and Importance of Downstream Processing in Biotechnological Processes; Characterization of Biomolecules and fermentation broths; Physico-Chemical basis of Bio-separations; Characteristics of Bio-separations; Process design criteria for bioproducts; Downstream process economics.

UNIT-II

Primary Separation And Recovery Processes: Cell Disruption methods for intracellular products- Mechanical, Chemical and Enzymatic Methods; Removal of Insolubles, Biomass separation techniques; Flocculation; Sedimentation; Centrifugation; Filtration: Theory, Equipment-Depth filters, Plate and frame filters, Pressure leaf filters, Continuous rotary drum filters, filter media and filter aids, Problems on specific resistance of the cake, time taken for filtration and, compressibility of cake.

UNIT-III

Product Enrichment Operations: Membrane-based separations-Types of membranes, solution diffusion model, capillary flow model; Types of flow-Cross flow, Tangential flow and mixed flow; Types of membrane based separations: Micro-filtration, Ultra-filtration, Dialysis, Electro dialysis, Reverse Osmosis; Theory, design and configuration of membrane separation equipment, Applications; Aqueous Two-phase extraction of proteins; Precipitation of proteins with salts and organic solvents; Adsorption processes.

UNIT-IV

Product Purification And Polishing: Chromatographic separations- Principles, Classification, General description of column chromatography; IMAC, Bio-affinity Chromatography; Design and selection of chromatographic matrices; Design of large-scale chromatographic separation processes

UNIT-V

New and Emerging Technologies: Pervaporation, super critical fluid extraction; Electrophoretic Separations; Final Product Polishing- Crystallization: nucleation, crystal growth, Industrial crystallizers, Drying: drying terminologies, drying curve, Industrial dryers Lyophilization: principles and applications; Formulation Strategies; Case studies (Citric acid / Penicillin and Low volume high value product like recombinant proteins).

Text Books:

1. Sivasankar B, J M Asenjo, Separation processes in Biotechnology, Marcel-Dekker, 1993.
2. Keith Wilson, John Walker, John M. Walker, Principles and Techniques of Practical Biochemistry 5th edition Cambridge University Press, 2000.

Suggested Reading:

1. Nooralabettu Krishna Prasad, Downstream Process Technology by PHI publications.

Y. Rajani

16BT C42

PLANT BIOTECHNOLOGY

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. The students should be able to understand explicitly the basic concepts of Plant Tissue culture.
2. To understand the developmental pathways of callus induction and plant regeneration.
3. To understand the techniques for production of secondary metabolites in *in vitro* using plant cell and tissue culture.
4. To understand the methods of gene transfer in plants for production of transgenics.
5. To understand the various strategies and sources of trangenes for crop improvement.

Course Outcomes:

At the end of the course the students are able to

1. Describe the theoretical concepts behind establishment of in vitro techniques.
2. Explain the importance and applications of various in vitro techniques
3. Exploit plant tissues for production of biologics at commercial scale.
4. Interpret the knowledge of how the transgenes are utilized in the production of trangenics resistant to biotic, abiotic stress resistant and improved quality etc.
5. Analyse and use the appropriate vectors for production of transgenics

UNIT-I

Introduction To Plant Tissue Culture: Introduction to cell and tissue culture: History, Totipotency, Cell Theory, Tissue culture media (composition, preparation);Sterilization techniques; Callus and cell suspension culture; Organogenesis and Embryogenesis and their applications.

UNIT-II

Tissue Culture In Crop Improvement: Micropropagation of virus-free plants; Somaclonal variation; Haploids in plant breeding; Germplasm conservation (Cryopreservation). Protoplast isolation, culture and fusion: Somatic hybridization.

UNIT-III

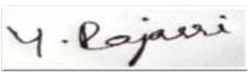
Molecular Farming & Industrial Products: in vitro production of short chain and long chain fatty acids; Industrial enzymes; Edible vaccines. Production of secondary metabolites from plant cell cultures using Cell suspension cultures, Immobilized cell systems, Precursor feeding (elicitation) and hairy roots. Bioreactor systems and models for mass cultivation of plant cells.

UNIT-IV

Plant Genetic Engineering –I Techniques: Agrobacterium mediated gene transfer; Plant vectors and their use in genetic manipulation; Direct gene transfer methods; electroporation, microinjection, particle bombardment and chemical methods.

UNIT-V

Plant Genetic Engineering –Ii Productivity And Safety Regulations: Transgenics in crop improvement: Biotic Stress resistance: Herbicide,Insect, Disease, virus etc., Abiotic stress tolerance: Drought, Temperature, Salt. Transgenics for improved nutrional quality, storage, longer shelf life. Environmental impact and gene flow.

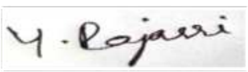


Text Books:

1. Bhojwani SS and Razdan, Plant Tissue Culture Theory and Practice, Elsevier Science, 2004
2. Chawla HS, Introduction to Plant Biotechnology, 4th edition, Oxford and IBH publishers, 2002

Suggested Reading:

1. Nigel G Halford, Plant Biotechnology: Current and future applications of genetically modified crops , edited John Wiley & Sons Ld. 2006.
2. Surabh Bhatia, Kiran Sharma, Randhir Dahiya and, Tanmoy Bera, Modern applications of Plant Biotechnology in Pharmaceutical Sciences, Elsevier publication, Academic press, 2015



16BT C43

ANIMAL BIOTECHNOLOGY

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. Students are expected to understand the technical procedure involved to culture animal cells.
2. Students will learn various steps involved in the establishment of primary culture and their maintenance.
3. Students will know about cell viability and cytotoxicity, cell death.
4. Students are expected to know about stem cells and their applications.
5. Students will describe IVF and embryo transfer, cloning and gene transfer methods for generation of transgenic animals and its applications.

Course Outcomes:

At the end of the course the students are able to

1. Explain the animal cell culture requirements and procedure.
2. Outline the establishment and maintenance of animal cell culture.
3. Discuss about Stem cells and their applications and describe the procedure for measurement of cell viability and cytotoxicity, cell death.
4. Explain various methods for IVF and embryo transfer, cloning and generation of transgenic animals and their applications.
5. Outline various applications of animal biotechnology.

UNIT-I

Animal Cell Tissue Culture: History and scope of animal cell tissue culture, advantages and disadvantages of tissue culture; Laboratory facilities for animal tissue culture; Aseptic techniques; The substrate on which cells grow; Treatment of substrate surfaces; Culture media for cells and tissues.

UNIT-II

Primary Culture and Cell Lines: Disaggregation (Enzymatic and Mechanical) of tissue and Primary culture. Culture cells and evolution of cell lines. Maintenance of cultures- Cell lines, Cell separation, Cell synchronization; Cloning of cell lines; Cell transformation; Bioreactors for animal cell culture; Scaling-up of animal cell culture.

UNIT-III

Stem Cells, Cell Viability and Toxicity: Stem cells, types of stem cells, embryonic stem cells and their applications; Measurement of cell viability and cytotoxicity, Measurement of cell death; Senescence, Apoptosis, Necrosis.

UNIT-IV

Embryo Transfer, Cloning and Transgenic Animals: Artificial insemination, *in vitro* fertilization and embryo transfer; Cloning of animals - Reproductive cloning, Therapeutic cloning; Gene transfer or Transfection methods; Transgenic animals- Mice, Sheep, Pig, Rabbit, Goat, Cow and fish.

UNIT -V

Applications of Animal Biotechnology: Application of animal cell culture; Mammalian cell products; Viral vaccines produced from animal cell cultures. Three dimensional culture; Tissue engineering.

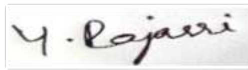
Y. Rajani

Text Books:

1. Ian Freshney, R., “Culture of Animal Cells: A manual of basic technique and specialized applications” Seventh edition, John Wiley and Sons, 2016.
2. John Masters, “Animal Cell culture: A practical approach” OUP Oxford, 2000.
3. Gupta P.K., “Biotechnology and Genomics” Rastogi Publications, 1^{st} edition, 6^{th} reprint, 2013

Suggested Reading:

1. Srivastava, A.K., Singh, R.K., Yadav, M.P., “Animal Biotechnology” Oxford & IBH Publishing Co. Pvt. Ltd., 2005.
2. Ranga, M.M., “Animal Biotechnology”, 3 reprint, Agrobios, India, 201



16BT C44

BIOPROCESS DYNAMICS & CONTROL

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. The course aims at providing dynamics of system process, flow, level and temperature etc.
2. The course aims at incorporating with concepts of response of first order system for non interacting and interacting systems.
3. The course aims at providing knowledge the design of control system for open and close loop control.
4. The course aims at inculcating concepts of the control of pH of process and biochemical reactions.

Course Outcomes:

At the end of the course the students are able to

1. Use the knowledge of Process dynamics to control level, temperature, flow variable etc in bioprocess industries.
2. Devise simple feedback control strategy for a bioprocess
3. Incorporate the knowledge of closed loop and open loop tuning methods to fine tune the control parameters.
4. Use the knowledge of control valve sizing in the design of control valve system in bioprocess units.
5. Apply the knowledge of process control to regulate the pH of bioreactors and apply the knowledge of process control to regulate the pH of bioreactors.

UNIT-I

Process Dynamics: Laplace transform of simple functions, transforms of derivatives, solutions of differential equations, inversion by partial fractions, Partial fractions. Process variables, Dynamics of simple processes – Flow, level, Temperature, Pressure and Concentration; Transfer function – Properties, response of simple processes for Step, Impulse and Sinusoidal Forcing functions. Concept of Time Constant, Linearization, Response of first order systems in series - Non-interacting and Interacting systems. Physical examples of secondorder system

UNIT-II

Control Actions And Controllers: Controller and Control system – measuring device and final control elements, Open and Closed loop control, Negative and Positive feedback control, Servo and Regulatory problems. Ideal transfer functions –Control valve, Controllers, Proportional, Integral and derivative actions – PI. PD and PID controls. Block diagram- Development of block diagram, Over all Transfer function for single loop system, overall transfer function for change in set point and load, transportation lag.

UNIT-III

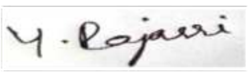
Optimum Controller settings: Controller Tuning – Evaluation criteria with l/4th decay ratio, Criteria for good control- IAE. ISE, ITAE. Controller Tuning – Ziegler –Nicholas and Cohen Coon methods .Continuous cycling method, Control of processes with a time delay.

UNIT-IV

Final Control Element: I/P Converter– pneumatic, electric and hydraulic actuators. Control valves – Construction, valve sizing, valve characteristics, valve positioner. Control of Globe, Butterfly and Diaphragm valves.

UNIT-V

Advanced Control Strategies: Brief description of Cascade control. Feed forward control, Ratio control, with a simple example. Dynamics and Control of pH of a process and Biochemical reactor.



Text Books:

1. Donald R.Coughanowr , Process Systems Analysis and Control, 2nd ed., McGraw Hill Inc., 1991.
2. George Stephanpoulos,"Chemical process control", Pearson Prentice Hall, 1984.
3. Seborg, Edgar, Mellichamp, Doyle, "Process Dynamics and Control", 3rd edition John Weily and Sons, 2010.
4. Harriott P, "Process control", Tata McGraw-Hill publishing Co., New Delhi, Reprint 1991.

Suggested Reading:

1. Patranabis D, Principles of Process Control by 2nd ed., Tata McGraw-Hill publishing Co., New Delhi, Reprint 1997.
2. Eckman D.P., Automatic process control, Wiley Eastern Ltd., New Delhi, 1993.

16BT C45

COMPUTER APPLICATIONS IN BIOPROCESS INDUSTRIES

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. This course aims at providing knowledge on basic concepts in software development processes, Algorithm design and Process Models.
2. The course is designed to give an understanding on obtaining. solutions of differential equations by Euler`s, Modified Euler`s, Runge-Kutta methods
3. This course aims at providing an insight into the solution of set of simultaneous equations by Gauss elimination, Gauss Jordan and Gauss Seidel methods.
4. The aim of the course is also to give the students an understanding of obtaining solutions of numerical methods.

Course Outcomes:

At the end of the course the students are able to

1. Distinguish between different process models
2. Formulate process models leading to set of ordinary differential equations and solution procedures numerical methods.
3. Formulate process models leading to set of linear simultaneous equations and solution procedures.
4. Formulate process models leading to transcendental and polynomial equations and solution procedures.
5. Understand the steps involved in optimization that are a prerequisite for the development of process flow sheets and optimize biochemical process.

The Programs are to be written in "C" only

UNIT-I

Computers and Software: Computing environments, the software development processes, Algorithm design, Program composition, Quality Control, Documentation, Storage and •Maintenance, Software strategy. Process Models: Uses, Distributed & Lumped parameter models, Linear and Nonlinear models, Steady state andDynamic models, Continuous and Discrete models, Empirical models. Formulation of Process Models: Momentum, mass and energy balances, constitutive rate equations, transport rate equations, biochemical kinetic rate expressions, thermodynamic relations. Review on "C" Language Fundamentals.

UNIT-II

Function Approximation: Function Approximations by Linear and nonlinear least square analysis, Formulation Process Models leading to set of ordinary differential equations and solution procedures by Eulers, Modified Eulers and Runge Kutta methods.

UNIT-III

Formulation of Process Models : Formulation of Process Models leading to set of linear simultaneousequations and solution procedures by Method of determinants, Gauss Elimination, Gauss Jordan, Jacobi and Gauss-Seidel methods.

UNIT-IV

Process Models Leading to Transcendental and Polynomial Equations:

Formulation of Process Models leading to transcendental and polynomial equations and solution procedures by Bisection, Reguli-falsi, Newton Raphson, Richmond, Muller's and Bairstow methods

UNIT-V

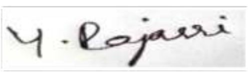
Process Optimization : Nature and organization, basic concepts and elements of Optimization, Scope and hierarchy of optimization, Essential features and general procedure of optimization problems and applications of optimization , single variable functions, direct, indirect and random search methods – with and without acceleration Elimination methods for unrestricted and exhaustive search, Fibonacci search, Dichotomous search, Golden-section (gradient) search methods.

Text Books:

1. DR. B.S. Grewal, Higher engineering mathematics Khanna publishers, 1998.
2. Steven C. Chapra and Raymond P Canale, Numerical methods for Engineers 2nd edition, MCGraw Hill International edition, 1988.

Suggested books:

1. Henry R. Bungay Computer Applications in Bioprocessing Volume 70 Springer, 2000.
2. Edger T.E., and Himmelbau D.M., “Optimization of chemical processes”, McGraw Hill international edition, 1988 3. Bioprocess engineering Enrique Galindo and Octavio T. Ramírez Volume 16, Issue 7, 1998.



16BT E46

GENOMICS & PROTEOMICS
Elective-V (Core)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. Student is made to understand the fundamentals of genome
2. Students are made to understand DNA sequencing and various DNA sequencing methods.
3. Students are enlightened about construction and screening of cDNA libraries.
4. Students are enlightened about the current methods existing in the field of genomics.
5. Students are made to understand the basics of proteomics, tools for proteomics and protein modifications

Course Outcomes:
At the end of the course the students are able to
1. Be able to know about genomes, types of genomes and the advanced techniques used for analysing genome.
2. Be able to construct cDNA libraries and explain the importance of cDNA libraries in the identification of functional genes in the genome.
3. Understanding the advancements in the field of modern genomics from classical genomics.
4. To have basics of how proteins are determined and about the function of proteins
5. Be able to design personalized medicines and explain their uptake, action and metabolism.

UNIT-I
Structural Genomics: Overview of genome-Types, analysis of genomes; comparative homologies; evolutionary changes; Genetic analysis:Linkage mapping and analysis, High resolution chromosome maps, Physical mapping, YAC, BAC, Hybrid mapping strategies, microarrays, Sequence specific tags(SST),Sequence tagged sites(STS), FISH, RFLP and RAPD.

UNIT-II
Functional Genomics: Construction and screening of cDNA libraries; cDNA microarrays(DNA micro array, protein micro array), Gene disruptions, Serial analysis of gene expression (SAGE), SAGE Adaptation for Downsized Extracts (SADE); Applications of DNA arrays.

UNIT-III
Next Generation Sequencing: Next generation sequencing- importance; Different sequencer platforms available; Methods of Sequencing; File formats; Data generation tools; Preprocessing of data; Genome wide association studies; Chip-Seq; RNA-Seq; Metagenomics.

UNIT-IV
Proteomics And Tools Used For Proteomics: Protein structure, Protein databases, data mining, Sequence alignment, Algorithms in proteomics, Applications of proteomics: proteome mining, protein expression profiling, protein-protein interactions, protein modifications; Protein digestion techniques; Mass spectrometry: MALDI-TOF, Mass analyzers, peptide Mass Fingerprinting, Protein arrays.

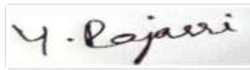
UNIT-V
Metabolomics And Pharmacogenomics: Metabolomis-Basics; Pharmacogenomics-Basics, Diseased genes and their identification; Drug uptake an metabolism; Drug targets; Designer medicine; Genomics perspective of bioterrorism; Ethical and legal implications.

Text Books:

1. Sahai S, “Genomics and Proteomics-Functional and Computational Aspects”, Plenum Publications, 1999.
2. Rastogi SC, Mendiratta N, Rastogi P, “Bioinformatics-Methods and Application, Genomics, Proteomics,and drug discovery”, 2nd edition, Prentice Hall of India, New Delhi, 2003.
3. Hunt SP, Levessy FJ, “Functional genomics” Oxford University Press, UK, 2000.

Suggested Reading:

1. Lieber DC, “Introduction to Proteomics, Tools for the new biology”, Humana Press, UK, 2000.
2. Cendric Gondro, “Primer to Analysis of Genomic Data Using R”, Springer, 2015.



16BT E47

CANCER BIOLOGY
Elective-V (Core)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. Student is made to understand the role of cell cycle and diet in cancer.
2. Students are taught the Molecular aspects of cell cycle control.
3. Importance of physical and chemical carcinogens taught by showing effects of mutagens on cell cycle.
4. Students are enlightened about discovery of proto-oncogenes and their activation.
5. Students are made to understand the diagnosis and treatment of cancer.

Course Outcomes:
At the end of the course the students are able to
1. Apply to real life situations, the concept of diet and cell cycle.
2. Incorporate the fundamentals of cell biology and Molecular biology to understand how they are responsible for cancer.
3. Explain the types of carcinogens and the effect of mutagens on cell cycle.
4. Describe the structure of retrovirus and how they led to discover the oncogens.
5. Outline the No. of stages of cancer, detection of cancer and treatment of cancer and explain the ADME properties of anti cancer drugs.

UNIT-I
Fundamentals Of Cancer Biology: Definition and hall marks of cancer, Cell cycle control, regulation of the cell cycle by cyclins, cyclin-dependent kinases, cdk inhibitors, Mutations that cause changes in signal molecules, Effects on receptor, Signal switches, Tumor suppressor genes, Different forms of cancer(Case studies for carcinoma ex: breast cancer and stomach cancer), Diet and cancer.

UNIT-II
Principles Of Carcinogenesis: Natural History of Carcinogenesis, Types of Carcinogenesis, Chemical Carcinogenesis, Metabolism of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, Ionizing radiation and UV radiation mechanism of Carcinogenesis.

UNIT-III
Principles Of Molecular Cell Biology Of Cancer: Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, Detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes, Activation of protooncogens to oncogens. Growth factors related to transformations.

UNIT-IV
Cancer Metastasis And Treatement: What is Metastasis, Classic theory of tumor Metastasis, Clinical significance of invasion, Heterogeneity of metastatic phenotype, Three-step theory of invasion (Basement Membrane disruption, role of Proteinases in tumor invasion and tumor cell locomotion).Diagnosis of cancers, Advances in Cancer detection(Biomarkers technology and nanotechnology), Different forms of therapy-Chemotherapy, Radiation therapy and immunotherapy.

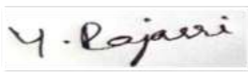
UNIT-V
Principles Of Cancer Pharmacology: Pharmacokinetics and pharmacodynamics of antineoplastic drugs. Metabolism of anticancer drugs, inter individual differences in response to anticancer drugs, mechanisms of anticancer drug resistance. Molecular targets for drug development, mechanism of gene silencing (antisense, ribozymes, RNAi) and chemoprevention studies.

Text Books:

1. Franks LM and N.M.Teich , "Introduction to Cellular and Molecular Biology of Cancer", 2^{nd} edition, Oxford Medical Publications, 1991.
2. Raymond W. Ruddon "Cancer Biology", 3^{rd} edition, Oxford University Press, USA 1995.
3. King, Roger J B, Robins, Mike W, "Cancer Biology", 3^{rd} edition, Prentice Hall, USA.2003.

Suggested Reading:

1. Fiona Macdonald, Christopher Ford, Alan Casson, "Molecular Biology of Cancer", 2^{nd} Edition, Taylor & Francis, 2004.
2. Robert A. Weinberg, "The Biology of Cancer", 5^{th} edition, Garland Science.2006.
3. Robin Hesketh, "Introduction to Cancer Biology" Cambridge University Publishers, Jan, 2013.



With effect from the Academic Year 2019-20

16BT E48

INTELLECTUAL PROPERTY RIGHTS REGULATORY AFFAIRS AND CLINICAL TRIALS
Elective-V (Core)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To make the students to under stand about Intellectual property rights and their importance, National and international regulatory affairs, GCP &ICH guidelines.
2. To introduce and provide a comprehensive introduction to Regulatory Affairs as typically practiced by Regulatory Affairs professionals in medical device and biopharma companies.
3. To enable to students to follow the Current trends in Clinical research and regulations.

Course Outcomes:

The students at the end of the course will

1. The Students will apply the knowledge gained about IPR and to demonstrate the process of patent filing.
2. To create awareness to the Students about the ICH, GCP, FDA guidelines.
3. To discuss and explain the role of regulatory affairs and their significance.
4. Evaluate the criteria for drug approval related documentation.
5. To evaluate, assess, compare and interpret various phases of clinical trials and the basis of approval of new drugs, their outcome in new drug discovery.

UNIT-I

Intellectual Property Rights: Intellectual property rights, and intellectual property protection, patents and methods of application of patents, trade secret, copy rights, trade marks, legal implication, trade related aspects (TRIPS), farmers rights, plant breeder's rights.

UNIT-II

Regulatory Affairs- India: Indian contest- requirements and guidelines of GMP, understanding of Drugs and Cosmetic Act 1940 and rules 1945 with reference schedule M, U & Y. The Narcotics Drugs and Psychotropic Substances Act Medicinal and Toilet Preparations (Excise Duties) Act, 1955. The Pharmacy Act, 1948 Types of ANDA filing (Para I, II, III, IV filing) Clinical trial approval by Drug Controller General of India (DCGI) Exclusivities (NCE, NS, NP, NDF, PED, ODE, PC).

UNIT-III

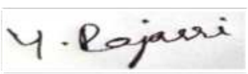
Regulatory Affairs- Global: Introduction to FDA, WHO, Code of federal Regulations, ICH Guidelines,Related quality systems- objectives and guidelines of USFDA, WHO & ICH, European Medicines Agency and its responsibility, EU clinical trial directive. Requirement of GLP: Guidance and recommendation on Dissolution and Bio-equivalence requirement. Hatch Waxmann Act.

UNIT-IV

Documentation And Protocols: Documentation: Types related to pharmaceuticals industry, protocols, harmonizing formulation development for global fillings, NDA, ANDA, IND, BLA, CTD, DMF, Dealing with post approval changes- SUPAC, handling and maintenance including electronic documentation, 510K device application.

UNIT-V

Introduction To Clinical Research: History, Importance and Scope, stake holders in clinical research, Framework of clinical research, Declaration of Helenski, 2000 amendment, medical and clinical research terminology, Principles of GCP, Roles and responsibilities in clinical research according to ICH GCP, Sponsor, Investigator, IRB/IEC, Essential documentation, Confidentiality issues. Clinical data management system, Double data entry.



Text Books:

1. Fleming DA, Hunt DL, “Biological Safety Principles and Practices”, 3rd edition, ASM Press, Washington, 2000.
2. Dominique PB and Gerhardt Nahler, International Clinical Trial, Volume 1&2,, Interpharm Press, Denver, Colorado.

Suggested Reading:

1. Good Clinical Practices, Central Drugs Standard Control Organization, Govt. of India Drugs and Cosmetics Act, 1940.
2. Code of Federal Regulations by USFDA-Download

HEAD
Dept. of Bio-Technology
Chaitanya Bharathi Institute of Technolo
Gandipet, Hyderabad-500 075.

16BT C49

DOWN STREAM PROCESSING LAB

Instruction	3 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. To provide an opportunity to experimentally verify the theoretical concepts studied.
2. To give extensive exposure to various unit operations of downstream processing.
3. Students are explained how to design protocol for separation of bioproduct based on characteristics

Course Outcomes:

At the end of the course the students are able to

1. Understand the fundamentals of downstream processing for biochemical product recovery.
2. Calculate operating parameters for a given downstream processing unit operation.
3. Develop their skills in the purification of bioproducts from fermentation broths.
4. Design chromatographic separation process for a given compound.
5. Arrange unit operations into an appropriate sequence for the purification of a given type of biological product.

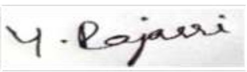
List of Experiments:

1. Cell Disruption of microorganism using sonicator.
2. Cell Disruption of plant cells / animal cells.
3. Homogenization of microbes / plant material using pestle and mortar.
4. Liquid-liquid extraction.
5. Separation of solids from liquid by Sedimentation
6. Separation of micro organisms from fermentation broth by Microfiltration.
7. Separation of solute particles by Dialysis.
8. Separation of alpha amylase by Ammonium Sulphate Precipitation.
9. Isolation and quantification of casein from milk by Isoelectric Precipitation.
10. Separation of biomolecules by Gel Exclusion Chromatography.
11. Purification of lysozyme from chicken egg white extract by Ion Exchange Chromatography.
12. Purification of proteins by Affinity Chromatography.
13. Determination of purity and molecular weight of proteins by SDS-PAGE.
14. Simple distillation- vapor liquid equilibrium.
15. Solid liquid extraction.

Text books:

1. David Plummer, "An introduction to Practical Biochemistry" 3rd edition, John Wiley & Sons, 1998.

2. Keith John Walker John Walker Principles and Techniques of Biochemistry and Molecular Biology by,Cambridge University Press; 6 edition ,2005.



With effect from the Academic Year 2019-20

16BT C50

TISSUE CULTURE LAB

Instruction	3 P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives:

1. The students should be able to understand explicitly the concepts of Plant Tissue culture and Animal tissue culture.
2. Develop their skills in plant tissues culture techniques.
3. Get extensive exposure to various techniques of plant cell and tissue culture.
4. To develop a protocol for genetic transformation using Agrobacterium strains.
5. The students will handle animal cell culture.

Course Outcomes:

At the end of the course the students are able to

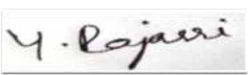
1. Provides an opportunity to experimentally verify the theoretical concepts studied.
2. Gain hands on training in developing protocols for various in *in vitro* techniques: callus cultures, cell and suspension cultures etc.
3. Establish *in vitro* techniques of micropropagation of crop/horticulture and medicinal plants.
4. Establish a system of genetic transformation using Agrobacterium strains.
5. Handle and experience the Protoplast isolation and culture that helps them to produce somatic hybrids.

List of Experiments

1. Preparation of Plant tissue Culture Media
   i) Preparation of MS stock solutions
   ii)Preparation of MS callus induction media
2. Surface sterilization
3. Callus induction: Embryo Culture.
4. Meristem tip culture
5. Micro propagation of horticultural/medicinally important plants
6. Cell suspension cultures initiation and establishment.
7. Organogenesis and Embryogenesis.
8. Production of synthetic seeds.
9. Protoplast isolation (demo)
10. Agrobacterium mediated gene transfer: induction of Hairy roots
11. Preparation of Animal cell culture media
12. Preparation of cheek epithelium cells
13. Preparation of Primary cell lines
14. Cell counting and viability
15. Staining of animal cells

Text Books:

1. H. Jones and John M. Walker, Plant Gene Transfer and Expression Protocols: Methods in Molecular Biology, 49, Humana Press, 1996.
2. J. G. Chirikjian, Biotechnology: Theory and Techniques (Plant Biotechnology, Animal Cell Culture and Immunobiotechnology), Jones & Bartlett Publishers, U.K., 1996.



16BT C51

PROJECT SEMINAR

Instruction	3 Hours per week
CIE	50 Marks
Credits	2

The objective of 'Project Seminar' is to enable the student take up investigative study in the broad field of Engineering / Technology, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a supervisor. This is expected to provide a good initiation for the student(s) towards R&D. The work shall include:

1. Survey and study of published literature on the assigned topic;
2. Working out a preliminary Approach to the Problem relating to the assigned topic;
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility;
4. Preparing a Written Report on the Study conducted for Presentation to the Department;
5. Final Seminar, as oral Presentation before a departmental Committee.

Guidelines for the award of Marks:

Max. Marks: 50

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Project Status / Review
	5	Report
Department Committee	5	Relevance of the Topic
	5	PPT Preparation
	5	Presentation
	5	Question and Answers
	5	Report Preparation
		Y. Rajani HEAD Dept. of Bio-Technology Chaitanya Bharathi Institute of Technology Gandipet, Hyderabad-500 075

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Choice Based Credit System (with effect from 2019-20)
B.Tech (Biotechnology)

SEMESTER – VIII

S.No	Course Code	Title of the Course	Scheme of Instruction Hours per week L/T	Scheme of Instruction Hours per week P/D	Scheme of Examination Duration of SEE in Hours	Maximum Marks CIE	Maximum Marks SEE	Credits
THEORY								
1	16BT E52 16BT E53 16BT E54	**Elective-VII (Core)** Tissue Engineering Immunodiagnostics Molecular Modeling & Drug Design	3	-	3	30	70	3
2	16ME O06 16EC O02 16EG O01	**Elective-VIII (Open)** Research Methodologies Biomedical Instrumentation Technical Writing Skills	3	-	3	30	70	3
3	16CS O03 16CS O04 16ME O01	**Elective- IX (Open)** IOT and Applications Basics of Data Science Using R Entrepreneurship	3	-	3	30	70	3
4	16BT C55	Seminar	3	-	3	50	-	2
5	16BT C56	Project	6	-	3	50	100	6
TOTAL			**18**		**15**	**190**	**310**	**17**

L: Lecture T: Tutorial D: Drawing P: Practical
CIE - Continuous Internal Evaluation SEE - Semester End Examination

Y. Rajani

16BT E52

TISSUE ENGINEERING

Elective-VII (Core)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives

1. To provide fundamental principles and elements of tissue engineering.
2. To get insight into the roles of cells, tissue organization and matrix in tissue engineering.
3. To learn the practical approach of carrying out tissue culture.
4. To learn about the Stem cells and different materials to use as biomaterials.
5. To gain knowledge about the medical applications of tissue engineering

Course Outcomes:

At the end of the course students will be able to

1. Recognize the upcoming concepts of tissue engineering, ethical issues, and future prospects
2. Illustrate the molecular mechanisms at tissue level and in cell matrix in tissue engineering.
3. Identify *in vitro* culturing techniques and scale up designs.
4. Classify and identifies the need of compatible biomaterials as scaffolds for Tissue engineering.
5. Identify and interpret the knowledge, of tissue engineering in producing organs for therapeutic applications.

UNIT-I

Introduction To Tissue Engineering: Basic definition of Tissue engineering ; origin and history of Tissue Engineering, overview of its basic steps and its applications; General scientific issues, Ethical issues; current challenges and future prospectives.

UNIT-II

Cells And Tissue Organization: Cells- cell growth and death; cell differentiation; Cells in tissues and organs. Cell to cell interactions; cell adhesion molecules (CAM) Organization of cells into higher ordered structures-Mesenchymal cells; EMT, Molecular mechanisms and control of EMT process. Tissues- Vascularity; angiogenesis; wound healing. Extra cellular matrix (ECM) –components.

UNIT-III

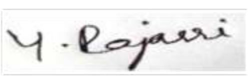
Functional Tissue Engineering: Cell and tissue culture- media; culture initiation; transformation and immortalization; validation; differentiation; maintenance of cells in vitro; cryopreservation. Stem cells in tissue engineering Bioreactors for tissue engineering- Bioreactor design requirements; Spinner flask bioreactors. Rotating-wall bioreactors, Compression bioreactors, Strain bioreactors, Hydrostatic pressure bioreactors, Flow perfusion bioreactors, combined bioreactors

UNIT-IV

Biomaterials of Tissue Engineering: Scaffolds- fabrication; 3D scaffolds Biodegradable polymers; synthetic polymers; hybrid of synthetic and biological polymers; prosthetic devices. Engineering biomaterials for tissue engineering.

UNIT-V

Applications of Tissue Engineering: Tissue replacement –crucial factors Skin grafting Bone tissue engineering; Cardiac tissue engineering; Neural tissue engineering; Vascular tissue engineering;

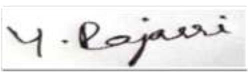


Text Books:

1. Robert.P.Lanza, Robert Langer & Vacanti, Principles of tissue engineering.. Academic Press. 2nd edition 2000.
2. B. Palsson, J.A. Hubbell, R. Plonsey & J.D. Bronzino. Tissue engineering. CRC Taylor & Francis 2000.

Suggested Reading:

1. Bernard prish, Tissue engineering- Design, practice & reporting, Woodhead Publishing Ltd. Cambridge. UK 2009.
2. Atala O.P & Lanza.L , Methods of tissue engineering.. Woodhead Publishing Ltd. Cambridge. UK. 2009.



With effect from the Academic Year 2019-20

16BT E53

IMMUNODIAGNOSTICS
Elective-VII (Core)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. The students will learn the basic principles, procedures and applications of immunodiagnostic tests.
2. The students are introduced to engineer antibody by using rDNA technology
3. The students are illustrated to the steps involved in the develop, production and applications of monoclonal antibody technology
4. The students will learn the development of preventive agents such as vaccines
5. The students also learn the novel methods used for immunodiagnostics

Course Outcomes:

At the end of the course students will be able to

1. Outline the principle, importance, scope, and classification of immunodiagnostic tests.
2. Demonstrate the antigen antibody reaction and its application in immunodiagnostics for diagnosing various diseases by using different types of immunodiagnostic tests
3. Discuss about the development of monoclonal antibodies for diagnosis, treatment and prevention of disease.
4. Explain the new methods of treating various diseases are being explored by vaccine development.
5. Describe the novel techniques used in immunodiagnostics.

UNIT-I

Introduction to Immunodiagnostics: Principles of immunodiagnostic tests and their development; classification of immunodiagnostic tests; Immunodiagnostics importance and scope; the antigen antibody reaction; Selection and preparation of reagents; Assay design; Antibody engineering; Catalytic antibodies.

UNIT-II

Immunodiagnostics Techniques: Immunodiagnostics techniques – Precipitation, Immunoelctrophoresis, Agglutination, RIA, ELISA, Fluoroimmunoassay, Luminescent immunoassay, Immunofluorescence, Cell separation techniques, Western blotting.

UNIT-III

Hybridoma Technology: Hybridoma technique - choice of host for immunization and myeloma cells, choice of immunogen, preparation of antigen for immunization, growth of myeloma cell lines, preparation of cells for fusion, cell fusion, selection and screening of hybridoma, purification and application (biochemical research, clinical diagnosis and treatment) of monoclonal antibodies.

UNIT-IV

Vaccines: Whole organism Vaccines; Subunit vaccines - Herpes Simplex virus, Foot and Mouth disease; Peptide vaccines - Foot and Mouth disease, Malaria; Live recombinant vaccines- Cholera, Salmonella; Vector vaccines - directed against viruses and bacteria; Purified vaccines, Conjugate polysaccharide vaccines; DNA vaccines; Antifertility vaccines.

UNIT-V

Novel Techniques in Immunodiagnostics: Imaging as an Immunodiagnostic Tool; Multicolor Flow Cytometry; Immunoglobulin and Free-light Chain Detection; Methods for Autoantibody Detection; Immunodiagnostic of Allergy; Multiplex Analysis of Cytokines; Immunomonitoring of Clinical Trials; Immunological Assays Used in Vaccine Clinical Trials.

Y. Rajasri

Text books:

1. Edwards R, “Immunodiagnostics: A practical approach” Oxford University Press, 1999.
2. Rastogi SC, “Immunodiagnostics Principles and Practice” New Age Publishers, 1996.

Suggested Reading:

1. Shepherd, P., Dean C., “Monoclonal Antibodies: A Practical Approach” Oxford University Press, 2000.
2. Jenni Punt, Sharon Stranford, Patricia Jones, Judith A Owen., “Kuby Immunology” 8^{th} edition, Macillan learning, 2018.
3. Ralph M Aloisi Lea, Principles of Immunology and Immunodiagnostics, Lea & Febiger, 1988.

16BT E54

MOLECULAR MODELING & DRUG DESIGN
Elective-VII (Core)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. Empirical force fields and Hydrogen bonding in different molecules.
2. Simulation methods to calculate Thermodynamic properties of molecules.
3. Molecular dynamics simulation of molecules by simple and continuous potential.
4. Practical aspects in setting and running the molecular dynamics simulation.
5. Montecarlo simulation method for rigid and flexible molecules.

Course Outcomes:
At the end of the course students will be able to
1. Calculate Total energy of molecule by using force field potentials.
2. Calculate Internal energy, Heat capacity, Temperature, pressure.
3. Hard sphere potential, Continuous potential by Finite differential method.
4. Choosing the initial configuration and analyzing the results of computer simulation.
5. Simulation of polymers by Random walk method, Self avoiding walk method and classify the CADD to treat Alzheimers and TB diseases.

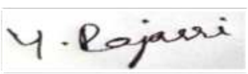
UNIT-I
Empirical Force Fields And Molecular Mechanics: Introduction to Molecular Mechanics, Coordinate system, Molecular graphics, Force fields, Bond stretching, Angle bending, Torsions, polarizable force fields Out of plane bending motions, Electrostatic interactions, Vanderwalis interactions, Effective pair potentials, Hydrogen bonding.

UNIT-II
Computer Simulation Methods: Calculation of Thermodynamic properties, Phase space, Practical aspects of computer simulation, Periodic boundary condition, Boundaries monitoring Equilibrium, Truncating the potential and minimum image convention, Long range process, Analyzing results of simulation and estimating errors.

UNIT-III
Molecular Dynamics Simulation Methods: Molecular Dynamics using simple modules, Molecular Dynamics with continuous potentials: Finite difference methods and Predictor corrector integration method, Constraint Dynamics, Transport properties, Time dependent properties, Molecular Dynamics at constant Temperature and Pressure, QMM simulations.

UNIT-IV
Montecarlo Simulation Methods: Metropolis methods, Importance of Hamiltonian equation, Montecarlo simulation of Rigid and Flexible molecules, Montecarlo simulation of Polymers: Lattice model & continuous polymer model, calculating chemical potential, Differences between Molecular dynamics & Montecarlo simulation method.

UNIT-V
Applications of Molecular Modeling and Drug Design: Production of Drugs in Pharmaceutical companies, CADD: Strucure Based Drug Design and Ligand Based Drug Design, Quantiative Structural Activity Relationship (QSAR) studies in Protein- Ligand interactions, Case studies of Alzheimers disease, Tuberculosis and Cancer etc.

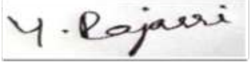


Text books:

1. AR Leach, Molecular modeling principles and Applications Longman Publications, 1996.
2. Molecular Dynamics simulation -Elementary Methods- John Wiley and Sons, 1997.

Suggested Reading:

1. C. Brandon and J. Tooze, Introduction to protein structure by Garland, 2nd edition, 1998.
2. V. Kothakar, Essentials of Drug Designing Dhruv publications, 1998.



18ME O06

RESEARCH METHODOLOGIES
(Open Elective- I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
1. To make the students to formulate the research problem
2. To identify various sources for literature review and data collection.
3. To prepare the research design
4. To equip the students with good methods to analyze the collected data
5. To explain how to interpret the results and report writing

Course Outcomes:
At the end of the course, the students are able to
1. Define research problem
2. Review and asses the quality of literature from various sources.
3. Understand and develop various research designs.
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Improve the style and format of writing a report for technical paper/ Journal report

UNIT-I
Research Methodology: Objectives and Motivation of Research, Types of Research- Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Research Approaches, Significance of Research, Research Methods verses Methodology, Research process, Criteria of Good Research, Problems Encountered by Researchers in India, Technique involved in defining a problem.

UNIT–II
Literature Survey: Importance of Literature Survey, Sources of Information-primary, secondary, tertiary, Assessment of Quality of Journals and Articles, Information through Internet.

UNIT –III
Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Steps in sample design

UNIT–IV
Data Collection: Collection of primary data, Secondary data, Measures of central tendency-mean, mode, median, Measures of dispersion- Range, Mean deviation, Standard deviation, Measures of asymmetry (skewness), Important parametric tests -z, t, F, Chi-Square, ANOVA significance

UNIT–V
Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation- Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

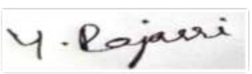
Y. Rajasri

Text Books:

1. C.R Kothari, “Research Methodology, Methods & Technique”, New Age International Publishers, 2004.
2. R. Ganesan, “Research Methodology for Engineers”, MJP Publishers, 2011

Suggested Reading:

1. Vijay Upagade and Aravind Shende, “Research Methodology”, S. Chand & Company Ltd., New Delhi, 2009
2. G. Nageswara Rao, “Research Methodology and Quantitative methods”, BS Publications, Hyderabad, 2012.
3. Naval Bajjai, “Business Research Methods”, Pearson 2011.
4. Ratan Khananabis and Suvasis Saha, “Research Methodology”, Universities Press, Hyderabad, 2015.



16EC O02

BIOMEDICAL INSTRUMENTATION
(Open Elective- I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:

1. To understand the physiological systems present in the human body.
2. To understand the application of electronic systems used in modern health care.
3. To acquire, process and analyse Bio medical signals.

Course Outcomes:

At the end of the course students will be able to

1. Know the functionality of the human body.
2. Know the practical limitations of electronic gadgets used for human systems.
3. Measure various physiological parameters.
4. Know the functionality of Bio medical recorders.
5. Learn the concepts of Brain- computer interface.

UNIT-I

Introduction to Bio Medical Instrumentation: Components of the Man-Instrument system, Physiological systems of the body, Problems encountered in measuring a living system.Sources of Bio electric potentials: Resting and action potentials, propagation of action potentials, Bio electric potentials.

UNIT-II

Basic Transducer Principles: Transducer principles, active and passive transducers, their bio medical applications.

Electrodes: Electrode theory, bio potential electrodes, bio chemical transducers.

UNIT-III

Cardiovascular System: The heart and cardiovascular system, the heart, blood pressure, blood flow, heart sounds, ECG, Measurement of blood pressure, blood flow, cardiac output, and heart sounds and PCG. Patient care and monitoring systems: Elements of Intensive care systems, patient monitoring systems, other instruments, organisation of the hospital for patient care monitoring, pace makers, defibrillators.

UNIT-IV

Bio Medical Amplifiers: Basic requirements, differential amplifier, carrier amplifier, chopper amplifier, phase sensitive detector. EEG: Signal sources, EEG recording, applications of EEG. EMG: Surface and needle electrodes, EMG, measurement of conduction velocity, ERG, EOG. Respiration: mechanism, spirometer, and pneumotachograph.

UNIT-V

Bio telemetry: Introduction, physiological parameters adaptable to biotelemetry, components of telemetry system, implantable units, applications of telemetry in patient care. Computer in Biomedical instrumentation: digital computer, micro processor, Interfacing computer with other medical equipment, Biomedical computer applications, Introduction to CAT scanner. X-Ray: X-ray unit, radiation therapy, Introduction to MRI and nuclear imaging.

Suggested Reading:

1. Leslie Cromwell, Fred J Weibell and Erich A Pfeiffer, BioMedical Instrumentation and Measurements, PHI, 2nd edition, 2003.
2. C Raja Rao and SK Guha, "Principles of Medical Electronics and BioMedical Instrumentation", Universities press, 2013.

Y. Rajani

16EG O01

TECHNICAL WRITING
(Open Elective-1)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives:
The course will introduce the students to:
1. Process of communication and channels of communication in general writing and technical writing in particular.
2. Learn Technical Writing including sentence structure and be able to understand and use technology specific words.
3. Write business letters and technical articles.
4. Write technical reports and technical proposals.
5. Learn to write agenda, record minutes of a meeting, draft memos. Understand how to make technical presentations.

Course Outcomes:
At the end of the course students will be able to
1. Communicate effectively, without barriers and understand aspects of technical communication.
2. Differentiate between general writing and technical writing and write error free sentences using technology specific words
3. Apply techniques of writing in business correspondence and in writing articles.
4. Draft technical reports and technical proposals.
5. Prepare agenda and minutes of a meeting and demonstrate effective technical presentation skills.

Unit-I
Communication – Nature and process.
Channels of Communication – Downward, upward and horizontal communication. Barriers to communication.
Technical Communication – Definition, oral and written communication. Importance and need for Technical communication. Nature of Technical Communication. Aspects and forms of Technical communication. Technical communication Skills – Listening, Speaking, Reading & Writing.

Unit-II
Technical Writing – Techniques of writing. Selection of words and phrases in technical writing. Differences between technical writing and general writing. Abstract and specific words. Sentence structure and requisites of sentence construction. Paragraph length and structure.

Unit-III
Business correspondence – Sales letters, letters of Quotation, Claim and Adjustment letters.
Technical Articles: Nature and significance, types. Journal articles and Conference papers, elements of technical articles.

Unit- IV
Technical Reports: Types, significance, structure, style and writing of reports. Routine reports, Project reports.
Technical Proposals: Definition, types, characteristics, structure and significance.

Unit-V
Mechanics of Meetings: Preparation of agenda, participation, chairing and writing minutes of a meeting. Memorandum. Seminars, workshops and conferences.
Technical Presentations: Defining purpose, audience and locale, organizing content, preparing an outline, use of Audio Visual Aids, nuances of delivery, importance of body language and voice dynamics.

Y. Rajasri

Text Book :

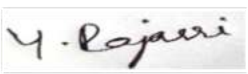
1. Meenakshi Raman & Sangeeta Sharma, “Technical Communications-Principles and Practice”, Oxford University Press, Second Edition, 2012.
2. 1.M Ashraf Rizvi, “Effective Technical Communication”, Tata McGraw Hill Education Pvt Ltd, 2012.

Suggested Reading :

1. Kavita Tyagi & Padma Misra, “Basic Technical Communication”, PHI Learning Pvt Ltd, 2012.
2. R.C Sharma & Krishna Mohan, “Business Correspondence and Report Writing”, Tata McGraw Hill, 2003

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18_mg13/preview
2. https://www.technical-writing-training-and-certification.com/
3. https://academy.whatfix.com/technical-writing-skills



16CS O03

IOT AND APPLICATIONS
(Open Elective-II)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Programming Basics.

Course Objectives:
1. Impart necessary and practical knowledge of components of Internet of Things.
2. Develop skills required to build IoT based systems in the field of biotechnology.

Course Outcomes:
At the end of the course students will be able to
1. Understand Internet of Things and its hardware and software components.
2. Interface I/O devices, sensors & communication module.
3. Remotely monitor data and control devices.
4. Develop real time IoT based projects.
5. Advance towards research based IoT in the field of biotechnology.

Unit- I
Introduction to IoT: Sensors, Types of sensors and Transducers, Actuators and Types of Actuators.

UNIT-II
Basics of Networking : Functional Components of IoT, IoT interdependencies, IoT Service oriented architecture, IoT categories, IoT gateways, IoT and associated technologies, Key technologies for IoT, IoT challenges.

Unit- III
IoT **Hardware Components:** Computing (Arduino/Raspberry Pi), Communication, Sensors, Actuators, I/0 interfaces, Programming API's (for Arduino/ Raspberry Pi).

Unit- IV
Generic IoT Systems: Home Automation: Smart Lighting, Environment: Weather Monitoring System, Weather Reporting Bot, Forest Fire Detection.

UNIT- V

IoT for Biotechnology: Agriculture: Drip-irrigation, Seed quality detection system, Biological water treatment system, Alcohol Detection System, Bio fuel cell for low power IoT devices

Text Books:

1. Raj and Anupama C. Raman,"The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press, 2017.
2. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi, 2018.
3. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.

Suggested Reading:

1. Dr. SRN Reddy, Rachit Tirnkral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs, 2018.
2. Adrian McEwen, "Designing the Internet of Things", Wiley, 2013.

3. Raj Kamal, “Internet of Things:Architecture and Design”, McGraw Hill, 2017.
4. Cuno Pfister, "Getting Started with the Internet of Things", 0 Reilly Media, 2011.
5. O. Vermesan, P. Friess, “Internet of Things – Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers, Series in Communications, 2013.

Online Resources / Weblinks / NPTEL Courses:

1. Li Da Xu, Wu He, and Shancang Li, “Internet of Things in Industries: A Survey “, IEEE Transactions on Industrial Informatics, Vol. 10, No. 4, Nov. 2014.
2. Gotovtsev, Pavel M., and Andrey V. Dyakov. "Biotechnology and Internet of Things for green smart city application." 2016 IEEE 3rd World Forum on Internet of Things (WF-IoT). IEEE, 2016.
3. Yanjing, Sun, et al. "Research and design of agriculture informatization system based on IOT." Journal of Computer Research and Development 48 (2011): 316-331.
4. Somov, Andrey, et al. "Bacteria to power the smart sensor applications: Biofuel cell for low-power IoT devices." 2018 IEEE 4th World Forum on Internet of Things (WF-IoT). IEEE, 2018.
5. Han, Shuqing, et al. "Analysis of the frontier technology of agricultural IoT and its predicationresearch." IOP Conference Series: Materials Science and Engineering. Vol. 231. No. 1. IOP Publishing,2017.

16CS O04

BASICS OF DATA SCIENCE USING R
(Open Elective-II)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisites: Probability and Statistics, basics of programming languages.

Course Objectives:
1. Understand R programming language.
2. Explore the programming skills needed to use R tool for statistical analysis of Biological data.
3. Analyze biological data.

Course Outcomes:
At the end of the course students will be able to
1. Understanding the basics of R, various statistical measures, algorithms useful for data analysis.
2. Explore the programming skills needed to use R tool for biological data.
3. Analyze biological data using R tool.
4. Apply classification and clustering algorithms to bilogical data.
5. Identify and work with the technologies and resources related to bioinformatics.

UNIT-I
Basics of R: Introduction, R features, setting up and exploring R environment, loading packages, types of data objects in R, working with R data objects, Controlling work space, importing files.
Programming with R: Variables and assignment, operators, control structures, Functions-built-in, writing own functions, package creation.

UNIT-II
Data Analysis and Graphics: Data summary functions in R, Graphics technology in R, saving graphics, additional graphics packages.
Bayesian Data Analysis: Need of Bayesian approach, Application of Bayes rule, Priors, Likelyhood functions, evaluating the posterior, Applications of Bayesial Statistics in Bioinformatics.
Stochastic Modeling: Stochastic process and Markov Processes, Classification of Stochastic processes, modeling a DNA sequence with Markov Chain, Characteristics of Markov Chain.

UNIT-III
MCMC using Brugs: ABO blood type example. Gibbs sampling.
Statistical Inference: Sampling distributions, Parameter estimation, interval estimation, bootstrapping, R packages for bootstrapping.
Hypothesis Testing: Package ctest, Binomial test, comparing variances, Wilcoxon tests, Chi-Square test, Fisher's Exact tests, Likelyhood Ratio tests.

UNIT-IV
ANOVA and Regression: ANOVA table, performaning ANOVA using R, graphical analysis of ANOVA comparison, Regression: Correlations, linear regression model, fitting and testing of regression mdoel, generalization of the model.
Working with Multivariate Data: Multivariate data, sample statistics, display of multivariate data, outliers and principal components. Classification of disriminant analysis- classification with two population and more than two populations, cross validation classification trees.

Y. Rajani

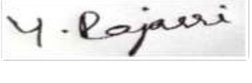
UNIT-V
Clustering methods: measures of dissimilarities, K-means clustering, K-Medoid clustering, Hierarchical clustering-Agglomeratve and divisive
R Packages: Bioconductor and SeqinR.
Data Technologies: R for Data manipulation, example, Database technologies, Bioinformatics resources on the WWW.

Text Books:

1. Kim Seefeld, Ernest Linder, "Statistics using R with Biological examples", 2007 (https://cran.r-project.org/doc/contrib/Seefeld_StatsRBio.pdf).
2. Robert Gentleman, "R Programming for Bioinformatics", 1st Edition, CRC Press, 2008.

Suggested Reading / Online Resources:

1. Arvil Cohhlan "A Little Book of R for Bioinformatics", Release 1.0, CC ver 3.0
2. https://epdf.tips/r-programming-for-bioinformatics.html
3. https://epdf.tips/r-programming-for-bioinformatics.htmlhttps://www.cyclismo.org/tutorial/R/objectOriented.html
4. https://www.w3schools.in/r/object-oriented/



16ME O01

ENTREPRENEURSHIP
(Open Elective-III)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: Student will understand

1. The environment of industry and related opportunities and challenges
2. Concept a procedure of idea generation
3. Elements of business plan and its procedure
4. Project management and its techniques
5. Behavioral issues and Time management

Course Outcomes:
At the end of the course students will be able to

1. Identify opportunities and deciding nature of industry
2. Brainstorm ideas for new and innovative products or services
3. Analyze the feasibility of a new business plan and preparation of Business plan
4. Use project management techniques like PERT and CPM
5. Analyze behavioural aspects and use time management matrix

UNIT-I
Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II
Identification and characteristics of Entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III
Business Plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT-IV
Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V
Behavioral Aspects of Entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior
Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

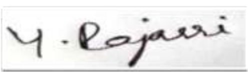
Text Books:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, "Entrepreneurial Development", S. Chand & Co. Pvt. Ltd., New Delhi

Y. Rajani

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, 5/e, Tata Me Graw Hill Publishing Company Ltd., 2005
2. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster Publication, 1994.
3. G.S. Sudha, “Organizational Behavior”, National Publishing House, 1996.



16BT C55

SEMINAR

Instruction	3Hours per week
CIE	50 Marks
Credits	2

The goal of a seminar is to introduce students to critical reading, understanding, summarizing, explaining and preparing report on state of the art topics in a broad area of his/her specialization. Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summaryand Conclusions
5. References

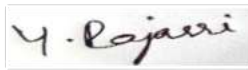
Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.
2. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20 minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
3. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the department.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule shall be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar shall preferably be from any peer reviewed recent journal publications.



Guidelines for awarding marks		
Sl No.	Description	Max Marks
1.	Contents and relevance	10
2.	Presentation skills	10
3.	Preparation of PPT slides	05
4.	Questions and answers	05
5.	Report in a prescribed format	20

16BT C56

PROJECT

Instruction	6 Hours per week
CIE	50 Marks
SEE	100 Marks
Credits	6

The object of Project is to enable the student extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/ Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar presentation before Departmental Committee.

Guidelines for the award of marks in CIE: (Max. Marks: 50)
CIE (Continuous Internal Evaluation) Max. Marks: 50

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
Department Review Committee	05	Review 1
	08	Review 2
	12	Submission
Supervisor	05	Regularity and Punctuality
	05	Work Progress
	05	Quality of the work which may lead to publications
	05	Report Preparation
	05	Analytical / Programming / Experimental Skills

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	Max .Marks	Evaluation Criteria / Parameter
External and Internal Examiners together	20	Power Point Presentation
	40	Thesis Evaluation
	20	Quality of the project • Innovations • Applications • Live Research Projects • Scope for future study • Application to society
	20	Viva-Voce

Y. Rajani

COMPUTER PROGRAMMING USING 'C'

20MCC101

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Outcomes:

After completion of the course, the students will be able to

1. Design algorithms and draw flowcharts for various problems.
2. Choose various data types which are suitable for the problems and distinguish the concepts of control structures.
3. Develop programs using functions and preprocessor directives.
4. Apply array and pointer concepts in solving various problems.
5. Utilize the concepts of strings and structures in various problems.
6. Build programs by using dynamic memory allocation and file management concepts.

UNIT – I

Algorithm, flowchart, structured programming, program development steps, creating and running programs, structure of a C program, character set, keywords, identifiers, constants, basic data types and sizes, variables, operators, operator precedence and associativity, expressions, evaluating expressions, type conversions, basic formatted Input/output statements, decision control structures: if and switch statements, loop control structures: while, do-while and for, continue, break.

UNIT – II

Functions: Basic concepts, user defined functions, parameter passing, local variables, global variables, recursive functions, comparison of iteration and recursion, standard library functions, header files, storage classes, preprocessor.

UNIT – III

Arrays: Basic concepts, one-dimensional array, passing of arrays to functions, searching and sorting: linear search, binary search and bubble sort, two-dimensional array, multi-dimensional array.
Pointers: Basic concepts, pointers as function arguments, pointer arithmetic, pointers to pointers, pointers and one-dimensional arrays, pointers and two-dimensional arrays, array of pointers.

UNIT – IV

Strings: Basic concepts, string I/O operations, pointers and strings, string manipulation functions. Structures: Declaration, definition and initialization of structures, accessing structures, nested structures, array of structures, structures and functions, pointers to structures, self-referential structures, unions, enumerated types, typedef.

UNIT – V

Dynamic memory management functions, command line arguments, Files: Basic concepts, text files, binary files, basic file I/O operations, sequential-access files, random-access files.

Text Books:

1. Pradip D and Manas G, "Programming in C", 2nd Edition, Oxford University Press, 2007.
2. B.A. Forouzan and R.F.Gilberg,"Computer science, A structured programming approach using C", 3rd Edition, Cengage Learning, 2007.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Suggested Reading:

1. BW Kernighan DM Ritchie, “The C programming Language”, 2nd Edition, Prentice Hall India, 1998.
2. P.J Deitel and H.M Deitel , “C How to program” , 6th Edition, PHI, 2010.
3. Yashwant Kanetkar, “Let us C”, 13th Edition, BPB Publications, 2013.
4. E Balaguru Swamy, “Programming in ANSI C”, 5th Edition, Tata McGraw-Hill, 2007.
5. K R Venugopal and S R Prasad, “Mastering C”, McGraw-Hill, 2007.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

COMPUTER ORGANIZATION AND ARCHITECTURE

20MCC102

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Outcomes:

After completion of the course, the students will be able to:

1. Acquaint with the operations and utilities of Boolean algebra and K Maps
2. Evaluate the work implementation of digital components, sequential and combinational circuits.
3. Learn the basic computer organization and its design.
4. Understand the components of CPU and their functionality.
5. Appreciate the input–output and memory organization.
6. Analyze Parallel processing concepts and its applicability.

UNIT -I

Digital Logic Circuits and Components: Data types and Number systems, Logic Gates, Boolean algebra, 3 and 4 Variable K Maps, Half Adder and Full Adder, SR flip flop and D flip flop, Integrated Circuits, Decoder, Multiplexers, Registers, Shift Registers

UNIT -II

Register Transfer and Micro Operations: Register Transfer language, Register transfer, Bus and Memory Transfer, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations and Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, CPU Registers, Computer Instructions, Timing and Control, Instruction Cycles, Memory Reference Instructions, Input, Output and Interrupts

UNIT -III

Central Processing Unit: Micro programmed Control, Control Memory, Address Sequencing, Design of Control Unit. General Register Organization, Stack Organization, Instruction Formats, Nine Addressing Modes, Data Transfer and Manipulation, Program Control.

UNIT -IV

Input–Output and Memory Organization: Peripheral Devices, I/O output interface, Asynchronous data transfer, Modes of transfer, Priority Interrupts, DMA controller and DMA process, Input output Processor, Serial Communication. Usefulness of Cache Memory, 3 types of Cache Memory mapping procedures

UNIT -V

Parallel Processing: Introduction to Parallel Processing, Shared Memory Multiprocessing, Abstract model of Parallel Computer, Parallel Processing Mechanism, Multi Programming and Time Sharing, Pipeline Computers, Serial V/s Parallel Processing, Parallelism V/s Pipelining.

Text Books:

1. M. Morris Mano, "Computer System Architecture", Pearson Asia/Prentice Hall, 3rd edn.2007.
2. M.Sasi Kumar, Dinesh Shikhare, P. Ravi Prakash,"Introduction to Parallel Processing", Published by PHI- 2nd Edition 2014.

Suggested Reading:

1. William Stallings, "Computer Organization & Architecture", Pearson Education, Sixth Edition, 2003.
2. Kai Hwang and Faye A.Briggs, "Computer Architecture and Parallel Processing" International Edition, 1984.

SOFTWARE ENGINEERING

20MCC103

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Outcomes:

After completion of the course, the students will be able to:

1. Understand the basics of software engineering principles and importance of software requirement's specification.
2. Acquire the knowledge and requirement of software development models.
3. Identify the importance of software design and architecture principles and models.
4. Acquaint with the software testing approaches and levels of testing
5. Learn the concepts of risk management, software reengineering, reverse engineering and software maintenance activities.

UNIT-I

Introduction to Software Engineering: Software Engineering Challenges, Software Engineering approach, Software Process, Waterfall, Iterative, Prototype, Incremental, Spiral Model, V model.

UNIT- II

Requirements specification, SRS Structure, Problem analysis, IEEE format of SRS, Function Oriented Design: Design Principles, Module-level concepts, Design notations and specifications, coupling and cohesion concepts

UNIT-III

Structured design methodology, Software Architecture: Role of Software Architecture, Architecture views, Component and Connector view. Risk Engineering - Risk Analysis and Management. RMMI Techniques.

UNIT-IV

Effort Estimations, Schedule Estimation, Software cost Estimation, COCOMO, Function Point Analysis. White box and black box testing approaches, unit testing, integration testing, system testing, acceptance testing.

UNIT-V

Software Maintenance, Maintenance activities, Software Reengineering, Reverse Engineering, Forward Engineering, Software configuration management.

Text Books:

1. Pankaj Jalote,"An Integrated Approach to Software Engineering", 3rd Edition, Narosa PublishingHouse, 2010.
2. Roger S, Pressman's,"Software Engineering: A Practitioner's Approach", 6th Edition, Tata Mc GrHill, 2010.

HEAD OF DEPARTMENT
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

MATHEMATICAL FOUNDATIONS FOR COMPUTER APPICATIONS

20MCC104

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Outcomes:

After completion of the course the students will be able to:

1. Understand the required propositional logic to test the logic of a program.
2. Examine various properties of Relations and Functions.
3. Identify the basics of Linear Algebra in the form of Matrices and Vectors.
4. Synthesize the importance of minimization and Least Squares in data analysis and fitting.
5. Expose the principle of Inclusion and Exclusion as a basis for various Permutations and Combinations.
6. Evaluate the procedural knowledge on Graphs and Trees to derive applications in Computer Science.

UNIT – I

Fundamentals of Logic: Basic Connectives and Truth Tables, Logical Equivalence, Logical Implication, Use of Quantifiers, Definitions and the Proof of Theorems. **Boolean algebra**: Switching Functions, Logic gates, Don't Care Condition **Set Theory**: Sets and Subsets, Set operations and the Laws of Set theory Counting and Venn Diagrams.

UNIT – II

Functions: Cartesian product, Functions, Onto Functions, Special Functions, Pigeonhole Principle, Composition and Inverse Functions, Computational Complexity. **Relations**: Partial Order Relations, Lattices, Equivalence Relations and Partitions.

UNIT – III

Linear Algebra: Linear Algebraic Systems- Matrices and Vectors, Matrix Inverses, Transposes and Symmetric Matrices, Practical Linear Algebra – Tridiagonal Matrices and Pivoting strategies, Vector Spaces- Real Vector Spaces and Sub spaces, Norms. **Minimization and Least Squares:** Minimization Problems, Minimization of Quadratic Functions, The Closest Point and Least Squares, Data Fitting and Interpolation, Eigen values and Eigen Vectors, Introduction to Gradient Descendent Algorithm.

UNIT – IV

Principles of Inclusion and Exclusion: Introduction, Generalization of principle, Derangements, Rooks Polynomial, Arrangements with Forbidden Positions.

UNIT – V

Graph Theory: Definitions and examples, Sub graphs, Complements and graph isomorphism, Vertex degree, Planar graphs: Hamiltonian paths and Cycles, Graph coloring. **Trees**: Definitions, Properties and examples, Rooted Trees, Spanning Trees and Minimum Spanning Trees.

Text Books:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, 4th Edition,2003.
2. Peter J. Olver, ChehrzadShakiban, "Applied Linear Algebra", Springer International Publishing, 2nd Edition, 2018.

Suggested Reading:

1. Kenneth H Rosen, "Discrete Mathematics and its Applications" Tata McGraw Hill, 6th Edition, 2007.
2. J.P Tremblay & R. Manohar, "Discrete Mathematical Structures with Applications to computer science" McGraw Hill. 1987.
3. Joe L. Mott, A.kandal& T.P. Baker, "Discrete Mathematics for Compute Scientists & Mathematicians", Prentice Hall N.J., 1986
4. Kevin Ferland, "Discrete Mathematics", Houghton Mifflin Company, 2009.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

PROBABILITY AND STATISTICS

20MTC27

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Outcomes:

On successful completion of this course the students shall be able to

1. Calculate the measures of skewness.
2. Apply probability on continuous and discrete random variables.
3. Use the basic probability for fitting the Random phenomenon.
4. Apply various tests for testing the significance of sample data.
5. Use the principle of Least Squares approximation for estimation of the data.

UNIT-I

Basic statistics: Measures of Central Tendency: Mean, Median, Mode. Measures of Dispersion: Quartile deviation, Standard deviation, Coefficient of dispersion, Coefficient of variation. Skewness: Karl Pearson's Coefficient of skewness, Bowley's Coefficient of Skewness and Kurtosis. Moments about a point and Moments about the Mean.

UNIT-II

Probability and Mathematical Expectation: Probability, Addition Theorem of probability, Conditional Probability, Multiplication theorem of probability, Bayes Theorem, Random variable, discrete random variable, continuous random variable, Properties of probability mass function and probability density function. Mathematical expectation, properties of expectation, properties of variance and covariance.

UNIT-III:

Probability Distributions: Discrete probability distribution: Poisson distribution, Mean, Variance, MGF, CGF, fitting of Poisson distribution. Continuous probability distributions: Normal distribution, Standard Normal random variable Expectation, Variance, MGF (with out proof), CGF, Properties of Normal Curve and Areas under Normal curve. Exponential distribution, Expectation, Variance, MGF, CGF.

UNIT-IV:

Testing of Hypotheses: Test of significance, null and alternative hypotheses, Errors in sampling, level of significance. Large sample test: Test of significance for single proportion, difference of proportions, single mean and difference of means. t-Test for single mean, differences of Means. F- test for equality of two population variances. Chi-Square test of Goodness of fit.

UNIT-V:

Regression and Curve Fitting: Correlation: karl pearson's coefficient of correlation. Linear Regression: Lines of regression, properties of regression coefficients. Curvilinear regression: Fitting of Parabola, fitting of a power curve $y = ax^b$, Fitting of Exponential curve $y = ae^{bx}$ and $y = ab^x$.

Text books:

1. S.C .Gupta, V.K. Kappoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
2. Sheldon Ross, "A First Course in Probability", 9th Edition, Pearson publications, 2014.

Suggested Reading:

1. Walpole, H. Myers, L. Myers, Ye, "Probability and statistics for engineers & Scintists" 9th Edition, Pearson Publications, 2016.
2. S.C. Gupta, "Fundamentals of Statistics", Himalaya publishing, 7th Edition ,2014.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

COMPUTER PROGRAMMING LAB USING 'C'

20MCC105

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Course Outcomes:

After completion of the course, the students will be able to:

1. Use various data types, operators and control structures in the programs.
2. Apply the built-in functions and customized functions for solving the programs.
3. Develop the programs using one-dimensional and two-dimensional array concepts.
4. Build the programs using pointer concepts.
5. Construct the Programs using strings and structures concepts.
6. Solve the problems using dynamic memory allocation and file management concepts.

List of Programs

1. Calculate the area of a circle, rectangle, square and triangle.
2. Find the biggest of three different numbers by using nested if -else statement.
3. Find the Roots of a Quadratic Equation $ax^2+bx+c=0$, where $a>0$.
4. Find the grade of student using marks of the subjects using if-else if statement.
5. Takes two numeric values and one operator form the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement).
6. Find the max, min and sum of given set of numbers.(Note: Don't use array concept)
7. Find the sum of individual digits of a positive integer.
8. Find the factorial of a given positive number.
9. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 1 and 1, Subsequent terms are found by adding the preceding two terms in the sequence. Generate the first n terms of the Fibonacci sequence. Where n value given by the user.
10. Generate all the prime numbers between n and m, where n and m values are given by the user.
11. Find the reverse of the given positive integer and check whether the reverse number is palindrome or not.
12. Find the value of sin(x) using series expansion. (Note: $\sin(x) = x - x^3/3! + x^5/5! -$ where x is in radians)
13. Find the value of cos(x) using series expansion. (Note: $\cos(x) = 1 - x^2/2! + x^4/4! - \ldots$where x is in radians.)
14. Find the factorial of a given positive integer using non-recursive and recursive functions.
15. Find the GCD (greatest common divisor) of two given positive integers using non-recursive and recursive functions.
16. Display array elements from last index to first index and find out sum of the even elements and sum of the odd elements of the array.
17. Search whether the given element is present in the list or not using linear search technique.
18. Search whether the given element is present in the list or not using binary search technique.
19. Arrange the given set of elements in ascending order using bubble sort technique.
20. Add two matrices and store the result in another matrix.
21. Multiply two matrices and store the result in another matrix.
22. Transpose the given Matrix.
23. Display the array elements from last index to first index and find out the even elements sum and odd elements sum of the array.
24. Implement call by reference mechanism by swapping of two integers using pointers.
25. Find the number of characters, words and sentences in the given string.
26. Copy the contents of one string into another string using pointers.
27. Concatenate two strings without using strcat built-in function.
28. Develop functions to perform the following operations on structure complex.
    i) Read a complex number.
    ii) Display a complex number.
    iii) Add two complex numbers.
29. Develop functions to perform the following operations on structure com
    i) Read a complex number.

HEAD OF DEPARTMENT
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

ii) Display a complex number.
iii) Multiply two complex numbers.

30. Allocate memory at runtime to store five student records and also display those students' records.
31. Find out number of characters, words and sentences in the given text file.
32. Copy the contents of one text file into another text file.
33. Read records sequentially from the file.
34. Read records randomly from the file based on user choice.

Suggested Reading:

1. E Balaguruswamy, "Programming in ANSI C", 5th Edition, Tata McGraw-Hill, 2007.
2. K R Venugopal & S R Prasad, "Mastering C", McGrawHill, 2007.
3. Yashwant Kanetkar, "Let us C", 13th Edition, BPB Publications, 2013.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

PYTHON PROGRAMMING LAB

20MCC106

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Course Outcomes:

After completion of the course, student will be able to:

1. Understand basic types of Python Programming.
2. Demonstrate the conditional and loop statements in Python Programming.
3. Experiment with functions and recursive functions.
4. Elaborate various operations on Strings, Lists, Tuples, Dictionaries.
5. Understand and experiment with libraries like Numpy, Pandas, matplotlib.
6. Demonstrating the Data Pre-Processing techniques.

List of Programs:

1. Demonstrate Python Datatypes, Variables.
2. Demonstrate the use of if and if-else statements.
3. Demonstrate the use of for and while loop statements.
4. Print the prime numbers up to 'n'.
5. Find sum of n natural numbers using recursion function.
6. Demonstrate Strings in Python.
7. Perform operations on Lists.
8. Perform operations on Tuples.
9. Perform operations on Dictionaries.
10. Find the factorial of a given number using functions.
11. Find the GCDof giventwo numbers using functions.
12. Find the factorial of giventwo numbers using recursive functions.
13. Find the GCDof given two numbers using recursive functions.
14. Display Fibonacci series using recursion and non-recursion functions with modules.
15. Create, access, rename and delete files.
16. Demonstrate Packages, Libraries of Python (Numpy, Pandas, Statistics, matplotlib etc)
17. Demonstrate application on feature scaling using MinMaxScaler with pandas.
18. Demonstrate application on feature scaling using StandardScaler with pandas.
19. Demonstrate application on feature scaling using Binarizer with pandas.
20. Demonstrate application on feature scaling using Normalizer with pandas.

Suggested Reading:

1. ReemaThareja,"Python Programming", Oxford Press, 2017.
2. Jake VanderPlas, "Python Data Science Handbook", O'Really Publications, 2017.
3. Dr. Charles R. Severance, "Python for Everybody-Exploring Data in Python 3".

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

PROFESSIONAL COMMUNICATION LAB

20EG101

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Course Outcomes:
After successful completion of the course the students will be able to:

1. Define the speech sounds in English and understand the nuances of pronunciation in English
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Differentiate various soft skills and illustrate proper email and mobile etiquette.
4. Determine the context, work in teams, discuss and participate in Group discussions and demonstrate effective presentation skills.
5. Design a resume and prepare and face interviews with confidence.

Exercises:

1. Introduction to English Phonetics: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. Sound system of English: Phonetic sounds and phonemic sounds, introduction to international phonetic alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters
3. Word stress: Primary stress, secondary stress, functional stress, rules of word stress.
4. Listening skills – practice with IELTS and TOEFL material
5. Soft Skills: Introduction, Hard Skills vs Soft Skills; Public Speaking, Leadership skills and Team Building; Business Etiquette - Email & Mobile Etiquette.
6. Group Discussions – dynamics of group, intervention, summarizing, modulation of voice and body language.
7. Presentation Skills –Elements of effective presentation – Structure of presentation – Presentation tools
   – Body language. Creating an effective PPT
8. Interview Skills – Resume Writing, Elements of an Effective Resume. Concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews.

Suggested Reading:

1. E.Suresh kumar et al.,“English for Success(with CD)”, Cambridge University Press India Pvt Ltd. 2010.
2. T Balasubramanian,. “A Textbook of English Phonetics for Indian Students”, Macmillan, 2008.
3. Edgar Thorpe,“Winning at Interviews”, Pearson Education, 2006.
4. Priyadarshi Patnaik,“Group Discussions and Interviews”, Cambridge University Press Pvt Ltd 2011.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

DATA STRUCTURES AND ALGORITHMS

20MCC107

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Outcomes:

After completion of the course, students would be able to:

1. Understand the basic concepts of C++.
2. Build classes with functions, constructors and apply OOPS concepts wherever required.
3. Make use of various linear data structures and their implementation according to situations.
4. Apply and Distinguish different sorting techniques and their implementation in real world environment.
5. Implement different collision resolution techniques on hashing.
6. Make use of various non-linear data structures and their implementation according to situations

UNIT- I

C++ Introduction: Overview, Program Structure, namespace, identifiers, variables, constants, data types, enum, operators, Overloading of functions, default arguments, inline functions, dynamic memory allocation and De allocation (new and delete).**C++ Class Overview:** Class Definition, Objects, Class Members, Access Control, Class Scope, Constructors and destructors.

UNIT- II

OOPS Concepts: Inheritance basics, base and derived classes, Inheritance types, base class access control, Friend Functions, Templates, Function and class templates , Polymorphism, Runtime Polymorphism using virtual functions, Operator overloading. **Analysis Of Algorithms** :Algorithm Specification, Time and Space Complexities, Performance Analysis, Asymptotic notations, Algorithm design techniques: Brief Introduction to Divide and Conquer method, Back Tracking method.

UNIT- III

Sparse Matrix: Representation and its efficiency in storage. **Stacks**: Definition and Operations and Applications, Array and Linked Representation of Stacks. **Queues:** Definition and Operations. Array and Linked Representation of Queues and their Applications. **Linked Lists**: Definition and Operations, Double linked list representation, Circular linked lists.

UNIT- IV

Sorting: Bubble sort, Merge Sort, Selection Sort, heap sort, Quick sort, Insertion sort , Posterior Analysis, Sequential Search, binary search. **Hashing:** Hash table, its implementation, Hash table representation, types of hashing, collision resolution techniques.

UNIT- V

Trees: Definitions and Properties, Representation of Binary Trees, Operations. Binary Tree Traversal, Binary search trees, operations- insertion, deletion and searching, heap trees. AVL Tress and Operations on AVL Trees.B-Trees and its operations. **Graphs**: Definition and representation of graphs, data structures for representing graphs- edge list structures, adjacency list structures, adjacency matrix, Graph traversals – BFS and DFS. Spanning trees, minimum spanning trees, prim's and kruskal's algorithms.

Text Books:

1. E. Balaguruswamy "Object Oriented Programming with C++", Tata McGraw Hill,4^{th} Edition, 2008.
2. S.Sahani, "Data Structures, Algorithms and Applications in C++",Universities Press. 2^{nd}Edition, 2006.
3. Ellis Horowitz, Sartaj Shani, SanguthevarRajasekaran, "Fundamentals of Computer Algorithms", 2^{nd} Edition, University Press, 2007.

Suggested Reading:

1. Langsam, Augenstein and Tanenbaum, "Data structures using C and C++", PHI, 2^{nd} Edition, 2002.
2. Michael T.Goodrich, R.Tamassia and D.Mount, "Data structures and Algorithms in C++", Wiley Student Edition, Seventh Edition, John Wiley and Sons, 2011.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 3^{rd}Edition, Pearson Education. Ltd., 2007.

ARTIFICIAL INTELLIGENCE

20MCC108

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Outcomes:

1. After completion of the course, students will be able to:
2. Differentiate between elementary Problem and AI problem.
3. Determine and evaluate the various search strategies.
4. Compare and contrast the various knowledge representation schemes in AI.
5. Understand and analyze the various reasoning techniques involved in solving AI problems.
6. Understand the different learning techniques.

UNIT I

Intelligent Agents: Intelligent agents, structure of agents Introduction & Problem Solving: AI problems, AI Technique, Defining problem as a State-Space Search, Production Systems, Problem Characteristics. Heuristic Search Techniques: Generate–and–test, Hill Climbing, Best–First Search, Problem Reduction, Constraint Satisfaction.

UNIT II

Game Playing: Overview, Min-Max search Procedure, Adding Alpha-beta Cutoffs, Additional Refinements, Iterative Deepening. Using Predicate Logic: Representing simple facts in logic, Representing Instance and ISA Relationships, Computable Functions, propositional calculus and predicates, Resolution.

UNIT III

Uncertainty and Reasoning Techniques: Non monotonic reasoning, Logics for Non monotonic reasoning, Implementation issues. Statistical reasoning: Probability and Bayes theorem, Certainty factors and Rule based systems, Bayesian Networks, Dempster-Shafer Theory.

UNIT IV

Learning: Introduction, Rote learning, Learning by taking advice, learning in problem solving, learning from examples: Induction. Expert System: Representing and Using Domain Knowledge, Expert systems shells, Explanation, Knowledge Acquisition.

UNIT V

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Statistical NLP, Spell Checking. PROLOG-The Natural Language of AI: Prolog facts and rules, variables, control structures, arithmetic operators, matching in Prolog, backtracking.

Text Books:

1. Elaine Rich, Kevin Night, Shivashankar B Nair, “Artificial Intelligence”,3rd Edition.,2008
2. Russell Norvig, “Artificial Intelligence-Modern Approach”, 3rdEdition, 2009.

Suggested Reading:

1. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2012.
2. Nelson M. Mattos, “An Approach to Knowledge Base Management”, Springer Berlin Heidelberg, 1991.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

OBJECT ORIENTED PROGRAMMING USING JAVA

20MCC109

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Outcomes:
After completion of the course, the students will be able to:
1. Gain the conceptual and practical knowledge on basic Object-Oriented Programming concepts.
2. Implement complex Object-Oriented Programs using distinct OOP principles.
3. Acquire the knowledge on Scheduling of real-time application clients using Thread models as well as Exception Handling mechanisms.
4. Evaluate the usage of Mutable and Immutable Strings in different systems development. Also inculcate basic Stream Programming
5. Identify the importance of Collections framework to develop complex applications with advanced Data Structures.
6. Design and practice the GUI Components and to habituate the Event driven programming.

UNIT -I
Object Oriented Programming: History of java, and evolution of java, java Buzzwords, Object Oriented Programming, Data types, Variables and Arrays, Operators, Control Statements.

UNIT -II
Introduction to Classes: Classes, Methods, Constructors, This keyword, finalize method, Garbage Collection, Overloading, Recursion, nested classes. **Inheritance**: Inheritance and its types, super, Overriding, Abstract Classes, Using final. **Packages and Interfaces**: packages, Access protection, importing packages, Implementing Interfaces.

UNIT -III
Exceptional Handling: Exception–handling fundamentals, Exception types, Using try and Catch, throw, throws and finally clauses. **Multithreaded Programming:** Java Thread Model, Creating Threads, Interrupting threads, Thread Priorities, Synchronizing Threads, Inter-thread Communication.

UNIT – IV
String Handling: String class, String buffer class, String length, Special String operations, string comparison, Enumerations, Primitive type wrappers and Autoboxing, Overview of Annotations. **Java I/0:**Classes and Interfaces, File class, Stream and Byte Classes, Reading and Writing Files.

UNIT –V
The Collections Framework: Introduction and overview of Collections framework, The Collection interfaces, Collection classes – Array List, Hash Set and Tree Set, Working with Maps using an Iterator, Comparators. **Applets and Event Driven Programming:** Introduction to Applets, Applet Life cycle methods, Passing Parameters to Applets, Event Handling, Delegation Event model, Event classes, Event Listener Interfaces. **AWT Controls, Layout Managers and Menus:** AWT classes, AWT control fundamentals, Window fundamentals**,** Understanding of Layout managers.

Text Books:
1. Herbert Scheldt, "Java, The Complete Reference" McGraw Hill Education, JavaTM 9th Edition, 2014.
2. Richard A. Johnson, "Java Programming and Object-Oriented Application Development" Cengage Learning, India Edition, 2009.

Suggested Readings:
1. John Dean and Raymond "Introduction Programming with Java A problem solving approach", McGr. Hill, 2008.
2. Joe Wigglesworth and Paula McMillan, "Java Programming: Advanced Topics" Cengage Learning. 3rd Edition, 2009.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

DATABASE MANAGEMENT SYSTEM

20MCC110

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	4

Course Outcomes:

After the completion of the course, students will be able to:

1. Acquire the knowledge of basic concepts of the database.
2. Exposure to different Data Models.
3. Map the ER Models into relations and normalize the relations.
4. Acquire the knowledge of query evaluation.
5. Gain the knowledge of concurrent execution and transaction management.
6. Understand the issues in system crash and recovery measures.

UNIT-I

Introduction to DBMS and DB Models: File system Vs. DBMS, Advantages of DBMS, Data Abstraction, Database Design, and ER diagrams, Entities, Attributes and Entity Sets, Relationship Sets, Additional features of ER model, Conceptual Design with the ER model. The Relational Model: Introduction to the Relational Model, Integrity Constraints over relations, Logical Database design(ER to Relational), creating tables, views, Destroying / Altering Tables and Views.

UNIT-II

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Normal Forms, Decompositions, Normalizations. **Structured Query Language**: Overviews, Basic Structure of SQL, Queries, Set Operations, Null Values, Additional Basic Operations, Aggregate Functions, Nested Sub queries, Join Expression .**Advanced SQL**: SQL Data Types, Integrity Constraints, Authorization, Functions and Procedural Constructs, Cursors, Triggers.

UNIT-III

Indexing and Hashing: Basic Concepts, File Organization Indexing, Index Data Structures, Tree-Structured indexing: Indexed sequential Access Method (ISAM) B+ Trees: A dynamic index structure, format of a node, search, Insert, Delete, Duplicates Trees in Practice. **Hash-Based Indexing**: Static Hashing, Extendable Hashing, Linear Hashing, Extendable Hashing versus Linear Hashing. Comparison of Ordered Indexing and Hashing.

UNIT-IV

Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control. **Concurrency Control**: 2PL, Serializability, Recoverability, Introduction to Lock Management, Dealing with Deadlock, Specialized Locking Techniques, Concurrency Control without Locking.

UNIT-V

Crash Recovery: Introduction to ARIES, The Log, Other Recovery Related Structures, The WAL, Check pointing, recovering from a system Crash, Media recovery. Security and Authorization: Introduction to database security, Access Control Discretionary Access control, Mandatory access control. Additional Issues related to Security.

Text Books:

1. Silberschataz, Korth, Sudarshan “Database System Concepts”, 5th Edition, McGraw Hill, 2011.

Suggested Reading:

1. Raghu Ramakrishna, Johannes, Gehrke, “Database Management Systems”, 3rd Edition, McGraw Hill, 2003.
2. RamezElmasri, Shamkant B. Navathe, Somayajulu, Gupta “Fundamentals of Database systems”, Pearson Education 2006.

ENTREPRENUERSHIP
(ELECTIVE-I)

20MCE102

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Outcomes:
After completion of the course, students will be able to:
1. Apply the entrepreneurial process.
2. Analyze the feasibility of a new business venture and preparation of Business plan.
3. Ability to evaluate entrepreneurial tendency and attitude.
4. Brainstorm ideas for new and innovative products or services.
5. Use a variety of feasibility studies, assess and select prospective new venture concepts.
6. Describe how to investigate financing alternatives for specific new venture concepts.

UNIT I:
Entrepreneur: Introduction, The Entrepreneur: Definition and Concept. Entrepreneurial Traits, Characteristics and Skills, Classification of Entrepreneurs, Entrepreneur vs Professional Managers, Women Entrepreneurs, Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, The Entrepreneurial Culture.

UNIT II:
Entrepreneurship: The Concept of Entrepreneurship, Theories of Entrepreneurship, Entrepreneurship Environment, Entrepreneurship Development, Entrepreneurship Training, Institutions in Aid of Entrepreneurship Development, Project: Concept and Classification Search for a Business Idea, Project Identification, Project Formulation, Project Design and Network Analysis, Project Report, Project Appraisal, Factory Design and Layout.

UNIT III:
Financial Analysis: Financial Analysis-An Input in Financial Appraisal, Ratio Analysis, Investment Process, Break-even Analysis, Profitability Analysis, Social Cost-Benefit Analysis, budget and planning **:** Budgetary Control, Planning Process, Applicability of Factories Acts.

UNIT IV:
Sources Of Finance: Sources of Development Finance, Project Financing, Institutional Finance to Entrepreneurs, Financial Institutions, Role of Consultancy Organizations, Quality standards: Standardization, Quality Control, marketing : Methods of Marketing, Marketing Channels, Marketing Institutions and Assistance, E-Commerce, Exploring Export Possibilities.

UNIT V:
Setting Up A Small Enterprise: Location of an Enterprise, Steps for Starting a Small Enterprise , Selection of Types of Ownership Organization , Incentives and Subsidies, Problems of Entrepreneurship , Sickness in Small-Scale Industries, Reasons and Remedies . Project work: Project Work and Successful Entrepreneurs.

Textbooks:

1. Vasanth Desai "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House.
2. Prasanna Chandra "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mc Graw-Hill Publishing Company Ltd., 1995.

Suggested Reading:

1. Stephen R. Covey and A. Roger Merrill "First Things First", Simon and Schuster Publication, 1994.
2. G.S. Sudha "Organizational Behaviuor", 1996.
3. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", Tata Me Gr Hill Publishing Company Ltd., 5th Edition, 2005
4. Robert D. Hisrich, Michael P. Peters, "Entrepreneurship", Tata Me Gr Hill Publishing Company Ltd., 5th Edition, 2005

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

BUSINESS INTELLIGENCE AND ANALYTICS
(ELECTIVE-I)

20MCE103

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	60 Marks
Continuous Internal Evaluation	40 Marks
Credits	3

Course Outcomes:
After completion of the course, the students will be able to:
1. Get clear idea about the basic concepts on Business Analytics in an organization.
2. Demonstrate detailed knowledge about the role of Business Analysts in decision making.
3. Distinguish between Descriptive, Predictive and Prescriptive Analytics.
4. Gain knowledge on Data Warehousing and Data Mining concepts.
5. Understand the usefulness of Business analytics in various functional areas of an organization.
6. Identify the key features of Big data and its implications.

UNIT- I:
Introduction: Introduction to Analytics, Data Science, Big data. Business analytics-challenges from outside and within, BASP (Business analytics success pillars) framework, Applications of Analytics to different domains, Data, Information, and Knowledge, Analyst's Role in the BA Model – Three Requirements the Analyst Must Meet , Required Competencies for the Analyst , Hypothesis-Driven Methods, Data Mining with Target Variables , Explorative Methods.

UNIT- II:
Descriptive Analytics: Descriptive analytics-Data warehousing-concepts, characteristics, Data marts, Meta data and process of data warehousing, Business Reporting, Visual Analytics and Business performance measurement, Why a Data Warehouse, Architecture and Processes in a Data Warehouse, Tips and Techniques in Data Warehousing.

UNIT- III:
Predictive Analytics: Introduction, Data mining concepts and Applications, Data mining process, methods, classification techniques. Text mining-introduction, text analytics and sentiment analytics. Web mining- introduction, Web analytics and social analytics.

UNIT- IV:
Prescriptive Analytics: Introduction- categories of models- optimization, simulation, heuristics, predictive models, other models. Automated decision systems and Expert systems, Knowledge Management and collaborative systems.

UNIT-V:
Big Data: Introduction, Defining Big Data, Big Data Landscape, Business Implications of Big Data, Technology Implications of Big Data, Big Data Technologies, Management of Big Data.

Text Books:
1. Ramesh Sharada, DursunDelen, Efraim Turban,"Business intelligence and analytics" Pearson.
2. Jean paulisson,jesse s.harriot,"Win with advanced Business analytics" Wiley and SAS.

Suggested Readings:
1. Gert H.N. Laursen, JesperThorlund "Business Analytics for Managers" JohnWiley& Sons, Inc., 2010.
2. The GIS Book: George B. Karte.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

DATA STRUCTURES LAB USING C++

20MCC111

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Course Outcomes:

After completion of the course, students will be able to:

1. Build classes with member functions, constructors and destructors.
2. Analyze the different kinds of inheritance types and its functionalities.
3. Make use of various linear data structures concepts in real world environment.
4. Apply and distinguish different sorting techniques and their requirement according to the situations.
5. Implement different collision resolution techniques on hashing.
6. Distinguish the DFS and BFS of graph traversals and their implementations.

List of C++Programs:

1. Overloading of Functions, Default Arguments.
2. Dynamic Memory allocation and De allocation.
3. Illustrate the concept of Class with member functions, Constructors and destructors
4. Illustrate the concept of Inheritance.
5. Implement Stack using Arrays and Linked Lists
6. Write a C++ programs for implementing Queues using Arrays and Linked Lists
7. Implement Linked Lists using Single, double and Ciruclar Linked Lists
8. Implement Binary Search Trees.
9. Implement Hashing.
10. Implement Quick Sort.
11. Implement Insertion Sort.
12. 12 Implement Selection Sort.
13. Implement Merge Sort.
14. Implement Graph Traversals DFS and BFS.

Suggested Reading:

1. Herbert Schildt, “Complete reference to C++”, 4th Edition, 2003.
2. E. Balaguruswamy, “Object Oriented Programming with C++”, Tata McGraw Hill, 4th Edition, 2008.
3. V.V.Muniswamy, “Advanced Data structures & Algorithms in C++”,Jaico Publishing House.
4. A.M. Berman, “Data structures via C++”, Oxford University Press.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

OBJECT ORIENTED PROGRAMMING LAB UISNG JAVA

20MCC112

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Course Outcomes:

After completion of the course, students will be able to:

1. Understand and model various mathematical computation programs using OOP concepts.
2. Conclude the restrictions on class members using package level access protection.
3. Implement the forecasting of multiple clients task execution using Multithreading and exception handling concepts.
4. Analyze the input as well as output data for String and Stream programming.
5. Determine the usage of Collections framework with the help of its interfaces and classes.
6. Apply Event handling using distinct Layout managers.

List of Java Programs

1. Demonstrate the usage of Operators, Control Structures, Arrays etc.
2. Create classes, objects
3. Demonstrate the usage of constructors
4. Implement Method overloading
5. Implement Method overriding, dynamic method dispatch
6. Demonstrate the concept of Inheritance
7. Implement Interfaces
8. Create and import Packages
9. Implement Exception handling
10. Create Multiple threads
11. Demonstrate String and String Buffer classes
12. Demonstrate Wrapper classes
13. Create I/O streams and files
14. Demonstrate Collections
15. Implement Applets
16. Implement AWT
17. Create Layout managers

Suggested Reading:

1. Herbert Schildt, "Java, The Complete Reference" McGraw Hill Education, JavaTM 9th Edition, 2014.
2. Richard A.Johnson, "Java Programming and Object-Oriented Application Development" Cengage Learning, India edition 2009.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

DATABASE MANAGEMENT SYSTEMS LAB

20MCC113

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	50 Marks
Credits	2

Course Outcomes:

After completion of the course, the student will be able to:

1. Implement SQL commands.
2. Declare and enforce integrity constraints on a database.
3. Implement the views with multiple options.
4. Develop PL/SQL programs using stored procedures, functions, cursorsand packages.
5. Create user access and authorization controls.
6. Design and build a Forms and Reports.

List of Programs

I. SQL

1. Creating tables using commands in DDL
2. Manipulating the data using DML
3. Using Aggregate functions Set operators
4. Simple condition query creation using SQL Plus
5. Complex condition query creation using SQL Plus
6. Exercising all types of Joins, views
7. Exercising Data Control Language and Transaction Control Language

II. PL/SQL

8. Demonstration of Blocks, Cursors,
9. Procedures, Functions and Packages.
10. Creation of Triggers

III. FORMS

11. Designing forms for various databases. (Creating, Inserting, Updating, Deleting)

IV. REPORTS

12. Generation using SQL Reports
13. Creation of Reports based on different queries.

Note:-The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

Suggested Reading:

1. Nilesh Shah "Database Systems Using Oracle", PHI, 2007.
2. Rick F Van der Lans "Introduction to SQL", 4th Edition, Pearson Education, 2007.
3. Benjamin Rosenzweig, Elena Silvestrova "Oracle PL/SQL by Example", 3rd Edition, Pearson Education, 2004.
4. Albert Lulushi, "Oracle Forms Developer's Handbook", Pearson Education, 2006.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MCC113 **DATABASE MANAGEMENT SYSTEM**

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives:

Students will:

1. Learn the basic fundamentals of database.
2. Understand the data models.
3. Make a study of SQL and relational database design.
4. Know about data storage techniques and query processing.
5. Impart knowledge in transaction processing, concurrency control techniques.
6. Study the concepts of system crash and recovery management.

Course Outcomes:

After completion of the course the students would be able to:

1. Acquire the knowledge of the basic concepts of the database.
2. Create the data models.
3. Map ER models into Relations and normalize the relations
4. Acquire the knowledge of query evaluation.
5. Gain the knowledge of concurrent execution and transaction management.
6. Understand the issues in system crash and recovery measures.

UNIT-I

Introduction to DBMS and DB Models: File system Vs. DBMS, Advantages of DBMS, Data Abstraction, Database Design, and ER diagrams, Entities, Attributes and Entity Sets, Relationship Sets, Additional features of ER model, Conceptual Design with the ER model. The Relational Model: Introduction to the Relational Model, Integrity Constraints over relations, Logical Database design(ER to Relational), creating tables, views, Destroying / Altering Tables and Views.

UNIT-II

Schema Refinement and Normal Forms: Introduction to Schema Refinement, Functional Dependencies, Normal Forms, Decompositions, Normalizations. **Structured Query Language**: Overviews, Basic Structure of SQL, Queries, Set Operations, Null Values, Additional Basic Operations, Aggregate Functions, Nested Sub queries, Join Expression. **Advanced SQL**: SQL Data Types, Integrity Constraints, Authorization, Functions and Procedural Constructs, Cursors, Triggers.

UNIT-III

Indexing and Hashing: Basic Concepts, File Organization Indexing, Index Data Structures, Tree-Structured indexing: Indexed sequential Access Method (ISAM) B+ Trees: A dynamic index structure, format of a node, search, Insert, Delete, Duplicates+ Trees in Practice.

Hash-Based Indexing: Static Hashing, Extendable Hashing, Linear Hashing, Extendable Hashing versus Linear Hashing. Comparison of Ordered Indexing and Hashing.

UNIT-IV

Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control. **Concurrency Control**: 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlock, Specialized Locking Techniques, Concurrency Control without Locking.

UNIT-V

Crash Recovery: Introduction to ARIES, The Log, Other Recovery Related Structures, The WAL, Check pointing, recovering from a system Crash, Media recovery. Security and Authorization: Introduction to database security, Access Control Discretionary Access control, Mandatory access control. Additional Issues related to Security.

Text Books:

1. Silberschataz, Korth, Sudarshan “Database System Concepts”, 5^{th} Edition McGraw Hill 2011.

Suggested Reading:

1. Raghu Ramakrishna, Johannes, Gehrke “Database Management Systems”, 3^{rd} Edition, Mc-Graw Hill 2003
2. Ramez Elmasri, Shamkant B. Navathe, Somayajulu, Gupta “Fundamentals of Database systems”, Pearson Education 2006.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MCC114 **WEB TECHNOLOGIES**

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives:
Students will:
1. Acquire knowledge on XHTML and CSS.
2. Learn basics of JavaScript.
3. Know how to create interactive web pages.
4. Acquire knowledge on XML.
5. Learn basics of PHP and MYSQL databases.
6. Acquire knowledge on client side and server side programming.

Course Outcomes:
After completion of the course, the students would be able to:
1. Develop the web pages using XHTML and CSS.
2. Perform client side validations.
3. Create interactive web pages.
4. Store and transport data using XML.
5. Access MYSQL database using PHP.
6. Design and Develop simple websites.

UNIT – I
Introduction to XHTML: origins and evolution of HTML and XHTML, basic syntax, standard XHTML document structure, basic text markup, images, hypertext links, lists, tables, forms, frames, syntactic differences between HTML and XHTML.
Cascading Style Sheets (CSS): Introduction, levels of style sheets, style specification formats, selector forms, property value forms, font properties, list properties, color, alignment of text, box model, background images, positioning.

UNIT – II
Basics of JavaScript: overview of JavaScript, object orientation and JavaScript, general syntactic characteristics, primitives, operations, expressions, screen output and keyboard input, control statements, object creation and modification, arrays, functions, constructors, pattern matching using regular expressions, errors in scripts.

UNIT- III
JavaScript and XHTML Documents: JavaScript execution environment, document object model, element access in JavaScript, events and event handling, handling events from body elements, handling events from button elements, Handling events from text box and password elements.
Dynamic Documents with JavaScript: Introduction, positioning elements, moving elements, element visibility, changing colors and fonts, dynamic content, stacking elements, locating the mouse cursor, reacting to a mouse click, slow movement of elements, dragging and dropping elements.

UNIT – IV
Introduction to XML: Introduction, syntax of XML, XML document structure, document type definitions, namespaces, XML schemas, displaying raw XML documents, displaying XML documents with CSS, XSLT style sheets, XML processors.

UNIT – V
Introduction to PHP: origins and uses of PHP, overview of PHP, general syntactic characteristics, primitives, operations, expressions, output, control statements, arrays, functions, pattern matching, form handling, cookies, session tracking.
Database Access through the web: MYSQL database system, database access with PHP and MYSQL.

Text Book:

1. Robert W.Sebesta, "**Programming the World Wide Web**", 4^{th} Edition, Pearson Education, 2008.

Suggested Reading:

1. Thomas Powell "HTML & XHTML: The Complete Reference", 4^{th} Edition, Tata McGraw-Hill, 2003.
2. Thomas A Powell, Fritz Schneider "JavaScript: The Complete Reference", 3^{rd} edition, Tata McGraw Hill, 2013**.**
3. Steven Holzner "PHP: The Complete Reference", McGraw Hill Education, 2008**.**

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MCC115 DESIGN AND ANALYSIS OF ALGORITMS

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives:
Students will:
1. Learn the various asymptotic notations and amortized analysis.
2. Acquire knowledge on divide and conquer and Greedy designing techniques.
3. Learn the concepts of dynamic programming techniques.
4. Acquire knowledge on backtracking and branch and bound designing techniques.
5. Learn the concepts of NP-Hard and NP-completeness.
6. Learn important algorithmic design paradigms and methods of analysis.

Course Outcomes:
After completion of the course, the students would be able to:
1. Analyze the time and space complexities of algorithms.
2. Solve various problems using divide and conquer and greedy method.
3. Solve various problems using dynamic programming, backtracking and branch and bound techniques.
4. Identify the complexity classes such as P, NP, NP-Complete and NP-Hard to which an algorithm belongs and design a feasible solution.
5. Determine the amortized running time of the problem.

UNIT-I
Introduction: Algorithm Definition, Algorithm Specification, Performance Analysis.
Review of Elementary Data Structures: Stacks, Queues, Trees, Dictionaries, Priority Queues, Sets and Disjoint Set Union.

UNIT-II
Divide and Conquer: General Method, Finding the Maximum and Minimum, Merge Sort, Quick Sort, Stassen's Matrix Multiplication.
Greedy Method: General method**,** Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Optimal Storage on Tapes, Optimal Merge Patterns.

UNIT-III
Dynamic Programming: General Method, Multistage Graphs, All-Pairs Shortest Paths, Optimal Binary Search Trees, 0/1 Knapsack, Reliability Design, Traveling Salesmen Problem.
Basic Traversal and Search Techniques: Breadth First Search (DFS) and Traversal, Depth First Search (DFS) and Traversal, Connected Components and Spanning Trees, Bi-connected Components and DFS.

UNIT-IV
Backtracking: General Method, 8-Queen's Problem, Sum of Subsets, Graph Coloring, Hamiltonian Cycles, Knapsack Problem.
Branch and Bound: The Method, 0/1 Knapsack Problem, Traveling Salesperson Problem.

UNIT -V
NP-Hard and NP-Complete Problems: Basic Concepts, Cook's Theorem, NP-Hard Graph Problems and NP-Hard Scheduling Problems.

Text Book:
1. Ellis Horowitz, Sartaj Shani, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, University Press, 2007.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Suggested Reading:

1. R. Pannerselvam “Design and Analysis of Algorithms”, PHI, 2007.
2. Hari Mohan Pandey "Design and Analysis of Algorithms", University Science Press, 2009.
3. Aho, Hopcroft, Ullman “The Design and Analysis of Computer Algorithms”, Pearson Education, 2000.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein “Introduction to Algorithms”, 2^{nd}Edition, Prentice Hall of India Private Limited, 2006.
5. Anany Levitin “Introduction to the Design & Analysis of Algorithms”, Pearson Education, 2003.
6. Parag H.Dave, Himanshu B. Dave “Design and Analysis of Algorithms”, Pearson Education, 2^{nd} Edition, 2014.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MCC116 **OPERATING SYSTEMS**

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives:

Students will:

1. Aware of the evolution and fundamental principles of operating system, processes and their communication.
2. Aware of the process execution in terms of threads and they came to know about different thread libraries.
3. Aware of the various process synchronization tools and they came to know about dead lock and its issues.
4. Aware of the various operating system components like process management, memory management.
5. Know about file management and I/O subsystems concepts in operating systems.
6. Aware of components of operating system in LINUX with relevant case study.

Course Outcomes:

After completion of the course the students would be able to:

1. Get the knowledge of operating system components and its services.
2. Understand the basic process execution in terms of threads and they came to know about different thread libraries.
3. Learn the various process synchronization tools and they came to know about dead lock and its issues.
4. Distinguish the mapping between the physical memory and virtual memory.
5. Apply file handling concepts in OS perspective.
6. Acquire the knowledge of components and services of LINUX Operating System.

UNIT-I

Operating System Introduction: Operating Systems Objectives and functions, Computer System Architecture, OS Structure, OS Operations, Evolution of Operating Systems - Simple Batch, Multi programmed, time shared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, Special - Purpose Systems**.**

System structures: Operating System Services, System Calls, Types of System Calls, System Programs, Operating System Design and Implementation, Operating System Structure, Virtual Machines, Operating System debugging.

Process Concept: Process Concept, Process Scheduling, Operations on process, Inter process Communication.

Multithreaded Programming: Multithreading Models, Thread Libraries, Threading Issues.

UNIT–II

Process Scheduling: Scheduling Criteria, Scheduling Algorithms, Thread Scheduling, Multiple Processor Scheduling.

Process Synchronization: Critical Section Problem, Peterson's Solution, Semaphores, Classic Problems of Synchronization, Monitors.

Deadlocks: System Model, Deadlock Characterization, Methods in Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

UNIT- III

Memory Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the Page Table, Segmentation.

Virtual Memory Management: Demand Paging, Copy on Write, Page Replacement Algorithms, Allocation of Frames, Thrashing.

System Protection: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix.

UNIT- IV

File System: File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File Sharing, Protection.

Implementing File System: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery.

Secondary Storage Structure: Overview of Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap Space Management, RAID Structure.

UNIT- V

I/O Systems: I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Request to Hardware Operations, STREAMS.

Case Study: **The Linux System**: Linux History, Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output, Inter process Communication.

Text Book:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", 7th Edition, John Wiley and Sons, 2011.
2.

Suggested Reading:

1. Gary Nutt, "Operating Systems", 3rd Edition, Pearson Education, 2004.
2. Harvey M. Deital, "Operating Systems", 3rd Edition, Pearson Education, 2004.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MCC117 DATABASE MANAGEMENT SYSTEMS LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives:
Students will:
1. Present SQL and procedural interfaces to SQL comprehensively.
2. Give an introduction integrity constraints on a database using a state-of-the-art RDBMS
3. Understand the concepts of Views and their usability.
4. Impart the knowledge PL/ SQL including stored procedures, stored functions, cursors, packages
5. Understand the Data Control Language (DCL) privileges and roles.
6. Present the concepts of Forms and Reports

Course Outcomes:
After completion of the course, the students would be able to:
1. Populate and query a database using SQL DML/DDL commands.
2. Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS
3. Implement the views with multiple options.
4. Programming PL/SQL including stored procedures, stored functions, cursors, packages.
5. Access and control authorization.
6. Design and build a Forms and Reports

List of Programs:

I. SQL
1. Creating tables using commands in DDL
2. Manipulating the data using DML
3. Using Aggregate functions Set operators
4. Simple condition query creation using SQL Plus
5. Complex condition query creation using SQL Plus
6. Exercising all types of Joins, views
7. Exercising Data Control Language and Transaction Control Language

II. PL/SQL

8. Demonstration of Blocks, Cursors,
9. Procedures, Functions and Packages.
10. Creation of Triggers

III. FORMS

11. Designing forms for various databases.(Creating, Inserting, Updating, Deleting)

IV. REPORTS

12. Generation using SQL Reports
13. Creation of Reports based on different queries.

Note:-The creation of sample database for the purpose of the experiments is expected to be pre-decided by the instructor.

Suggested Reading:

1. Nilesh Shah "**Database Systems Using Oracle**", PHI, 2007.
2. Rick F Van der Lans "**Introduction to SQL**", 4th Edition, Pearson Education, 2007.
3. Benjamin Rosenzweig, Elena Silvestrova "**Oracle PL/SQL by Example**", 3rd Edition, Pearson Education, 2004.
4. Albert Lulushi "**Oracle Forms Developer's Handbook**", Pearson Education, 2006.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MCC118 **WEB TECHNOLOGIES LAB**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives:
Students will:
1. Practice various tags in XHTML and CSS.
2. Practice programs using JavaScript control statements, arrays, functions etc.
3. Practice programs using events on the XHTML elements.
4. Practice programs using XML.
5. Practice programs using PHP control statements, arrays, functions etc.
6. Practice programs using MYSQL database.

Course Outcomes:
After completion of the course, the students would be able to:
1. Create static web pages using XHTML and CSS.
2. Create dynamic web pages and perform client side validations using JavaScript.
3. Store and Transport data using XML.
4. Write programs using PHP.
5. Access MYSQL database through PHP.
6. Design and Develop websites.

List of programs:

XHTML: Create programs using the following concepts

1. Text Markup Tags.
2. Images.
3. Hyperlinks.
4. Ordered and Unordered Lists.
5. Tables and Nested Tables.
6. Forms.
7. Frames.

CSS: Create programs using the following concepts

8. Inline Styles.
9. Internal Stylesheet.
10. External Stylesheet.
11. Pseudo Classes.
12. Font properties. Borders, Margins, Paddings and Background Images.

JAVASCRIPT: Create programs using the following concepts

13. Pre-defined objects (Date, String, Math etc.,).
14. Selection statements switch statements and loop statements.
15. Demonstrate user defined objects.
16. Array object.
17. Functions.
18. Illustrate pattern matching using regular expressions.
19. Handle various events occurred in the HTML document.
20. Validate the form data.
21. Illustrate positioning of the HTML elements in the web page.
22. Demonstrate moving elements, elements visibility, stacking elements and dragging and dropping elements.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

XML: Create programs using the following concepts

24. XML Documents.
25. XML Schema for the XML documents.
26. CSS style sheets for the XML documents.
27. XSLT style sheet for the XML documents.
28. Design an XML document to store information about patients in a hospital.

PHP: Create programs using the following concepts

29. Selection statements and loop statements.
30. Arrays.
31. Functions.
32. Pattern matching.
33. Handling forms.
34. Access MYSQL database through PHP.

Suggested Reading:

1. Robert W.Sebesta "**Programming the World Wide Web**", 4th Edition, Pearson Education, 2008.
2. Thomas Powell "**HTML & XHTML: The Complete Reference**", 4th Edition, Tata McGraw-Hill, 2003.
3. Thomas A Powell, Fritz Schneider "**JavaScript: The Complete Reference**", 3rd Edition, Tata McGraw Hill, 2013.
4. Steven Holzner "**PHP: The Complete Reference**", McGraw Hill Education, 2008.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MCC119 **OPERATING SYSTEMS LAB**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives:
Students will:
1. Learn programs on system calls, threads and signals
2. Learn programs on process scheduling algorithms
3. Learn programs on Inter process Communication.
4. Learn programs on synchronization problems
5. Learn programs on files
6. Learn about the basic Linux commands.
7. Learn basic shell programs.

Course Outcomes:
After completion of the course, the students would be able to:
1. Write programs on system calls, threads and signals.
2. Write programs on process scheduling algorithms
3. Write programs on Inter process Communication.
4. Write programs on synchronization problems
5. Write programs on files
6. Use basic Linux commands
7. Write basic shell programs

List of Programs:

1. Programs using process related systems calls.
2. Print type of file for each command line arguments.
3. Programs to create threads.
4. Program using Signals.
5. Programs on process scheduling algorithms
6. Echo server-using pipes.
7. Echo server-using message Queues.
8. Producer & Consumer Problem using Semaphores and Shared memory
9. Producer & Consumer Problem using message passing.
10. Readers & Writers Problem using Semaphores and Shared memory
11. Dining philosopher's problem using semaphores.
12. Programs related to files
13. Program using File Locking.
14. Basic Linux Commands
15. Basic shell scripts

Suggested Reading:

1. W. Richard Stevens, "**Unix Network Programming**", Pearson Education Inc, PHI Learning 1990.
2. Behrouz A. Forouzan, Richard F. Gilberg, "**UNIX and Shell Programming: A Textbook**", Books/Cole-Thomson Learning, 2003.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16CEC03 HUMAN VALUES AND PROFESSIONAL ETHICS (Open Elective)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives:

Students will:

1. Develop the critical ability among students to distinguish between what is of value and what is superficial in life
2. Enable the students understand the values, the need for value adoption and prepare them meet the challenges
3. Enable the students develop the potential to adopt values, develop a good character and personality and lead a happy life
4. Motivate the students practice the values in life and contribute for the society around them and for the development of the institutions /organization around they are in.
5. Make the students understand the professional ethics and their applications to engineering profession

Course Outcomes:

After completion of the course, students would be able to:

1. Develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Turn themselves into champions of their lives.
3. Take things positively, convert everything into happiness and contribute for the happiness of others.
4. Become potential sources for contributing to the development of the society around them and institutions / organizations they work in.
5. Shape themselves into valuable professionals, follow professional ethics and are able to solve their ethical dilemmas.

UNIT-I

Concepts and Classification of Values –Need and challenges for value Adoption

Definition of Values – Concept of Values – Classification of Values – Hierarchy of Values – Types of Values –Espoused and Applied Values – Value judgement based on Culture – Value judgement based on Tradition – Interdependence of Values Need for value education – Findings of Commissions and Committees - Corruption and illegal practices – Science and Technology without values- Exploitation of nature – Increasing use of violence and intoxicants – Lack of education in values – Implications of education in values – Vision for a better India Challenges for Value adoption – Cultural, Social, Religious, Intellectual and Personal challenges.

UNIT – II

Personal Development and Values in Life

Personal Development: Enlightened self-interest – Accountability and responsibility – Desires and weaknesses – Character development – Good relationships, self-restraint, Spirituality and Purity – The quest for Character – Tests of Character – The key to good character.

Values in Life: Building an ethical policy – Integrating values in everyday life – Archaic Social Values – Parenting practices – Critical Thinking - Analyzing and Prioritizing values – Practicing Yoga and Meditation.

UNIT – III

Practicing Values for the development of Society

Resentment Management and Self-analysis – Positive Thinking and Emotional Maturity – The importance of Women , Children and Taking care of them – Helping the poor and needy – Fighting against addictions and atrocities – Environmental awareness – Working for the Sustainable development of the society. Values in

Education system: Present Scenario- Engineering education –Current trends-Need for quality improvement-Adoption of value education – Principles of Integrity-Institutional Development.

UNIT – IV

Basic Concepts of Professional Ethics

Ethics, Morals and Human life , Types of Ethics, Personal Ethics, Professional ethics, Ethical dilemmas, Indian and Global thoughts on ethics, Profession, Professional and Professionalism, Ethical role of a professional Basic ethical principles, Some basic ethical theories, use of ethical theories. Science, Religion Ethics, Genders and ethics, Media and ethics, Computer Ethics, Case Studies on Professional Ethics, Exemplary life sketches of prominent Indian personalities.

UNIT-V

Ethics in engineering profession

Engineering profession-Technology and Society-Engineering as Social Experimentation-Engineering ethics-Ethical obligations of Engineering Professionals-Role of Engineers-Engineers as Managers-Professional responsibilities of Engineers- Engineers Responsibility for Safety- A few Case Studies on Risk management. Conflicts of Interest- Occupational Crimes- Plagiarism-Self plagiarism-Ethics Audit-Consideration for ethics audit-Ethics Standards and Bench Marking.

Text Books:

1. Subramanian. R. "Professional Ethics" , Oxford University Press , 2013
2. Nagarajan R.S. "A Text Book on Human Values and Professional Ethics" New Age, Pub. 2007.
3. Dinesh Babu S., "Professional Ethics and Human Values" , Laxmi Publications , 2007

Suggested Reading:

1. SantoshAjmera and Nanda Kishore Reddy "Ethics, Integrity and Aptitude",Mc Grawhill Education Private Limited, 2014.
2. GovindaRajan M., Natarajan S., Senthil Kumar V.S. "Professional Ethics and Human Values" Prentice Hall India Private Limited, 2012.
3. Course Material for Post Graduate Diploma In "Value Education & Spirituality" Prepared by Annamalai University in Collaboration with Brahma Kumaris, 2010

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MEE20 **ENTREPRENUERSHIP (Open Elective)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives:
Students will:
1. Understand the essence of Entrepreneurship
2. Know the environment of industry and related opportunities and challenges
3. Know the concept a procedure of idea generation
4. Understand the elements of business plan and its procedure
5. Understand project management and its techniques
6. Know behavioral issues and Time management

Course Outcomes:
After completion of the course, students would be able to:
1. Apply the entrepreneurial process
2. Analyze the feasibility of a new business venture and preparation of Business plan
3. Ability to evaluate entrepreneurial tendency and attitude
4. Brainstorm ideas for new and innovative products or services
5. Use a variety of feasibility studies, assess and select prospective new venture concepts
6. Describe how to investigate financing alternatives for specific new venture concepts

UNIT-I
Indian Industrial Environment-competence, Opportunities and Challenges. Entrepreneurship and Economic growth. Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries. Types of enterprises, Corporate Social Responsibility.

UNIT-II
Identification and characteristics of entrepreneurs: Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas and their sources. Choice of Technology - Collaborative interaction for Technology development.

UNIT-III
Business plan: Introduction, Elements of Business Plan and its salient features. Technical Analysis, Profitability and Financial Analysis, Marketing Analysis. Feasibility studies, Executive Summary.

UNIT-IV
Project Management during construction phase: project organization, project planning and control using CPM, PERT techniques. Human aspects of project management. Assessment of tax burden.

UNIT-V
Behavioral aspects of entrepreneurs: Personality - determinants, attributes andmodels. Leadership concepts and models. Values and attitudes. Motivation aspects. Change behaviour. Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and time management matrix

Text Books:

1. Vasant Desai "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.

2. Prasanna Chandra "Project-Planning, Analysis, Selection, Implementation and Review", Tata Mc Graw-Hill Publishing Company Ltd. 1995.

Suggested Reading:

1. Stephen R. Covey and A. Roger Merrill "First Things First", Simon and Schuster Publication, 1994.
2. G.S. Sudha "Organizational Behaviuor", 1996.
3. Robert D. Hisrich, Michael P. Peters "Entrepreneurship", Tata Me Graw Hill Publishing Company Ltd., 5th Edition, 2005
4. Robert D. Hisrich, Michael P. Peters "Entrepreneurship", Tata Me Graw Hill Publishing Company Ltd., 5th Edition, 2005

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MCC120 **COMPUTER NETWORKS**

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives:
Students will:
1. Learn the basics of data communication and networks.
2. Get the idea of different layers of OSI model.
3. Learn the concepts of Data Link layer such as Flow and Error control.
4. Study various Routing Algorithms and concepts of Network layers.
5. Learn Transport layer protocols and concepts of Application layer.
6. Obtain the concepts of Socket programming.

Course Outcomes:
After completion of the course, the students would be able to:
1. Gain good knowledge of the basics of data communication and networks.
2. Get an overview of the different layers of OSI model.
3. Gain knowledge of Flow and Error control mechanisms of Data Link layer.
4. Design various Routing Algorithms of Network layer.
5. Formulate Transport layer protocols and concepts of Application layer.
6. Acquire the knowledge of Socket programming.

UNIT - I
Data Communications: Components – Data Representation - Data Flow, Networks- Network Criteria – Physical Structure- Network Models – Categories of Networks – Internetwork, Internet, Protocols and Standards, Network models - ISO/OSI model and its layers, TCP/IP model, Addressing, Physical layer and Media – Digital to Digital conversion, Line coding, Transmission modes, Transmission Media- Guided media – Unguided media, Modem, RS232 Interfacing.

UNIT-II
Data link Layer: Error detection and Correction – Block coding, Hamming code, CRC, Flow and Error control, Noiseless channels - Simple and Stop and Wait protocols, Noisy channels-Stop and Wait ARQ – Go back-N ARQ – Selective repeat ARQ – Piggybacking, HDLC.
Multiple Access: LAN-Pure and Slotted ALOHA, Ethernet IEE 802.3, IEEE 802.4,IEEE 802.5, Bridges.

UNIT-III
Network Layer- Internetworks - Switching– Virtual Circuit and Datagram Network concepts, Logical Addressing, Internet Protocol. Routing – Unicast Routing Protocols - Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP.

UNIT-IV
Transport Layer: Services of Transport Layer, Multiplexing.
Transmission Control Protocol (TCP) – Congestion control and Quality of Services - User Datagram Protocol (UDP).
Application Layer: Domain Name Space (DNS), SMTP and FTP, WWW and HTTP, Fire Walls.

UNIT-V
Socket Programming: Socket address, elementary socket system calls, advanced socket system calls, reserved ports, socket option, asynchronous I/O input/output Multiplexing out-of-band data, sockets and signals, Internet super server.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Text Books:

1. Behroz A Forouzan, “Data Communications and Networking”, 4th Edition, Tata McGraw – Hill, 2009.
2. W. Richard Stevens, “Unix Network Programming”, Pearson Education Inc, PHI Learning 1990.

Suggested Reading:

1. Andrew S. Tanenbaum, “Computer Networks”, 5th Edition, Pearson Education, 2011.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MCC121 **DATA WAREHOUSING AND DATA MINING**

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives:

Students will:

1. Identify the scope and necessity of Data Mining & Warehousing for the society.
2. Describe and designing of Data Warehousing to integrate the Data Mining system
3. Understand Data Mining functionalities to solve the real world problems.
4. Develop ability to design various algorithms based on data mining techniques.
5. Understand various interesting patterns and presentation techniques for decision making
6. Gain the interest in research and design of new Data Mining Techniques.

Course Outcomes:

After completion of the course, the students would be able to:

1. Identify the scope of Data Mining & Warehousing for the society.
2. Design of Data Warehouses and integrate the Data Mining system for various organizations.
3. Apply Data Mining functionalities to solve the real world problems
4. Design and implement the various data mining algorithms based on various requirements
5. Identify interesting patterns and presentation techniques in making decisions
6. Make base for further research on advanced Data Mining Techniques

UNIT-I:

Introduction: What Motivated Data Mining? Why Is It Important, What Is Data Mining, Data Mining—On What Kind of Data, Data Mining Functionalities—What Kinds of Patterns Can Be Mined?, Are All of the Patterns Interesting? Classification of Data Mining Systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or Data Warehouse System, Major Issues in Data Mining,. Data Preprocessing: Why Preprocess the Data, Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

UNIT-II:

DataWarehouse and OLAP Technology: What Is a DataWarehouse, A Multidimensional Data Model, DataWarehouse Architecture, DataWarehouse Implementation, From DataWarehousing to Data Mining, Data Cube Computation and Data Generalization: Efficient Methods for Data Cube Computation, Further Development of Data Cube and OLAP Technology, Attribute-Oriented Induction—An Alternative Method for Data Generalization and Concept Description.

UNIT-III:

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods, Mining Various Kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining,

UNIT-IV:

Classification and Prediction: What Is Classification? What Is Prediction, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines, Classification by Association Rule Analysis, Lazy Learners, Other Classification Methods, Prediction Accuracy and Error Measures, Evaluating the Accuracy of a Classifier or Predictor, Ensemble Methods—Increasing the Accuracy, Model Selection.

UNIT-V

Cluster Analysis: What Is Cluster Analysis, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Methods, Model-Based Clustering Methods, Clustering High-Dimensional Data, Constraint-Based Cluster Analysis, Outlier Analysis.

Text Books:

1. Jaiwei Han and Micheline Kamber “Data Mining- Concepts and Techniques”, Morgan and Kaufmann, 2^{nd} Edition, 2006.

Suggested Reading:

1. Pang-Ning Tan,Micheal Steinbach, Vipin Kumar, “Introduction to data Mining”, Pearson Education, 2008.
2. Ian. H. Witten, Eibe Frank and Mark.A.Hall “Data Mining:Practical Machine Learning Tools and Techniques”, 3^{rd} Edition(Then Morgan Kufmann series in Data Management systems), 2011
3. “Statistical and Machine learning –Learning Data Mining, Techniques for Better Predictive Modeling and Analysis to Big Data”.
4. Arun K Pujari “Data Mining Techniques”, University Press, 2^{nd} Edition, 2009
5. MH Dunham “Data Mining” Pearson Education, 2009.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MCC122 ADVANCED JAVA PROGRAMMING

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Course Objectives:
Students will:
1. Servlets, session management and usage of JDBC in servlets.
2. Java beans, Application builder tool and java beans API.
3. EJB Architecture, EJB requirements and EJB entity beans.
4. EJB clients, deployment tips and perl control structures and operators.
5. JSP scripting elements & directives and java messaging services.
6. JDBC driver connection to database, Row set object and Result set.

Course Outcomes:
After completion of the course, the students would be able to:
1. Get the knowledge of servlets, session management and usage of JDBC in servlets.
2. Employ the java beans, Application builder tool and java beans API.
3. Demonstrate the EJB Architecture, EJB requirements and EJB entity beans.
4. Demonstrate the EJB clients, deployment tips and perl control structures and operators.
5. Identify the JSP scripting elements & directives and java messaging services.
6. Examine the JDBC driver connection to database, Row set object and Result set

UNIT - I
J2EE Platform: Enterprise Architecture Styles, Containers and Technologies.
Servlet overview: The Java web server – your first servlet – servlet chaining – server side includes- Session management – security – HTML forms – using JDBC in servlets – applet to servlet communication.

UNIT - II
Java Beans: The software component assembly model- The java beans development kit- developing beans – notable beans – using infobus - Glasgow developments - Application Builder tool- JAR files-Introspection-Bound Properties-Persistence-customizers - java beans API.

UNIT - III
EJB: EJB architecture- EJB requirements – design and implementation – EJB session beans- EJB entity beans-EJB Clients – deployment tips, tricks and traps for building distributed and other systems – implementation and future directions of EJB-Variable in perl- perl control structures and operators – functions and scope.

UNIT - IV
JSP: Introduction JSP-Examining MVC and JSP -JSP scripting elements & directives-Working with variables scopes-Error Pages - using Java Beans in JSP Working with Java Mail-Understanding Protocols in Javamail-Components-Javamail API-Integrating into J2EE-Understanding Java Messaging Services-Transactions.

UNIT – V
JDBC : Introduction to JDBC, JDBC Drivers, Packages related to JDBC, JDBC Data Sources, Retrieving Meta Information from database and Result set, Distributed Transactions and Row Set objects, Accessing a Database through Servlets and JDBC.

Text Books:
1. H. Schildt, 2002 “Java 2 Complete Reference”, 5th Edition, Tata McGraw Hill, New Delhi.
2. Subramanyan AllamRaju “Professional Java Server Programming”, J2EE 1.3 Edition, A Press Publications.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Suggested Reading:

1. K. Moss "Java Servlets", 2nd Edition, Tata McGraw Hill, New Delhi, 1999.
2. Joseph O'Neil "Java Beans from the Ground Up", Tata McGraw Hill, New Delhi, 1998.
3. J. McGovern,R. Adatia,Y. Fain, "J2EE 1.4 Bible", Wiley-Dreamtech India Pvt. Ltd, New Delhi, 2003.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MCC123 **COMPUTER NETWORKS LAB**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives:
Students will:
1. Learn Networking commands.
2. Understand connection oriented and connection less iterative programs
3. Learn connection oriented and connection less concurrent programs.
4. Acquire the knowledge of Pre fork Server program.
5. Obtain the concept of Remote command execution.
6. Gain the knowledge of Advanced Socket System Calls.

Course Outcomes:
After completion of the course, the students would be able to:
1. Use Networking commands.
2. Implement connection oriented and connection less iterative programs.
3. Execute connection oriented and connection less concurrent programs.
4. Implement the Pre fork Server program.
5. Run the program on Remote command execution.
6. Execute programs on Advanced Socket System Calls.

List of Programs:

1. Using and understanding following Commands. Ifconfig, net stat, ping, arp, telnet, ftp, finger.
2. a) Connection oriented Iterative Echo Server
   b) Connectionless Iterative Echo server
3. a) Connection oriented Concurrent Echo Server
   b) Connectionless Concurrent Echo server
4. a) Connection oriented Iterative Time Server
   b) Connectionless Iterative Time Server
5. a) Connection oriented Concurrent Time Server
   b) Connectionless Concurrent Time Server
6. Remote command execution.
7. Program to pass file descriptors.
8. To demonstrate the usage of Advanced Socket System Calls like
   Getsockopt(), Setsockopt(), Select(), Readv(), getpeernamet(), Getsockname().
9. To demonstrate the Non-Blocking (Asynchronous) Input-Output.
10. To demonstrate the implementation of Pre forked Server.

Suggested Reading:

1. W. Richard Stevens, “Unix Network Programming”, Pearson Education Inc, PHI Learning 1990.
2. Behroz A Forouzan, “Data Communications and Networking”, 4th Edition, Tata McGraw – Hill, 2009.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MCC124 DATA WAREHOUSING AND DATA MINING LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives:
Students will:

1. Understand the need of Data Warehouses over Databases, and the difference between usage of operational and historical data repositories.
2. Understand loading the data from different sources and preprocessing of different types of the data.
3. Build different types of data models from various datasets which are useful to model the data
4. Experience row and column operations of different datasets.
5. Get a clear idea of various classes of Data Mining techniques, their need, scenarios (situations) and scope of their applicability.
6. Learn the algorithms used for various types of Data Mining Problems.

Course Outcomes:
After completion of the course, the students would be able to:

1. Understand the need of Data Warehouses over Databases.
2. Load the data from different sources and preprocess of different types of the data.
3. Build variety of data models useful in modeling data.
4. Use data mining functionalities in different Scenarios.
5. Prepare graphs using data mining tools for patterns presentation.
6. Execute variety of algorithms.

List of Programs:

1. Connect and load data from Databases, User input, Excel files
2. Select the records from data sets using “Select” operation.
3. Extract samples from different data sets using “Selection” operation.
4. Demonstrate of record operation “balance” on different datasets.
5. Aggregate the records using Aggregate operation on different datasets
6. Manage the records of different datasets using “Sort” operation.
7. Merge the records from different datasets.
8. Separate the top most records using “Distinct” operation.
9. Demonstration of record operation “Distinct” on different datasets
10. Filter the fields from different datasets.
11. Derive a new field using existing fields from different datasets using “Derive” operation.
12. Demonstration of field operation “Derive” on different data sets
13. Group the data into different bins using binning.
14. Partition the data using field operation portioning.
15. Interchange the rows and columns of dataset using transpose operation.
16. Draw the graph of “Plot” Graph building on variety of data
17. Draw the graph of “Distribution” Graph building on variety of data
18. Construct histogram on variety of data.
19. Construct collection graph on variety of data.
20. Draw the graph of “Multi plot” Graph building on variety of data
21. Create “Web” Graph on variety of dat.
22. Build Apiori association model on transactional data.
23. Build C4.5 classifier.
24. Train and Test CRT classifier on categorical data.
25. Train and Test CHAID classifier.
26. Construct and Test QUEST classifier.
27. Design, Model and test Neural Network classifier.
28. Construct Binary classifier for binary class data.
29. Construct and Test K-Means clustering model.
30. Model COHENON unsupervised data.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

31. Construct GRI classifier.
32. Construct different REGRESSION equations.
33. Design and Test Logistic modeling.
34. Demonstration of output operations
    a) Stats b) Analysis, c) Matrix, d) Table, e) Transform

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MCC125 **MINI PROJECTS**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Course Objectives:
Students will:

1. Handle small scale projects in the lab.
2. Learn the basic concepts of Front End, Middleware and Back End technologies.
3. Learn the implementation of Mini Project which shall lead into the implementation of Major Project.

Course Outcomes:
After completion of the Mini Project, the students would be able to:

1. Implement the basic level technologies pertaining to Front End, Middleware and Back End.
2. Implement the Major Project successfully.

Fourth Semester of the MCA course contains the Mini Project has to be carried out by each student individually in a period of 15 weeks of duration. Students should submit a synopsis at the end of 2nd week in consultation with the Project Guide. The synopsis should consist of definition of the problem, scope of the problem and plan of action. Before completion of the fourth semester the students are required to present their work before the internal committee of the MCA department, in which each student will be awarded with marks.

At the end of the semester the students are required to present their project work before the External Committee for Vive-Voce examination, in which each student will be awarded with marks.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MCE102 **SOFTWARE TESTING (Elective-I)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives:
Students will:
1. Learn the basic concepts of Testing.
2. Follow the methodology of White Box Testing.
3. Learn the concepts of Functional Testing.
4. Obtain knowledge of Integration and System Tastings.
5. Understand the concepts of Object Oriented Testing.
6. Obtain the concepts Millennium Testing.

Course Outcomes:
After completion of the course, the students would be able to:
1. Gain the basic knowledge of Testing.
2. Acquire the knowledge of White Box Testing methods.
3. Test an application using Functional Testing.
4. Gain knowledge about Integration and System Testing.
5. Use Object Oriented Testing and Millennium Testing methods.
6. Explore on testing types which are to be applied for various applications.

UNIT-I
Introduction to Software Testing Concepts, White Box Approach, Basis Path Testing, Cyclomatic Complexity, Independent paths, D-D Graphs, Dataflow Testing,

UNIT-II
Functional Testing: Boundary Value Testing, Equivalence Class Testing, Decision Table-Based Testing, Retrospective on Functional Testing.

UNIT-III
Integration and System Testing: Levels of Testing, Unit testing, Integration Testing, System Testing, Interaction Testing.

UNIT-IV
Object-Oriented Testing: Issues in Object-Oriented Testing, Class Testing, GUI Testing, Object-Oriented System Testing.

UNIT-V
Millennium Testing: Exploratory Testing, Model-Based Testing, Test-Driven Development, All Pairs Testing, Software Testing Excellence.

Text Books:
1. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", 3rd Edition, CRC Press, 2007.
2. Roger S. Pressman "Software Engineering", 7th Edition, Pearson Education.

Suggested Reading:
1. Boris Beizer "Software Testing Techniques", 2nd Edition, Dreamtech, 2013.
2. M.G. Limaye "Software Testing: Principles – Techniques and Tools", 1st Edition, Tata Mc. Hill, 2009
3. Mauro Pezze, Michal Young "Software Testing and Analysis: Process, Principles and Techniques", Wiley India Pvt. Ltd.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MCE103 **ARTIFICIAL NEURAL NETWORKS (Elective-I)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives:
Students will:

1. Basics of Biological Neural Networks.
2. Basics of Artificial Neural Networks.
3. Applications of Artificial Neural Networks.
4. Different pattern recognition tasks using Artificial Neural Networks.
5. Competitive learning neural networks.
6. ART networks.

Course Outcomes: After completion of the course, the students would be able to:

1. Gain the knowledge of ANN techniques and their applications.
2. Understand the various algorithms for ANN.
3. Apply various algorithms for ANN.
4. Understand the clustering concepts and algorithms
5. Bring out structural ART networks and feature extraction techniques.
6. Identify, Analyze, Formulate and solve different application oriented problems.

UNIT – I
Introduction to ANN - Features, structure and working of Biological Neural Network Trends in Computing Comparison of BNN and ANN.
Basics of Artificial Neural Networks - History of neural network research, characteristics of neural networks terminology, models of neuron Mc Culloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture

UNIT – II
Backpropagation networks (BPN) - Architecture of feed forward network, single layer ANN, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.
Activation & Synaptic Dynamics - Introduction, Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks.

UNIT – III
Basic functional units of ANN for pattern recognition tasks - Basic feedforward, Basic feed back and basic competitive learning neural network. Pattern association, pattern classification and pattern mapping tasks. Feedforward neural networks – Linear responsibility X-OR problem and solution.
- Analysis of pattern mapping networks summary of basic gradient search methods.
Feedback neural networks Pattern storage networks, stochastic networks and simulated annealing, Boltzmann machine and Boltzmann learning.

UNIT – IV
Competitive learning neural networks - Components of CL network pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network.

UNIT – V
Applications of ANN - Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters.
NET Talk - to convert English text to speech. Recognition of consonant vowel (CV) segments, texture classification and segmentation.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Text Books:

1. B. Yegnanarayana "Artificial Neural Networks", PHI, 2010.
2. S. Raj Sekaran , Vijayalakshmi Pari "Neural networks, Fuzzy logic and Genetic Algorithms", 2015.

Suggested Reading:

1. Simon Hhaykin "Neural Networks A comprehensive Foundations", Pearson Education, 2nd Edition 2004.
2. Li Min Fu "Neural Networks in Computer Intelligence", TMH 2003.
3. James A Feeman David M S Kapura "Neural Networks", Pearson Education 2004.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MCE106 **CLOUD COMPUTING (ELECTIVE-II)**

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives:

Students will:

1. Analyze the components of cloud computing and its business perspective.
2. Evaluate the various cloud development tools.
3. Collaborate with real time cloud services.
4. Analyze the case studies to derive the best practice model to apply when developing and deploying cloud based applications.
5. Understand large data processing in the cloud.
6. Utilize the resource management in the cloud.

Course Outcomes:

After completion of the course, the student would be able to:

1. Identify the components of cloud computing for service perspective.
2. Apply the Cloud Computing developing tools.
3. Imply the Cloud Computing models for developing best applications.
4. Give services in Real time requirements.
5. Apply large data processing methods in Clouds.
6. Use the maximum Cloud Computing resources properly.

UNIT-I

Fundamental Cloud Computing-Understanding Cloud Computing, Origins influences, Basic Concepts and Terminology, Goals, Benefits, risks, Challenges, Rolls and boundaries, Cloud characteristics, Cloud Delivery models, Cloud deployment models.

UNIT-II

Cloud enabling technology-Broadband Networks and Internet architecture, Data center technology, Visualization technology, Cloud Security-basic terms and concepts, Threat agents, Cloud security threats,

UNIT-III

Cloud Infrastructure Mechanisms-Logical network perimeter, Virtual server, Cloud Storage device, cloud usage monitor, Resource replication, special cloud mechanisms, cloud management mechanisms, cloud security mechanisms,

UNIT-IV

Cloud Computing Architecture-Fundamental Architecture, Work load distribution architecture, Resource pooling architecture, Dynamic scalability architecture, service load balancing architecture, Cloud bursting architecture, redundant storage architecture, Hyper clustering architecture, load balanced virtual server instances architecture, non-disruptive service architecture, zero down time architecture, cloud balancing architecture, Resource reservation architecture, rapid provision architecture.

UNIT-V

Working with clouds-(Cloud Provider Perspective) Building IaaS Environments, Equipping PaaS Environment, optimizing SaaS Environments. (Cloud consumer perspective)- Working with IaaS Environments, working with PaaS Environment, working with SaaS Environments.

Text Book:

1. Thomas Erl, Ricardo Puttini "Cloud Computing: Concepts, Technology & Architecture", Prentice, Hall, 1st Edn. 2015

Suggested Reading:

1. Rajkumar Buyya, James Broberge and Anddrzej, M Gosciniski “Cloud Computing Principles and Paradims”. Wiley publishing 2011.
2. John W Rittinghouse,james F.Ransome. “Cloud Computing Implementation, Management and Security” CRC Press 2009.
3. Kai Hwang. Geoffrey C.Fox,Jack J. Dongarra, “Distributed and Cloud Computing from parallel Processing to the Internet of things”.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MCE107 SOFTWARE PROJECT MANAGEMENT (ELECTIVE-II)

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Course Objectives:
Students will:
1. Introduce software project management and to describe its distinctive characteristics.
2. Discuss project planning and the planning process.
3. Show how graphical schedule representations are used by project management.
4. Discuss the notion of risks and the risk management process.
5. Managing the people in software industry.
6. Understand the quality of a project.

Course Outcomes: After completion of the course, the students would be able to:
1. Gain basic knowledge of software project management principles
2. Come up with a project schedule and assign resources
3. Choose an appropriate project development model.
4. Identify project risks, monitor and track project deadlines.
5. Work in a team environment and be aware of different modes of communications.
6. Understand the various levels of quality metrics and measurements.

UNIT-I
Software Project Management: Introduction, Importance, Software Projects Vs Other types of Projects, Contract Management, Technical Project Management, Activities covered by SPM, Plans, Methods and Methodologies. Setting Objectives, Project Success and Failures, Management and Control.
Project Evaluation and Programme Management: Project port polio management, Evaluation of Individual projects, Cost Benefit Evaluation Techniques, Risk Evaluation, Program Management, Managing the Resource with in the Program, Strategic Program Management, Aids to Program Management, **Overview of Project Planning.**

UNIT-II
Selection of an Appropriate Project Approach: Choosing the methodologies and technologies, Software process and process models.
Software Effort Estimation: Problems with Over and Underestimates, Software Effort Estimation Techniques. Function Point Analysis. A Parametric Productive Model – COCOMO-2
Activity Planning: Objectives of Activity Planning, Schedules, Activities, Sequencing, Network Planning Models.

UNIT-III
Risk Management : Categories of Risk, A Frame work with Dealing with Risk, Evaluating Risk with the Schedule.
Resource Allocation: Nature of Resource, Identify Resource Requirements, Scheduling, Creating Critical path, Cost Schedules, Scheduling Sequence.
Monitoring & Control: Creating Framework, Collecting Data, Project Termination Review, Visualizing Progress, Cost Monitoring, Prioritizing Monitoring, Change Control, Software Configuration Management.

UNIT-IV
Managing Contracts: Types of Contracts, Stages in Contract Placement, Typical Terms of Contracts, Contract Management Acceptance.
Managing People in Software Environments: Organizational behavior, selecting the Right person for the Job, Instruction in the best methods, Motivations, the Oldham-hackman Job characteristics model, Stress, Health and Safety, Some Ethical and Professional concerns.
Working in Teams: Becoming a Team, Decision making, Organization and Team Structures, Coordination of dependencies, Communication genres, Communication plans, Leadership.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

UNIT –V

Software Quality : The Place of Software Quality in Project planning, Quality Management Systems, Process Capability models, Software Reliability Quality plans,

ISO : ISO – 9126, Product and Process Metrics

An Overview of PRINCE 2 : Components of Prince 2.

Text Book:

1. Bob Hughes and Mike Cotterell "Software Project Management", 5th Edition, Tata McGraw Hill, 2010.

Suggested Reading:

1. Walker Rayce "Software Project Management: A Unified Framework", Addison Wesley, 1998.
2. Watts S. Humphrey "Managing Software Process", Addison – Wesley Pearson Education, 1998.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MC C126

OBJECT ORIENTED SYSTEM DEVELOPMENT

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Objectives:
Students will:

1. Learn the concepts of nine UML diagrams.
2. Use the concepts of things and relationships in UML.
3. Learn about the structural and dynamic modeling.
4. Apply the concepts of Architectural modeling.
5. Acquire the concept and structure of RUP and USDP.
6. Study about the various models of USDP and core workflows.

Outcomes:
After completion of the course the students would be able to:

1. Understand the basic building blocks of UML.
2. Use the knowledge and applications of nine UML diagrams.
3. Learn the knowledge of how to model the object oriented applications through UML.
4. Acquire the knowledge of Structural and Behavioral modeling.
5. Apply the knowledge of dynamic and architectural modeling.
6. Study the concepts of RUP, USDP and models.

Unit – I:
UML Introduction, Why we model, introducing the UML, Building blocks of UML.Basic Behavioral Modeling, Use Cases, Use Case Diagrams, Structural Modeling, Object diagrams, Class Diagrams, Relationships, Advanced Relationships in Class diagrams.

Unit – II:
Dynamic modeling, Interactions, Interaction Diagrams, Events and signals, State Machines, Processes and Threads, State Chart Diagrams, Activity Diagrams.

Unit – III:
Architectural Modeling, Interfaces, Packages, Components, Component Diagrams, Design Patterns and Frame works, Deployment diagrams, Systems and models.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Unit – IV:

Unified Software Development Process, The Unified Process, The Four Ps, Use-Case- Driven Process, Architecture – Centric Process, Iterative and Incremental Process.

Unit – V:

Core Workflows, Capturing Requirements as Use Cases, Analysis Model, Design Model, Implementation Model and Test Model.

Text Books:

1. Grady Booch, James Rumbaugh, Ivor Jacbson, "The Unified ModelingLanguage – User Guide", 2nd Edition, Pearson Education, India, 2007.
2. Ivor Jacbson, Grady Booch, James Rumbaugh, "The Unified Software Development Process", Pearson Education, India, 2008.

Suggested Reading:

1. Grady Booch, Rabert A. Maksimehuc and Three more, " Object Oriented Analysis and Design with Applications", 3rd Edition, Pearson Education, 1991.
2. Craig Larman, "Applying UML and Patterns: An Introduction to Object Oriented Analysis and Design and Iterative Development", 3rd Edition, Pearson Education, 2008.
3. Ali Bahrami, "Object Oriented System Development", Irwin/Mc Graw Hill, 1999.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MC C127

MACHINE LEARNING

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Objectives:
Student will:
1. Learn the concepts of Classification and Prediction.
2. Understand the mathematical concepts related to Multilayer perception.
3. Apply clustering techniques for unsupervised data.
4. Train classifiers and predictors on supervised data.
5. Find optimal models for decision making.
6. Design ensemble models for Classification.

Outcomes:
After completion of the course the students would be able to:
1. Acquire the basic knowledge of Machine Learning; identify algorithms, machine learning problems.
2. Classify data sets using classifiers.
3. Use prediction Techniques.
4. Recognize patterns using Machine Learning models.
5. Apply dimensionality reduction techniques on different datasets.
6. Design ensemble methods.

Unit-I
Introduction: Learning, Types of Machine Learning.
Concept learning: Introduction, Version Spaces and the Candidate Elimination Algorithm.
Learning with Trees: Constructing Decision Trees, CART, Classification Example.

Unit-II
Linear Discriminants: The Perceptron, Linear Separability.
Linear Regression Multilayer Perceptron (MLP): Going Forwards, Backwards, MLP in practices, Derivingback.
Propagation SUPPORT Vector Machines: Optimal Separation, Kernels.

Unit-III
Some Basic Statistics: Averages, Variance and Covariance, The Gaussian.
The Bias-Variance Tradeoff Bayesian learning: Introduction, Bayes theorem, Bayes Optimal Classifier, Naive Bayes Classifier.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Graphical Models: Bayesian networks, Approximate Inference, Making Bayesian Networks, Hidden Markov Models, The Forward Algorithm.

Unit-IV

Evolutionary Learning: Genetic Algorithms, Genetic Operators.

Genetic Programming Ensemble learning: Boosting, Bagging.

Dimensionality Reduction: Linear Discriminant Analysis, Principal Component Analysis.

Unit-V

Clustering: Introduction, Similarity and Distance Measures, Outliers, Hierarchical Methods, Partitional Algorithms, Clustering Large Databases, Clustering with Categorical Attributes, Comparison.

Text Books:

1. Tom M. Mitchell, "Machine Leaming ",MacGraw Hill, 1997
2. Stephen Marsland, "Machine Learning - An Algorithmic Perspective ", CRC Press, 2009.

Suggested Reading:

1. J F Khamber, Data Mning Concepts, Elsevier, 2007
2. Margaret H Dunham, "Data Mining", Pearson Edition, 2003.
3. GalitShmueli, Nitin R Patel, Peter C Bruce, "Data Mining for Business Intelligence", Wiley India Edition, 2007.
4. RajjallShinghal, "Pattern Recognition ", Oxford University Press, 2006.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MC C128

CRYPTOGRAPHY & NETWORK SECURITY

Instruction	3L+1T Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	4

Objectives:
Students will:
1. Learn OSI Security architecture and classical Encryption techniques.
2. Acquire fundamental knowledge on the concepts of finite fields and number theory.
3. Understand various block cipher and stream cipher models.
4. Describe the principles of public key cryptosystems, hash functions and digital signatures.
5. Acquire the knowledge of Security practices and system security.
6. Gain the knowledge of e-mail, IP and Web security.

Outcomes:
After completion of the course the students would be able to:
1. Compare various cryptographic techniques.
2. Design secure applications.
3. Inject secure coding in developed applications.
4. Develop secure cipher models.
5. Generate secure e-mail, IP and Web security algorithms.
6. Build secure system.

Unit-I
Introduction & Number Theory : Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid salgorithm-Finite fields- Polynomial Arithmetic –Prime numbers-FermatsandEulers theorem-Testing for primality The Chinese remainder theorem- Discrete logarithms.

Unit-II
Block Ciphers & Public Key Cryptography: Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles

of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

Unit-III

Hash Functions And Digital Signatures: Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

Unit-IV

Security Practice & System Security: Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs-SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

Unit-V

E-Mail, IP& Web Security: E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

Text Books:

1. William Stallings, “Cryptography and Network Security”, 6th Edition, Pearson Education, 2013.
2. Charle Kaufman, Radha Perlman and Mike Speciner “Network Security”, Prentice Hall of India, 2002.

Suggested Reading:

1. Behrouz A. Forouzan, “Cryptography and Network Security”, Tata McGraw Hill, 2007.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MC C129

OBJECT ORIENTED SYSTEM DEVELOPMENT LAB

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Objectives:

Students will:

1. Learn basic operations of Rational Rose case tool .
2. View and browse the four sections of Rational Rose case tool.
3. Depict and model the diagrams of UML in Rational Rose case tool.
4. Know about the representation of Structural and Dynamic modeling.
5. Understanding the concepts of Architectural modeling and its representation.
6. Submit a technical report of the case study in IEEE format.

Outcomes:

After completion of the course the students would be able to:

1. Understood the browsing and viewing sections of Rational Rose case tool.
2. Gained the knowledge of selecting a case study and converting it to be suitable to model in UML.
3. Gained the knowledge to draw and model the UML diagrams.
4. Gained the practical knowledge of structural modeling of Object Oriented Applications through UML.
5. Gained the practical knowledge of dynamic modeling of Object Oriented Applications through UML.
6. Gained the knowledge of technical writing and documentation of the case study in IEEE format.

List of Experiments:

1. Use case Diagram
2. Class Diagram
3. Object Diagram
4. Sequence Diagram
5. Collaboration Diagram
6. State chart Diagram
7. Activity Diagram
8. Component Diagram
9. Deployment Diagram

The students should finally submit a technical report on their case study in IEEE format.

Text Book:

1. Ivor Jacbson, Grady Booch, James Rumbaugh, "The Unified Software Development Process", Pearson Education, India, 2008.

16MC C130

MACHINE LEARNING LAB USING PYTHON

Instruction	3 Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	50 Marks
Continuous Internal Evaluation	25 Marks
Credits	2

Objectives:

Students will:

1. Learn the basic concepts and techniques of Machine Learning.
2. Develop the skills in using recent machine learning software for solving practical problems.
3. Be familiar with a set of well-known supervised semi-supervised and unsupervised learning algorithms.
4. Do experiments on real-time data for decision making.

Outcomes:

After completion of "**Machine Learning Lab**", the student is expected to:

1. Understand complexity of Machine Learning algorithms and their limitations;
2. Understand modern notions in data analysis oriented computing;
3. Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own.
4. Be capable of performing experiments in Machine Learning using real-world data.

Experiments:

1. Python Datatypes, Variables, Recursive Functions.
2. Strings, Lists, User defined functions, Tuples, Dictionaries.
3. Packages, Libraries of Python.
4. Demonstrating the Data preprocessing techniques.
5. Demonstration on How to get different datasets
6. Write a simple program on Simple Linear Regression
7. Multiple Linear Regression Backward Elimination – Preparation & Automatic Backward Elimination.

Use Decision Tree functions on real time data for

8. C4.5,
9. CART,
10. CHAID
11. Logistic Regression
12. K-Nearest Neighbors
13. Support Vector Machine with different kernals
14. Random Forest Classification

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Use clustering functions on real time data for

15. K-Means.
16. Hierarchical Clustering.

Use Association mining functions for

17. Apriori.

Apply Data compression techniques for real time data

18. Linear Discriminant Analysis (LDA).
19. Principal Component Analysis (PCA).

Text Book:

1. **Andreas C. Müller, Sarah Guido,** "ntroduction to Machine Learning with Python: A Guide for Data Scientists" O'Reilly Media, edition 1, 2016.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MC C131

SEMINAR

Instruction	3 Hours per week
Continuous Internal Evaluation	50 Marks
Credits	2

Objectives:

Students will:

1. Prepare a systematic and independent study of the state of the art technological topic in the broad area of his/her specialization.
2. Prepare PPT slides with the write-up and block diagrams of the selected area of study.
3. Present the selected topic and deliver a speech in front of the class and evaluating faculties.

Outcomes:

After completion of the course the students would be able to:

1. Conduct a independent technical study and survey on the selected topic.
2. Prepare a PPT slides presentation.
3. Deliver a speech and presentation of the study topic in front of the class and evaluating faculties.

Oral presentation is an important aspect of technical education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his/her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects of the seminar presentation.

- Literature Survey.
- Organization of the material.
- Presentation of PPTs.
- Technical writing.

Each student is required to submit one page of synopsis of the seminar talk two days before for display on the notice board. Give a 15 minutes presentation followed by 5 minutes discussions. Submit a report on the seminar topic with a list of references and slides used within a week. Seminars are to be scheduled in the 5th week of the semester. The sessional marks will be awarded to the students by at least two faculty members on the basis of an oral and written presentation as well as their involvement in the discussion.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MC E110

INTERNET OF THINGS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Objectives:

Students will:

1. Gain vision and Introduction to IoT.
2. Understand IoT Market perspective.
3. Acquire IoT standards and Business processes.
4. Learn data and knowledge Management and use of Devices in IoT Technology.
5. Understand State of the Art – IoT Architecture.
6. Have knowledge of Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Outcomes:

After completion of the course the students would be able to:

1. Gain vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use Devices, Gateways and Data Management in IoT.
4. Implement IoT standards and Business processes.
5. Build state of the art architecture in IoT.
6. Develop Applications of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

Unit-I

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.M2M to IoT – A Market Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.

Unit-II

M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data Management.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Unit-III

M2M and IoT Technology Fundamentals - Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management. IoT Architecture-State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and Architecture, IoT Reference Model.

Unit-IV

IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and operational View, Other Relevant architectural views. Real-World Design Constraints-Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

Unit-V

Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation-Introduction, Case Study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Text Book:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.

Suggested Reading:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1stEdition, VPT, 2014.
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013. HakimaChachi "Internet of Things (Connecting Objects)" Wiley – 2010.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MC E111

BUSINESS INTELLIGENCE AND ANALYTICS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Objectives:

Students will:

1. Learn data mining techniques and understand relationships between the underlying business process of an organization.
2. Understand the role of business analytics within an organization.
3. Acquire the knowledge on data warehousing concepts.
4. Provide in-depth knowledge of handling data and business analytics tools that is used for decision-making.
5. Acquire knowledge on prescriptive analytics.
6. Understand the various applications of business analytics on different domains.

Outcomes:

After completion of the course the students would be able to:

1. Get clear idea about the basic concepts of business analytics in an organization.
2. Demonstrate detailed knowledge about the role of business analytics in decision making.
3. Distinguish between descriptive, predictive and prescriptive analytics.
4. Gaining knowledge on data warehousing and data mining concepts.
5. Understand the usefulness of business analytics in various functional areas of an organization.
6. Understand the future directions for business analytics.

Unit- I:

Introduction: Introduction to Analytics, data science, Big data. Business analytics-challenges from outside and within, BASP (Business analytics success pillars) framework, Applications of Analytics to different domains, Data, Information, and Knowledge, Analyst's Role in the BA Model - Three Requirements the Analyst Must Meet , Required Competencies for the Analyst , Hypothesis-Driven Methods, Data Mining with Target Variables , Explorative Methods.

Unit- II:

Descriptive analytics : Descriptive analytics-Data warehousing-concepts, characteristics, Data marts, Meta data and process of data warehousing, Business

Reporting, Visual Analytics and Business performance measurement, Why a Data Warehouse, Architecture and Processes in a Data Warehouse, Tips and Techniques in Data Warehousing.

Unit- III:

Predictive analytics: Introduction, Data mining concepts and Applications, Data mining process, methods, classification techniques. Text mining-introduction, text analytics and sentiment analytics.Web mining-introduction, Web analytics and social analytics.

Unit- IV:

Prescriptive analytics : Introduction- categories of models- optimization, simulation, heuristics, predictive models, other models. Automated decision systems and Expert systems, Knowledge Management and collaborative systems.

Unit-V:

GIS : Nature of Geographic data, Spatial Objects and Data Models, Getting map on Computers, GIS standards and Standardization Process of GIS development, Implementation and Deployment phases, Big Data, Defining Big Data, Big Data Landscape, Business Implications of Big Data, Technology Implications of Big Data, Big Data Technologies, Management of Big Data.

Text Books:

1. Ramesh sharada, DursunDelen, Efraim Turban, "Business intelligence and analytics" Pearson, 2013.
2. Jean paulisson,jesse s.harriot,"Win with advanced Business analytics" wiley and sas, 2012.

Suggested Readings:

1. Gert H.N. Laursen, JesperThorlund "Business Analytics for Managers" JohnWiley& Sons, Inc.2010.

16MC E113

BIG DATA ANALYTICS

Instruction	3L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Objectives:
Students will:

1. Introduce the concepts and challenges of big data, role of HDFS in handling big data and MapReduce Architecture.
2. Explore mapper and reducer to solve real world problems.
3. Introduce the features of NoSQL and study the working mechanisms of MongoDB.
4. Impart knowledge to work with semi structured and unstructured data using Pig.
5. Familiarize with features of Hive to process and query big data.
6. Process and query the big data in HDFS environment.

Outcomes:
After completion of the course the students would be able to:

1. Develop framework for handling Big Data using Hadoop
2. Acquire, Store and analyse big data in business environments using HDFS
3. Develop programs in MapReduce to solve real world problems
4. Model data using MongoDB
5. Handle semi structured and unstructured big data using Pig
6. Process and query big data in HDFS environment using Hive

Unit - I:
Introduction to Big data and its importance, Considering a Big data solution, Big Data use cases: IT for IT Log Analytics, The Fraud Detection Pattern, Social Media Pattern. The Hadoop Distributed Files system: The Design of HDFS, HDFS Concepts, Blocks, Name nodes and Data nodes, Block Caching, HDFS Federation, HDFS High Availability, The Command-Line Interface, Basic File system Operations, Hadoop File systems, Interfaces, The Java Interface, Reading Data from a Hadoop URL, Reading Data Using the File System API, Writing Data, Directories, Querying the File system, Deleting Data, Data Flow, Anatomy of a File Read, Anatomy of a File Write, Coherency Model, Parallel Copying with distcp, Keeping an HDFS Cluster Balanced.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Unit - II:

MapReduce: A Weather Dataset, Data Format, Analyzing the Data with Hadoop, Map and Reduce, Java MapReduce, Scaling Out, Data Flow, Combiner Functions, Running a Distributed MapReduce Job Developing a MapReduce Application: Writing a Unit Test with MRUnit, Mapper,Reducer, Running Locally on Test Data, Running a Job in a Local Job Runner, Testing the Driver, Running on a Cluster, Packaging a Job, Launching a Job, The MapReduce Web.

Unit – III:

How MapReduce Works: Anatomy of a MapReduce Job Run, Job Submission, Job Initialization, Task Assignment, Task Execution, Progress and Status Updates, Job Completion, Failures, Task Failure, Application Master Failure, Node Manager Failure, Resource Manager Failure, Shuffle and Sort, The Map Side, The Reduce Side, MapReduce Types and Formats: MapReduce Types, The Default MapReduce Job, Input Formats, Input Splits and Records, Text Input, Output Formats, Text Output.

Unit – IV:

No SQL Databases: Review of traditional Databases, Need for NoSQL Databases, Columnar Databases, Failover and reliability principles, CAP Theorem, Differences between SQL and NoSQL databases, Working mechanisms of Mongo DB: Overview, Advantages, Environment, Data Modelling, Create Database, Drop Database, Create collection, Drop collection, Data types, Insert, Query, Update and Delete operations, Limiting and Sorting records, Indexing, Aggregation.

Unit – V:

Pig: Installing and Running Pig, an Example, Generating Examples, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators, Pig in Practice. Hive: Installing Hive, The Hive Shell, An Example, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User-Defined Functions, Writing a User Defined Functions, Writing a User Defined Aggregate Function.

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O'Reilly Media Inc, 2015.
2. Paul C. Zikopoulos, Chris Eaton, Dirk DeRoos, Thomas Deutsch, George Lapis, "Understanding Big Data - Analytics for Enterprise class Hadoop and Streaming Data", McGrawHill, 2012.
3. Kristina Chodorow, "MongoDB: The Definitive Guide-Powerful and Scalable Data Storage", 2nd Edition, O'Reilly Media, 2013.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

Suggested Reading:

1. Chuck Lam, Mark Davis, AjitGaddam, “Hadoop in Action”, Manning Publications Company, 2016.
2. Alex Holmes,” Hadoop in Practice”, Manning Publications Company, 2012.
3. Alan Gates, “Programming Pig”, O’Reilly Media Inc, 2011.
4. Edward Capriolo, Dean Wampler, and Jason Rutherglen, “Programming Hive”, O’Reilly Media Inc, October 2012.

   VigneshPrajapati, “Big data Analytics with R and Hadoop”, Packt Publishing, November 2013.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075

16MC E114

E-COMMERCE

Instruction	3 L Hours per week
Duration of Semester End Examination	3 Hours
Semester End Examination	70 Marks
Continuous Internal Evaluation	30 Marks
Credits	3

Objectives:

Students will:

1. Learn basics of E-Commerce.
2. Design the E-Commerce Network Infrastructure.
3. Study and the E-Commerce Security Issues and its solutions.
4. Learn the Various electronic Payment options.
5. Apply the various Electronic Advertisements.
6. Use the basics of M Commerce.

Outcomes:

After completion of the course the students would be able to:

1. Apply knowledge of Basics on E-Commerce and its Applications.
2. Obtain knowledge on E-Commerce Network Infrastructure.
3. Get Knowledge on E-Commerce Security Issues and its solutions.
4. Apply exposure on various electronic Payment systems.
5. Use the obtain knowledge on various Electronic Advertisements.
6. Gets Exposure on the basics of M Commerce.

Unit-I

Electronic Commerce: Introduction, definition, benefits, impact, classifications, Applications, Business models.

Electronic Data Interchange: Building blocks of EDI, Value added networks, Benefits of EDI, Applications of EDI.

Unit-II

Architecture: Introduction to Architecture and Frameworks. **Network Infrastructure**: LAN, Ethernet, WAN, Internet, TCP/IP Reference Models, Domain Name Servers (DNS), Internet and Industry Structure.

Information Distribution and Messaging: FTP and its Applications, e-mail, WWW Server, HTTP, Web Server Implementation.

Unit-III

Information Publishing Technology: Publishing, Web Browsing, HTML, CGI, Multimedia and its Objects, Virtual Reality Modelling Language (VRML). **Securing Business on Internet**: Vulnerable, Security policy and Procedures. Site Security, Protecting the Network, Firewalls, Securing the Web (HTTP) Service.

Securing the Network Transactions : Transaction Security, Cryptology, Cryptographic Algorithm, Public-Key Algorithm, Authentication Protocols, Digital Signature.

Unit-IV

Electronic Payment Systems: Introduction, Online-Payment Systems, Pre-Paid, Post Paid, Requirements Metrics of a Payment System. Search Engine and Directory services.

Internet Advertising: Introduction, Competitive advertising media, Models of Internet Advertising, Banner, Sponsoring, Screen saver, Push Broadcasting, Corporate Web Sites.

Unit-V

Mobile Commerce : Introduction, Benefits, Frameworks, Agents in Electronic Commerce, Types, Agent Technologies, Agent Standards and Protocols, Agent Applications.

Text Book:

1. Bharat Bhasker "Electronic Commerce: Framework, Technologies and Applications", Tata McGraw-Hill Education, 2006.

Suggested Reading:

1. Ravi Kalakota& AB.B. Whinston – "Frontiers of Electronic Commerce ", Pearson Education, India 1999.
2. Daniel Minoli, Emma Minoli : "Web Commence Technology Handbook", Tata McGraw Hill, 2007.

HEAD OF DEPARTME
Master of Computer Applicatio
C.B.I.T., Hyderabad-500 075

16MC C132

MAJOR PROJECT WORK

Instruction	6 Hours per week
Semester End Examination	Viva Voce
Continuous Internal Evaluation	100 Marks
Semester End Examination	100 Marks
Credits	12

Objectives:

Students will:

1. Understand the client /user project requirements.
2. Develop a software life cycle mechanism for the given problem scenario
3. Convert the project requirements in a implementable format.
4. Develop test cases and testing scenario to the code generated.
5. Document the entire project work in a IEEE format.

Outcomes:

After completion of the course the students would be able to:

1. Understand to capture project requirements from the client/end users.
2. Understand and implement software life cycle for the given requirements.
3. Design a real time solution for the given software requirement specifications
4. Understand how to develop test cases and design test case scenarios.
5. Document the entire project work in IEEE standards and format.

Sixth (Final) Semester of the MCA course is exclusively meant for Major Project work. Major Project Work has to be carried out by each student individually in a period of 15 weeks of duration. Students should submit a synopsis at the end of 2nd week in consultation with the Project Guide. The synopsis should consist of definition of the problem, scope of the problem and plan of action. After completion of eight weeks students are required to present a Project Seminar on the topic covering the aspects of analysis, design and implementation of the project work to the committee consisting of two faculty members of MCA department in the college along with a guide will evaluate the project and award internal marks.

At the end of the semester the students are required to present their project work before the External Committee for Vive-Voce examination, in which each student will be awarded with marks.

HEAD OF DEPARTMENT
Master of Computer Applications
C.B.I.T., Hyderabad-500 075