CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
CIVIL / MECHANICAL / PRODUCTION ENGINEERING
B.E. I – Year

I - Semester

THEORY						
S.No	**Code**	**Subject**	**L**	**T**	**P/D**	**Credits**
1	EG 111	English - I	2	0	0	2
2	MT 111	Mathematics - I	3	1	0	3
3	PY 111	Engineering Physics - I	3	0	0	3
4	CY 111	Engineering Chemistry - I	3	0	0	3
5	CS 112	Structured Programming	3	0	0	3
6	CE 111	Engineering Mechanics – I	3	1	0	3
7	ME 111N	Engineering Graphics – I	0	0	6	4
PRACTICALS						
8	EG 112	English Language Laboratory – I	0	0	2	1
9	PY 114/ CY 114	Engineering Physics Lab – I / Engineering Chemistry Lab – I	0	0	3	2
10	CS 114	Programming Lab -I	0	0	3	2
11	ME 113	Workshop – I	0	0	3	2
TOTAL			**17**	**02**	**17**	**28**

II – Semester

THEORY						
S.No	**Code**	**Subject**	**L**	**T**	**P/D**	**Credits**
1	EG 121	English - II	2	0	0	2
2	MT 121	Mathematics - II	3	1	0	3
3	PY 121	Engineering Physics – II	3	0	0	3
4	CY 121	Engineering Chemistry - II	3	0	0	3
5	CS 121	Object Oriented Programming through C++	3	1	0	3
6	CE 121	Engineering Mechanics – II	3	1	0	3
7	ME 121N	Engineering Graphics – II	0	0	6	4
PRACTICALS						
8	EG 122	English Language Laboratory – II	0	0	2	1
9	PY 125 / CY 123	Engineering Physics Lab – II / Engineering Chemistry Lab – II	0	0	3	2
10	CS 122	Programming Lab - II	0	0	3	2
11	ME 123	Workshop – II	0	0	3	2
TOTAL			**17**	**03**	**17**	**28**

EG 111

ENGLISH – I
(common to all branches)

Instruction	2L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

To enable the students to

- To understand the role and importance of communication and to develop their basic communication skills in English.
- To enable the students to communicate through listening, speaking, reading and writing.
- To achieve a sound foundation and acquaint the students in the basics of grammar.
- To develop vocabulary and to use appropriate idiomatic expressions, one word substitutes etc,.
- To ensure students use learning materials prescribed, and to inculcate the habit of reading for pleasure.
- To enhance imaginative creative and critical thinking through literary texts.
- To enable students to write composition and draft different kinds of letters.

UNIT-I

Effective Communication: Role and importance of communication, process of communication, types of communication , barriers to communication, Verbal communication and non verbal communication , formal versus informal communication.

UNIT-II

Review of Grammar:1. Tense and aspect 2. Articles 3.Prepositions 4.Voice 5.Concord 6. Direct and indirect speech

Vocabulary Enhancement: 1.Synonyms2.Antonyms

UNIT-III

Reading comprehension and reading strategies.

Lessons Prescribed: 1. Barack Obama: A Trendsetter 2. Rendezvous with IndraNooyi

Text based exercises

Vocabulary Enhancement:1. Homonyms 2. Homophones 3. Homographs 4. Words often confused

UNIT-IV

Writing Skills: Paragraph writing, Essay writing , Letter of application, Resume writing, Complaint letter with response.

Vocabulary Enhancement: Idiomatic expressions and one word substitutes.

UNIT-V

Soft skills - Introduction to soft skills, soft versus hard skills, professional etiquette in formal and semi formal situations, telephonic etiquette, E-mail etiquette.

Text Books:

1. "Essential English"-E Suresh Kumar et al**.**(Orient Balck Swan PVT Ltd.)
2. "Communication Skills and Soft Skills: An Integrated Approach"- E Suresh Kumar et al**. (**Pearson Publications)

Suggested Reading:

1. "English Vocabulary in Use" - Michael McCarthy (Cambridge University Press)
2. "Developing Communication Skills" – Krishna Mohan & Meera Banerjee (Macmillan)
3. "Murphy's English grammar" (Cambridge University Press)
4. "English Phrasal Verbs in use" - Michael McCarthy (Cambridge University Press)
5. "Written Communication in English" –Sarah Freeman (Orient Longman)
6. "Model Business letters, E-Mails and Other Business Documents" - Shirley, Taylor (Pearson) "Effective Technical Communication" – M. Ashraf Rizvi (Tata- McGraw Hill)
7. "Business Correspondence and Report Writing – R.C Sharma and Krishna Mohan (Tata McGrawHill)
8. Soft Skills, Alex , Publishers S. Chand

MT 111

MATHEMATICS– I
(common to all branches except Bio-Tech)

Instruction	3L + 1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

UNIT-I: Matrices: Rank of a matrix, Echelon form-Normal form-Consistency of a linear system of equations. Eigen values, Eigen vectors- properties (with out proofs). Cayley- Hamilton Theorem (statement only) inverse and powers of a Matrix by Cayley-Hamilton Theorem. Reduction of Quadratic form to Canonical form by linear transformation, rank, positive, negative, definite, semi-definite, index and signature.

UNIT-II: Sequences and Series: Convergence and divergence, ratio test, Comparison test, integral test, Cauchy's root test, Raabes's test-Alternating series, Absolute and conditional convergence, Leibniz's Test (tests without proofs).

UNIT-III: Differential Calculus:
Mean value theorems (statements only) - Rolle'sTheorem, Lagrange's theorem, Cauchy's theorem, and generalized mean value theorem (Taylor's Theorem), Geometrical interpretations. Curvature and Radius of curvature, center of curvature, circle of curvature.Evolutes,involutes and Envelopes. Functional dependence, Jacobian, Taylors series in two variables, Maxima and Minima for function of two variables with and without constraints.

UNIT-IV:Integral Calculus: Curve tracing – Cartesian, polar and parametric curves (standard curves only). Double and triple integrals change of order integration, applications of integration, rectification, areas, volumes and surfaces of solids of revolution in Cartesian and polar coordinates.

UNIT-V: Beta and Gamma Functions: Definitions of Beta and Gamma functions-elementary Properties of both Beta and Gamma functions, Relation between Beta and gamma functions, differentiation under the integral sign.

Text Books:

1. Advanced Engineering by Kreyszig, john wiley&sons -publishers.
2. Mathematical Methods of science and engineering, Aided with MATLAB, Kanti.B.Datta.Cengage Learning India Pvt.Ltd,418 Pratapgang,New Delhi.
3. Mathematics for Engineers and Scientists by AlenJaffery , 6th edition 2013 CRC press, Taylor & Francis Group.(Elsevier)
4. Advanced Engineering Mathematics by Michael Greenburg, Second Edition –Pearson Education.

Suggested Reading:

1. Mathematics for Engineers-a modern interactive approach by A.Craft and Robert Davison-Willey
2. Applied Mathematics and physicists by Loius Pipes-McGraw Hill pubulishers.
3. Advanced Engineering Mathematics by R.K.Jain&S.R.K.Iyenger, 3rd edition, Narosa Publications
4. Matrices for Engineering Dynamics by AR Collar and A. Simpson-John Willey & sons
5. Essential Mathematics for Engineers by W.Bolton-Betterworth and Heineman
6. Mathematics for Physicists and Engineers- L F Landoviz, Publishers- Rienfold Book Corporation.
7. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers.
8. Engineering Mathematics by B.V.Ramana
9. Calculus by Smith and Minton
10. Applications of Linear Algebra by David.C Lay

PY 111

ENGINEERING PHYSICS – I
(common to all branches except Chemical Engg & Bio-Tech)

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

UNIT – I

Waves and Oscillations: Simple harmonic motion – Differential equation and its solution – Torsional pendulum – Superposition of two mutually perpendicular linear SHMs of same frequency – Lissajous figures – Damped vibrations – Differential equation and its solution – Logarithmic decrement - Relaxation time – Quality factor – Forced vibrations – Differential equation and its solution – Amplitude resonance.

Ultrasonics: Introduction – Production of ultrasonics by piezoelectric and magnetostriction methods – Detection of utrasonics– Determination of ultrasonic velocity in liquids – Engineering applications.

UNIT – II

Interference: Introduction – Division of amplitude & division of wavefront – Interference in thin films (reflected light) – Newton's rings – Fresnel's biprism.

Diffraction: Introduction – Distinction between Fresnel and Fraunhoffer diffraction – Diffraction at single slit & double slit – Diffraction grating (N Slits).

UNIT – III

Polarization: Introduction – Brewster's law – Malus's law – Double refraction – Nicol's prism – Quarter & Half wave plates – Optical activity – Laurent's half shade polarimeter.

Lasers &Holography: Introduction – Characteristics of lasers – Spontaneous & stimulated emission of radiation – Einstein's coefficients – Population inversion – Ruby laser – He-Ne laser – Semiconductor laser – Applications.

Basic principle of Holography – Recording & Reconstruction of hologram – Applications.

UNIT - IV

Electromagnetic Theory: Review of steady and varying fields – Conduction and displacement current – Maxwell's equations in differential and integral forms – Electromagnetic wave propagation in free space, dielectric and conducting media – Poynting theorem.

Fibre Optics: Introduction – Types of optical fibres– Propagation of light through an optical fibre – Acceptance angle – Numerical aperture – Pulse dispersion – Fibre materials – Fibre drawing process by double crucible method – Applications.

UNIT – V

Elements of Statistical Mechanics: Introduction – Ensembles – Phase space – Thermodynamical probability – Boltzmann theorem on entropy – Maxwell-Boltzmann, Bose-Einstein & Fermi-Dirac statistics – Photon gas– Planck's' law of black body radiation – Wien's law and Rayleigh-Jean's law from Planck's law.

Text Books:

1. M.N. Avadhanulu and P.G. Kshirsagar, *A Text BookEngineering Physics*, S. Chand Publications, 2014
2. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, DhanpatRai Publications, 2011
3. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013

Suggested Reading:

1. R. Murugeshan and KiruthigaSivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2005
2. M. Arumugam, *Materials Science*, Anuradha Publications, 2002.
3. Satyaprakash and Agarwal, *Statistical mechanics*, Kedannath Publications
4. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012
5. Hitendra K Malik and A.K. Singh, *Engineering Physics*, Tata McGahill Education Publications, 2011

CY 111

ENGINEERING CHEMISTRY-I
(common to all branches except Chemical Engg. & Bio-Tech)

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

The syllabus has sought to fulfill the objective of making the student of engineering and technology realize that chemistry like other subjects is the real base of his profession and that therefore he must have a good understanding of chemistry before he can use it in his profession. The various units of the syllabus is so designed to fulfill the following objectives.

1. Thermodynamics and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems. It also discusses the devices used for electrical energy storage and captive generation and tapping it as and when required.
2. "Those who control materials control technology". Newer materials lead to discovering of technologies in strategic areas like defense and space research. Recently modern materials synthesized find applications in industry and creating instruments for solving problems of electronics, telecommunications, health care, agriculture, and technology etc., Inorder to emphasize the above the topics like composite materials, polymers, conducting polymers and nano materials have been incorporated in the curriculum.
3. Knowledge to prevent corrosion of machinery and metallic materials and water chemistry which require serious attention in view of increasing pollution has been included in the syllabus.
4. Fuels have been taught with a view to give awareness as to materials which can be used as sources of energy and fuel cells which are the alternate energy sources for generating electrical energy on spot and portable applications.
5. To appraise the students about the importance and role of chemistry in the field of Engineering by explaining the relevant topics.
6. To enable students to apply the knowledge acquired in improving the properties of engineering materials.
   The engineer who has the above background can effectively manage the materials in his designing applications and discovering and improving the systems for various uses in industry, agriculture, health care, technology, telecommunications, electronics and instruments detecting in advance in natural calamities. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

UNIT – I

Chemical Thermodynamics – I:

The concept of reversible and irreversible process, Work done in isothermal and adiabatic reversible and irreversible process, Success and limitations of First law of thermodynamics, need for second law of thermodynamics, statements of second law of thermodynamics, Carnot cycle, heat engine and its efficiency, Carnot theorem, numericals.

UNIT – II

Chemical Thermodynamics - II & Phase Rule:

Concept of Entropy – Entropy changes in reversible and irreversible processes, physical significance of entropy, Helmholtz free energy and Gibb's free energy functions, chemical potential, criteria of spontaneity in terms of entropy and Gibb's free energy function, Gibb's – Helmholtz equation and its applications, numericals.

Phase rule – Terminology, phase diagram – one component system (water system).

UNIT – III

Fuels – I:

Classification, requirements of a good fuel, calorific value, types of calorific value, relation between HCV & LCV and numericals. Determination of calorific value by Bomb calorimeter, Dulong's formula, numericals.

Combustion, ignition temperature of fuel, calculation of air quantities by weight and volume required for combustion of fuel, numericals.

Solid fuels: coal and its chemical composition, analysis of coal – proximate and ultimate analysis, importance.

UNIT – IV

High Polymers:

Definition of polymer, degree of polymerization. Thermo plastics and thermo sets. Molecular weight – number average and weight average. Determination of molecular weight of a polymer by viscosity method.

Preparation, properties and uses of plastics (Polyvinyl chloride, Bakelite), fibers (Kevlar, polyurethane), Rubbers – natural rubber and its chemical structure, vulcanization and its significance.

Preparation, properties and uses of silicone rubber, conducting polymers – definition, classification and applications.

UNIT –V

Engineering Materials:

Nano materials – Introduction to nano materials and general applications, basic chemical methods of preparation – Sol-gel and hydrothermal methods.Carbon nanotubes and their applications.

Powder X-ray diffraction- particle size estimation (Scherrers equation)

Composite materials – definition, types of composites, fibre reinforced, glass fibre reinforced and carbon fibre reinforced composites and applications.

Text books:

1. J.C. Kuriacase& J. Rajaram, "Chemistry in engineering and Technology", Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. S.S.Dara&S.S.Umare, "Engineering Chemistry", S.Chandcompany.
3. ShasiChawla, "Text Book of Engineering Chemistry", DhantpatRai Publishing Company, NewDelhi (2008).
4. P.C.Jain and Monica Jain, "Engineering Chemistry", DhanpatRai Pub, Co., New Delhi (2002).
5. Puri& Sharma, "Principles of Physical Chemistry
6. P.R.Vijayasarathi, "Engineering Chemistry" PHI Learning Private Limited, New Delhi (2011).

Suggested Reading:

1. Physical chemistry by P.W.Atkin (ELBS OXFORD PRESS)
2. Physical chemistry by W.J.Moore (Orient Longman)
3. Physical Chemistry by Glasstone
4. Physical Chemistry by T.Engel& Philip Reid, Pearson Publication.
5. Introduction to nano materials by T.Pradeep.

CS 112

STRUCTURED PROGRAMMING
(common to Civil, Mechanical & Production Engg)

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

UNIT-I

Introduction to computers: Hardware Components, Functional block diagram, Operating Systems,Program Development Environments.

Programming languages: System Programming, Application Programming, Low-level, High-level, Classification of Programming languages.

Translators: Compiler, Interpreter, Loader, and Linker.

Number Systems: Representationof Binary, Octal and Hexadecimal Numbers, Conversions, Negative Binary Numbers, Fractional Numbers.

UNIT-II

Problem solving: Algorithm: Key Features of an Algorithm, A Strategy for Designing Algorithms, Tracing an algorithm to Depict Logic, Specification for converting algorithms into programs, Flowchart, Pseudo codes.

Introduction to C Programming: Standardizations, Developing Programs In C, Parts and structure of C Program, character set, Variable, Data types ,Statement, Declaration, Token, Operators and Expressions.

UNIT-III

Control Structures: Test Condition for Selection and Iteration, Conditional Execution and Selection, Iteration and Repetitive Execution, Break, Continue and go to statement, Nested Loops.

Functions: Concept of Functions, Types of functions, Parameter passing techniques, Scope and Extent, Storage Classes, Recursion.

UNIT-IV

Arrays: Declaration, Initialization, Accessing Array Elements, Internal Representation and Variable Length Arrays of One-dimensional Array and Multidimensional Arrays , Passing Arrays to Functions, Searching and Sorting.

Pointers: Address Operator (&),Declaring and Initializing Pointers, Indirection Operator and Dereferencing, Pointer Arithmetic, Pointers to Pointers, Array of Pointers, Pointers to Functions, Dynamic Memory Allocation, Command Line Arguments.

UNIT-V

User-defined Data Types and Variables: Structures , Declaring Structures and Structure Variables, Accessing the members of a Structure , Initialization, Nesting of Structures, Arrays of Structures, Structures and Pointers, Structures and Functions, Union, Enumeration Types

File Processing: Working with Text and Binary Files, Sequential and Random Access File, Files of Records

Text Books:

1. PradipDey and ManasGhosh “Programming in C 2/e” Oxford University Press , 2nd Edition 2011.
2. B. W. Kernighan & D.M. Ritchie, "The 'C' Programming Language” Prentice Hall India, 2nd Edition. 1990.
3. R S Bichkar “Programming with C “University Press, 2012.

Suggested Reading:

1. Rajaraman V. "The Fundamentals of Computers" 4th Edition, Prentice Hall of India, 2006.
2. BehrouzA .Forouzan, Richard F.Gilberg “Computer Science: A Structured Programming Approach using C” Cengage Publishers, 2006.

CE 111

ENGINEERING MECHANICS - 1
(common to all branches)

Instruction	3L + 1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

- To provide fundamental understanding of any anatomy for which Engineering Mechanics forms the basis.
- To understand the concept of force transfer, necessary conditions of equilibrium, significance of friction and geometric properties in statics.
- To equip the students to apply the principles learnt for the analysis of structures and equipments.

UNIT - I

Force Systems: Resolution of coplanar and non-coplanar force systems (both concurrent and non-concurrent), Determining the resultant of all force systems using scalar and vector concepts.Moment of force and its applications.

UNIT – II

Equilibrium of Force System: Free body diagrams, equations of equilibrium of planar force systems. Equilibrium of spatial force systems.

UNIT – III

Theory of Friction: Introduction,types of friction, laws of friction, application of friction to a single body & connecting systems. Wedge and belt friction.

UNIT – IV

Centroids: Significance of centroids, moment of area, centroids of line elements, plane areas, composite areas, theorems of Pappus& its applications.

UNIT – V

Area Moment of Inertia: Definition, polar moment of Inertia, radius of gyration, transfer theorem, moment of Inertia of plane & composite areas, product of inertia, transfer formula for product of inertia.

Text Books:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, *Singer's Engineering Mechanics*, BS Publications, Hyderabad, 2011.
2. Ferdinand L Singer,*Engineering Mechanics*,Harper and Collins, Singapore, 1904.

Suggested Reading:

1. A. Nelson, *Engineering Mechanics*, Tata McGraw Hill, New Delhi, 2010.
2. S. Rajashekaran& G. Sankarasubramanyam, *Engineering Mechanics*,Vikas publications, Hyderabad, 2002.
3. S.B. Junarkar and H.J Shah, *Applied Mechanics***,** Charotar publishers, New Delhi, 2001.
4. Basudeb Bhattacharyya, *Engineering Mechanics*, Oxford University Press, New Delhi, 2008.
5. K.L Kumar &Veenu Kumar, *Engineering Mechanics*, Tata McGraw Hill, New Delhi, 2011.

ME 111N

ENGINEERING GRAPHICS - I
(common to Civil, Mechanical & Production Engg)

Instruction	6D Periods per week
Duration of Mid term Examination	90 minutes
Duration of University Examination	3 Hours
University Examination	100 Marks
Sessionals	50 Marks
Credits	4

Course Objectives:

1. To equip the students with the inputs of Engineering drawing required for technical communication
2. To act as a pre-requisite for Engineering Graphics-II
3. To provide the basics required for Machine Drawing/ Production Drawing/ Building drawing

Course Outcomes:

1. To understand theory of projections
2. Ability to improve visualization skills
3. Ability to sketch Engineering Objects

UNIT-I

Introduction: Instruments and their uses, Lettering and dimensioning.
Simple Geometric Constructions: Construction of Regular polygons given length of the side.

UNIT-II

Conic sections: ellipse, parabola and hyperbola by different methods.
Engineering curves: Cycloid, Epicycloid and Hypocycloid.

UNIT-III

Projection of points and straight lines: Orthographic projection, projection of points placed in different quadrants. Projection of straight lines inclined to one and both the reference planes. Traces

UNIT-IV

Projection of planes: projection of perpendicular planes, oblique planes and Traces of planes.

UNIT-V

Projection of Solids: Polyhedra, solids of revolution, projection of solids with axis inclined to one and both the reference planes.

Text Books:

1. N.D.Bhatt," Elementary Engineering Drawing", Charotar Publishers, 2012
2. Basanth Agrawal and C M Agrawal "Engineering Drawing 2e ", McGraw-Hill Education(India) Pvt. Ltd.

Suggested Reading:

1. K.L.Narayana and P.K.Kannaiah, "Text Book of Engineering Drawing", Scitech Publications, 2011
2. P.S.Gill' "Engineering Graphics", Kataria Publications, 2011.
3. K.Veenugopal, "Engineering Drawing and Graphics + Autocad", New Age International Pvt.Ltd, 2011
4. Shaw M.B and Rana B.C., "Engineering drawing", Pearson, 2nd edition, 2009
5. P I Varghees, " Engineering Graphics ",Tata McGraw-Hill publications, 2013
6. Bhattacharya. B, "Engineering Graphics", I. K. International Pvt.Ltd, 2009
7. Dhawan R.K., "Principles of Engineering Graphics and Drawing", S. Chand 2011

EG 112

ENGLISH LANGUAGE LABORATORY – I
(common to all branches)

Instruction	2 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	1

Comuter Assisted Language Learning Lab (CALL)

Introduction:
The language lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.
The following are the **objectives** of the course:

1. To make students recognize the sounds of English through audio – visual aids and computer software.
2. To help them overcome their inhibitions and self consciousness while speaking in English and to build their confidence. The focus shall be on fluency rather than accuracy.
3. To enable them to speak English correctly with focus on stress and intonation.
4. To expose the students to a variety of self instructional, learner friendly modes of communication.

Syllabus:
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. Aspects of connected speech: Strong forms, weak forms, contracted forms, elision.

Interactive Communication Skills Lab (ICS LAB)

Introduction:

The objective of the course is to enrich interpretation skills, problem solving skills, interpersonal skills, analytical skills and leadership skills of the students, the most essential requirement of communication skills for Engineering students. The course lays emphasis on the language integrated skills in simple and comprehensive manner.
The following are the **objectives** of the course:

1. To expose the students to a team environment and how best one works with teams while adapting themselves to a corporate environment and to make business presentations.
2. Use proper body language expressions in presentation and speeches.
3. Depict situations in the dialogue that are relevant and useful to the learner, retain the truth value in the dialogue.
4. Public speaking is to be shown in action by incorporating narrative examples and extracts from speeches relating directly to students actual life experiences.

Syllabus:

1. Situational dialogues &role plays.
2. Group discussions: Objectives of a GD, types of GD's, initiating, continuing and concluding of GD.
3. Public speaking: Advantages of public speaking, essentials of an effective speech,rehearsal techniques, planning and delivering speeches.

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. KavitaTyagi and Padma Misra. **Professional Communication**, PHI Learning Pvt Ltd, 2011
4. J Sethi et al. **A Practical Course in English Pronunciation** (with CD), Prentice Hall India, 2005.
5. Meenakshi Raman and Sangeeta Sharma**. Technical Communication**, Oxford Universuty Press 2009.

PY 114

ENGINEERING PHYSICS LAB - I
(common to all branches except Chemical Engg)

Instruction	3 Periods per alternate week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

1. Error Analysis – Estimation of errors in the determination of time period of a torsional pendulum
2. Newton's Rings – Determination of wavelength of given monochromatic source
3. Single Slit Diffraction – Determination of wavelength of given monochromatic source
4. Diffraction Grating – Determination of wavelengths of two yellow lines of mercury light
5. Malus's Law– Verification of Malus's law
6. Double Refraction – Determination of refractive indices of O-ray and E-ray of given calcite crystal
7. Polarimeter– Determination of specific rotation of glucose
8. Laser – Determination of wavelength of given semiconductor red laser
9. Fibre Optics – Determination of NA and power losses of given optical fibre
10. Recording & Reconstruction of Hologram

CY 114

ENGINEERING CHEMISTRY LAB - I
(common to all branches except Chemical Engg & Bio-Tech)

Instruction	3 Periods per alternate week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To impart fundamental knowledge in handling the equipment/glassware and chemicals in the chemistry laboratory.
2. To offer hands on experience on the basic equipment related to engineering chemistry.
3. For practical understanding of theoretical concepts of chemistry

I. Volumetric Analysis:

1. Introduction to volumetric analysis and Techniques of weighing and usage of analytical balance.
2. Estimation of amount of ferrous ion using $K_2Cr_2O_7$ solution.
3. Estimation of Carbonate and Bicarbonate in the given solution using HCL (Link) Solution

II. Kinetics:

4. Hydrolysis of methyl acetate in acidic medium.

III. Organic Polymers:

5. Preparation of urea – formaldehyde / phenol- formaldehyde resin.

IV. Instrumental Chemical Analysis:

i) **Conductometric Titrations:**

6.Strong acid vs strong base.

7. Mixture of strong acid and weak acid vs strong base.

ii) Colorimetry:

8. Determination of concentration of given $K_2Cr_2O_7$ solution.
9. Determination of concentration of given $KMnO_4$ solution.
10. Determination of viscosity of sample oil by Redwood viscometer.

Text Books:

1. Vogel's text book of quantitative chemical analysis by J.Mendham and Thomas, Person education Pvt.Ltd.New Delhi 6th ed.2002.
2. Senior practical physical chemistry by BD Khosla, A.Ghulati, VC.Garg; R.Chand and CD; NewDelhi 10th edition.
3. Laboratory manual in engineering chemistry by S.K.Bhasin and Sudha Rani; DhanpathRai Publishing company.

CS 114

PROGRAMMING LAB - I
(common to all branches except Chemical Engg)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

1. Identify the hardware components, assembling of computers.
2. Basic of OS commands, Installation of OS (Linux, DOS and XP).
3. Familiarization of Editors.
4. Sin x and Cos x values using Series expansion.
5. Demonstration of switch case (menu driven).
6. Demonstration of Parameter passing in Functions.
7. Demonstration of Functions using Recursion.
7. Program to count No of lines, characters, blanks, tab and special characters.
8. Demonstration of arrays
    i) Search-Linear
    ii) Sorting-Bubble, Selection
    iii) Operations on Matrix
9. Generation of address labels using structures.
10. Implementation of string manipulation operations with and without library function.
11. Sequential file operations.
12. Random Access File Operations.

ME 113

WORKSHOP- I
(common to Civil, Mechanical& Production Engg)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Trades For Practice

1. **Fitting**	2. **Tin smithy**	3. **Plumbing**

Exercises in Fitting

1. To make a perfect rectangular MS flat
2. To do parallel cuts using Hack saw
3. To drill a hole and tap it
4. To make male and female fitting using MS flats-Assembly1
5. To make male and female fitting using MS flats-Assembly2

Exercises in Tin smithy

1. To make a square tray from the given sheet metal.
2. To make a rectangular box from the given sheet metal with base and top open. Solder the corners.
3. To make a scoop.
4. To make a dust pan from the given sheet metal.
5. To make a pamphlet box.

Exercises in Plumbing

1. To make external threads for GI pipes using dies.
2. To connect the GI pipes as per the given diagram using taps, couplings & bends.
3. To connect the GI pipes as per the given diagram using, couplings, unions, reducer & bends.
4. To connect the GI pipes as per the given diagram using shower, tap & valves
5. Demonstration of above exercise by giving water connection.

Demonstration of BOSCH tools.

Note: A minimum of 12 exercises from the above need to be done

With effect from academic year 2013-14

EG 121

ENGLISH – II
(common to all branches)

Instruction	2L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

- To understand the difference between oral and written communication, interpersonal and intrapersonal communication
- To acquaint the students with the process of technical writing through different types of reports and information transfer.
- To enhance the different sub- skills of reading through skimming and scanning.
- To enhance imaginative, creative and critical thinking through literary texts.
- To help students develop their Presentation skills through AV aids and different aspects of body language.

UNIT- I

Effective communication: Intrapersonal communication, Interpersonal communication, Dyadic Communication, One way versus two way communication and Johari Window.

UNIT- II

Grammar Practice: Common errors in English ad, Punctuation.

Vocabulary Enhancement:

Indian and American usage, Words often misspelt, Prefixes & Suffixes, technical vocabulary

Prose: Muthyala Raju Revu: An Engineer Turned IAS Officer.

UNIT- III

Writing Skills: Reports, Technical Report Writing, Information transfer: Flow charts, piecharts, graphs and scientific papers

UNIT- IV

Reading comprehension – Unknown passages, Skimming and Scanning, intensive reading and critical analysis.

Prose: R. Madhavan : Engineering to Farming

UNIT- V

Soft Skills: Presentation skills – Rubrics, use of AV aids and making of a Power Point Presentation, Body Language. Leadership skills and Team Building.

Text Books:

1. "Essential English"- E Suresh Kumar et al**.**(Orient Black Swan PVT Ltd.)
2. "Communication Skills and Soft Skills: An Integrated Approach"- E Suresh Kumar et al**. (**Pearson Publications)

Suggested Reading:

1. " High School English Grammar & Composition" – Wren and Martin (S.Chand)
2. "ABC of Common Grammatical Errors" – Nigel D Turton (Macmillan)
3. "Communication Skills & Soft Skills" – An Integrated approach – E Suresh Kumar (Pearson)
4. "Examine your English" – Margaret M Maison (Orient Longman)
5. "Professional Presentation" – Malcolm Goodale (Cambridge University Press)
6. "English Grammar at alance" – M. Gnanamurali (S. Chand)
7. "Business Communication & Soft skills" (Lab Manual) – D. Sudha Rani (Pearson)
8. "A Course Book in English" – K.R. Lakshminarayan (SciTech Publication)
9. "Effective Technical Communication" – M. Ashraf Rizvi (Tata- McGraw Hill)

With effect from academic year 2013-14

MT 121

MATHEMATICS – II
(common to all branches except Bio-Tech)

Instruction	3L + 1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

UNIT- I

Ordinary differential Equations: Exact Differential equations (integrating Factors) Applications differential equations-Orthogonal trajectories-Problems on oscillatory electrical circuits (LC and LCR circuits). Linear Differential equations of higher order with constant coefficients, complementary function and particular integrals when RHS is of the forms e^{ax}, sinax, cosax, x^m, $e^{ax}(v)$, $x^m(v)$, where v-is a function of 'x', Legender's and Cauchy's form of Homogeneous equations.

UNIT- II

Laplace Transforms: Definition of integral transform, domain of the function and kernel of the Laplace transforms. Existence of Laplace transforms. Properties- Laplace transforms of standard functions, Laplace transforms of piecewise continuous functions, first and second shifting theorems, multiplication by 't', division by 't'. Laplace transforms of derivatives and integrals of functions-Unit step function- Periodic functions (without proofs). Inverse Laplace transforms-by partial fractions (Heaviside method), Residue method-Convolution Theorem. Solving Ordinary differential equations by Laplace Transforms

UNIT- III

Series solution of Differential equations: Introduction-ordinary and singular points of an equation-power series solution- Solution of Legender equation (without proof)- Legendre polynomials-Rodrigue'sformula-Generating function of Legender polynomials-Recurrence relations- orthogonal property.

UNIT- IV

Vector Differentiation: Scalar and vector fields- directional derivative- Gradient of a scalar-Divergence and Curl of a vector point function. Properties of divergence, curl - vector identities. Solenoidal and Irrotational vectors.

UNIT-V

Vector Integration: Vector Line integrals, surface integrals and volume integrals
Greens Theorem, Gauss divergence Theorem and Stokes theorem (without proofs)
Applications of Integration-problems based on verification and evaluation using the above theorems (for cube, rectangular parallelepiped, sphere, cylinder)

Text Books:

1. Advanced Engineering by Kreyszig, John Wiley & Sons -Publishers.
2. Mathematical Methods of Science & Engg, Aided with MATLAB, Kanti.B.Datta. Cengage Learning India Pvt.Ltd.

3. Mathematics for Engineers and Scientists by Alen Jaffery , 6th ed 2013 CRC press,Taylor & Francis Group. (Elsevier)
4. Advanced Engineering Mathematics by Michael Greenburg, Second Edition –Pearson Education.

Suggested Reading: (for further reading and examples on applications)

1. Mathematics for Engineers-a modern interactive approach by A.Craft and Robert Davison-Willey
2. Applied Mathematics and physicists by Loius Pipes-Mc Graw Hill pubulishers.
3. Advanced Engineering Mathematics by R.K.Jain & S.R.K.Iyenger, 3rd edition, Narosa Publications
4. Matrices for Engineering Dynamics by AR Collar and A. Simpson-John Willey & sons
5. Essential Mathematics for Engineers by W.Bolton-Betterworth and Heineman
6. Mathematical for Physicists and Engineers- L F Landoviz, Publishers- Rienfold Book Corporation.
7. Higher Engineering Mathematics by B.S.Grewal, Khanna Publishers.
8. Engineering Mathematics by B.V.Ramana
9. Calculus by Smith and Minton
10. Applications of Linear Algebra by David.C Lay

With effect from academic year 2013-14

PY 121

ENGINEERING PHYSICS - II
(common to Civil, Mechanical & Production Engg)

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Unit – I

Elements of Quantum Mechanics:

Introduction – Dual nature of light – de Broglie's hypothesis – Expression for de Broglie's wave length – Heisenberg's uncertainty principle and its illustration (diffraction of a beam of electron at a slit) – Schrödinger time independent and time dependent wave equations – Interpretation of wave function – Infinite square well potential (particle in a box) – Potential step – Potential barrier (qualitative) – Tunneling effect.

Unit – II

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 cubic crystals by powder diffraction method.

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

Unit – III

Magnetic Materials: 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.

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

Unit – IV

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

Thin Films: Distinction between bulk, thin and nanofilms – Thin film preparation techniques – Physical vapor deposition (PVD) techniques – Thermal evaporation – Electron beam evaporation – Pulsed laser deposition – Applications of thin films – Solar cell – Gas sensor.

Unit – V

Nanomaterials: Zero dimensional materials – Properties of materials at reduced size – Surface to volume ratio – Quantum confinement – Preparation of nanomaterials – Bottom-up methods: Sol-gel, Sputtering and Chemical vapor deposition (CVD) – Top-down methods: Ball milling – Elementary ideas of carbon nanotubes – Applications.

Techniques for Characterization of Materials: Principles of X-ray fluorescence – Auger (OJ) process – Atomic force microscopy – Electron microscopy (SEM and TEM).

TEXT BOOKS AND SUGGESTD READING:

1. S.L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011
2. M.N. Avadhanulu and P.G. Kshirsagar, *A Text Book Engineering Physics*, S. Chand Publications, 2014
3. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications S. Chand Publications, 2005
4. M. Arumugam, *Materials Science*, Anuradha Publications, 2002.
5. Satyaprakash and Agarwal, *Statistical mechanics*, Kedannath Publications
6. V. Rajendran, *Engineering Physics*, McGahill Education Publications, 2013
7. P.K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012
8. Hitendra K Malik and A.K. Singh, *Engineering Physics*, Tata McGahill Education Publications, 2011

With effect from academic year 2013-14

CY 121

ENGINEERING CHEMISTRY - II
(common to all branches except Chemical Engg & Bio-Tech)

Instruction	3L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

The syllabus has sought to fulfill the objective of making the student of engineering and technology realize that chemistry like other subjects is the real base of his profession and that therefore he must have a good understanding of chemistry before he can use it in his profession. The various units of the syllabus is so designed to fulfill the following objectives.

1. Thermodynamics and Electrochemistry units give conceptual knowledge about spontaneous processes and how can they be harnessed for producing electrical energy and efficiency of systems. It also includes the devices used for electrical energy storage and captive generation and tapping it as and when required.
2. Newer materials lead to discovering of technologies in strategic areas like defense and space research. Recently modern materials synthesized find applications in industry and creating instruments for solving problems of electronics, telecommunications, health care, agriculture, and technology etc., Inorder to emphasize the above the topics like composite materials, polymers, conducting polymers and nano materials have been incorporated in the curriculum.
3. Knowledge to prevent corrosion of machinery and metallic materials and water chemistry which require serious attention in view of increasing pollution has been included in the syllabus.
4. Fuels have been taught with a view to give awareness as to materials which can be used as sources of energy and fuel cells which are the alternate energy sources for generating electrical energy on spot and portable applications.
5. To appraise the students about the importance and role of chemistry in the field of Engineering by explaining the relevant topics.
6. To enable students to apply the knowledge acquired in improving the properties of engineering materials.

The engineer who has the above background can effectively manage the materials in his designing applications and discovering and improving the systems for various uses in industry, agriculture, health care, technology, telecommunications, electronics and instruments detecting in advance in natural calamities. The above knowledge also helps students to carry out inter disciplinary research such that the findings benefit the common man.

UNIT – I

Electrochemistry

Introduction, construction of electrochemical cell, sign convention, cell notation, cell emf, SOP and SRP, electrochemical series and its applications

Activity, fugacity, Nernst equation and applications, numericals

Types of Electrodes – Standard Hydrogen Electrode, Saturated Calomel Electrode, Quinhydrone electrode and Ion selective electrode (Glass electrode), construction

UNIT – II

Corrosion Science

Introduction, causes and effects of corrosion, chemical and electro chemical corrosion, mechanism of electro chemical corrosion

Galvanic corrosion and types of differential aeration corrosion (pitting and waterline corrosion)

Factors affecting corrosion (position of the metals in galvanic series, relative areas of anode and cathode, nature of corrosion product – solubility and volatility of corrosion product, nature of corroding environment – temperature, humidity and P^H).

Corrosion control methods – cathodic protection, sacrificial anodic protection and impressed current cathodic protection.

Protective coatings – Anodic and cathodic coatings

Paints, constituents and their functions

UNIT – III

Water Chemistry

Hardness of water – Types, units of hardness, estimation of temporary and permanent hardness of water by EDTA method, alkalinity of water and its determination

Numericals on hardness and alkalinity

Specifications of potable water, disinfection of water by chlorination, break point chlorination and by ozone treatment

Desalination of water by reverse osmosis and electro dialysis

UNIT – IV

Fuels – II

Liquid fuels, fractional distillation of crude oil, cracking and significance, catalytic cracking by fixed bed cracking, knocking, significance, antiknocking agents (TEL, MTBE), octane number, cetane number, unleaded petrol.

Gaseous fuels, LPG, CNG, composition and uses, automobile exhaust – catalytic converter.

Battery Technology

Types of batteries, Lithium battery and Lithium ion battery, fuel cell – MeOH – Oxygen fuel cell, H_2-O_2 fuel cell Rocket propellants, requirements of a good propellant, classification, solid-liquid propellants with examples. Photo catalysis

UNIT –V

Instrumental Techniques in Chemical Analysis

Principle, method and applications of Conductometry (acid-base titration), Potentiometry (acid-base, redox titration), P^H-metry (acid – base titration), UV, Visible Spectro photometer (Beer-Lambert's Law), examples

Atomic absorption spectroscopy-Principle, instrumentation (Block Diagram only), estimation of Nickel by Atomic absorption spectroscopy

Text Books:

1. J.C. Kuriacase & J. Rajaram, “Chemistry in engineering and Technology”, Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008)
2. S.S.Dara & S.S.Umare, “Engineering Chemistry”, S.Chand company
3. ShasiChawla, “Text Book of Engineering Chemistry”, Dhantpat Rai Publishing Company, NewDelhi (2008)
4. P.C.Jain and Monica Jain, “Engineering Chemistry”, Dhanpat Rai Pub, Co., New Delhi (2002)
5. Puri & Sharma, “Principles of Physical Chemistry
6. P.R.Vijayasarathi, “Engineering Chemistry” PHI Learning Private Limited, New Delhi (2011)

Suggested Reading:

1. Physical chemistry by P.W.Atkin (ELBS OXFORD PRESS)
2. Physical chemistry by W.J.Moore (Orient Longman)
3. Physical Chemistry by Glasstone
4. Physical Chemistry by T.Engel & Philip Reid, Pearson Publication
5. Introduction to nano materials by T. Pradeep

With effect from academic year 2013-14

CS 121

OBJECT ORIENTED PROGRAMMING THROUGH C++
(common to all branches)

Instruction	3L + 1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

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, Function Template.

UNIT- II

Classes and Objects: Defining classes and Member functions, Arrays, Static Members, Friend Functions.

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

UNIT - III

C++ operator overloading: Fundamentals, restrictions, overloading unary / binary operators, overloading ++ and --, Manipulation of Strings.

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

UNIT- IV

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

C++ Stream Input/Output: Streams, Stream classes, Formatted and Unformatted operations, Manipulators.

Files: Classes for file Stream operations, Sequential and Random access operations, Command line Arguments

UNIT-V

C++ Templates: Introduction, class templates, member function template, overloading template functions.

C++ Exception Handling: Try, throw, catch.

Suggested Reading:

1. E. Balagurusamy "Object Oriented Programming with C++" , McGraw-Hill Education (India), 6 th Edition 2013

2. Bjarne Stroustrup “The C++ Programming Language”, Pearson Education, 5th Edition (2013)
3. Robert Lafore **“**Object-Oriented Programming in C++ “ Fourth Edition Sams Publishing,2002

With effect from academic year 2013-14

CE 121

ENGINEERING MECHANICS - II
(common to Civil, Mechanical & Production Engg)

Instruction	3L + 1T Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

- To know the basic concepts of dynamics and analysis as a particle and rigid body.
- To understand the work energy principle, impulse momentum and their application.
- To understand the concepts of simple harmonic motion and free vibrations.

UNIT – I

Centers of Gravity: Centers of Gravity of solid & composite bodies.

Mass Moment of Inertia: Moment of Inertia of masses, transfer formula and moment of inertia of composite bodies.

UNIT – II

Kinematics: Rectilinear and curvilinear translation, fixed axis rotation, analysis as a particle and rigid body.

Kinetics: Analysis as a particle and rigid body in translation and fixed axis rotation.

UNIT – III

Work Energy Method: Equation of work energy for translation and fixed axis rotation, work energy principles applied to particle motion, connected systems.

UNIT – IV

Impulse and Momentum: Introduction, linear impulse momentum, principle of conservation of linear momentum, elastic impact and types of impacts, coefficient of restitution.

UNIT – V

Theory of Vibrations: Introduction, definitions, concepts, simple harmonic motion, free vibrations, simple pendulum, natural frequency & compound pendulum.

Text Books:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, *Singer's Engineering Mechanics*, BS Publications, Hyderabad, 2011.
2. Ferdinand L Singer, *Engineering Mechanics,* Harper and Collins, Singapore, 1904.

Suggested Reading:

1. A. Nelson, *Engineering Mechanics*, Tata McGraw Hill, New Delhi, 2010.
2. S. Rajashekaran & G. Sankarasubramanyam, *Engineering Mechanics,* Vikas publications, Hyderabad, 2002.
3. S.B. Junarkar and H.J Shah, *Applied Mechanics***,** Charotar publishers, New Delhi, 2001.

4. Basudeb Bhattacharyya, *Engineering Mechanics,* Oxford University Press, New Delhi, 2008.
5. K.L Kumar & Veenu Kumar, *Engineering Mechanics,* Tata McGraw Hill, New Delhi, 2011.

With effect from academic year 2013-14

ME 121

ENGINEERING GRAPHICS - II
(common to Civil, Mechanical & Production Engg)

Instruction	6D Periods per week
Duration of Mid term Examination	90 minutes
Duration of University Examination	3 Hours
University Examination	100 Marks
Sessionals	50 Marks
Credits	4

Course Objectives:

1. To equip the students with the inputs of Engineering drawing required for technical communication
2. To provide the basics required for Machine Drawing/ Production Drawing/ Building drawing

Learning Outcome:

The student should be able to

1. Interpret the principles of development of surfaces and intersection of surfaces
2. Interpret and draw isometric projection and perceptive view of a single engineering component

UNIT-I

Development Of Surfaces: Basic concepts of development of surfaces, Methods of development: parallel line development and radial line development. Development of prisms, Pyramids, Cylinders and Cones.

UNIT-II

Intersection Of Surfaces: Intersection of cylinder to cylinder, Cylinder to Cone, axis perpendicular and inclined with and without offset.

UNIT-III

Isometric Projections : isometric projections and views of prisms, pyramids, cones and cylinders, and combination of two or three solids.

UNIT-IV

Conversion Of Pictorial To Orthographic Views: Introduction, Procedure for preparing a scale drawing.

UNIT-V

Prospective Views : Perspective views of straight lines, plane figures (Triangle, square, Pentagon , Hexagon and circle.) and simple solids (Cylinder, Cone, Regular Prism, Regular Pyramid) using visual ray methods and vanishing point method.

Text Books:

1. N.D.Bhatt," Elementary Engineering Drawing", Charotar Publishers, 2012.
2. Dhananjay A Jolhe, Engineering Graphics" , Tata McGraw-Hill publications, 2012

Suggested Reading:

1. K.L.Narayana and P.K.Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.
2. Basanth Agrawal and C M Agrawal “Engineering Drawing 2e “, McGraw-Hill Education(India) Pvt. Ltd.
3. P.S.Gill, “Engineering Graphics”, Kataria Publications, 2011.
4. Kulkarni, D.M., Engineering graphics with AUTOCAD, PHI 2011
5. Bhattacharya. B, “Engineering Graphics”, I. K. International Pvt.Ltd, 2009
6. Dhawan R.K., “Principles of Engineering Graphics and Drawing”, S. Chand 2011.

EG 122

ENGLISH LANGUAGE LABORATORY - II
(Common to all branches)

Instruction	2 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	1

COMPUTER ASSISTED LANUAGE LEARNING LAB (CALL)

Introduction:
The language lab focuses on the practice of connected speech and word stress. They are also introduced to the process of Listening.
The following are the objectives of the course

1. To recognize and be familiar with word stress and identify stress patterns.
2. To develop awareness of rhythm and notion of stress time
3. Listen effectively in a variety of situations for a variety of purposes, practice the behavior of effective active listeners
4. Assess strength in listening and set goals for the future.

SYLLABUS:

1. Word stress: Primary stress, secondary stress, functional stress, rules of word stress.
2. Rhythm & Intonation: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications
3. Aspects of connected speech: Strong forms, weak forms, contracted forms, elision.
4. Listening skills

INTERACTIVE COUNICATION SKILLS LAB (ICS LAB)

Introduction:

The objective of the course is to introduce them to the art of making effective presentations. They also learn do debate, the interview process and interview skills
The following are the **Objectives** of the course:

1. To enable students to express themselves fluently and appropriately in social and professional contexts
2. To provide techniques for preparing and delivering a presentation
3. Practicing interview skills via an interpersonal encounter similar to real life situation
4. To understand and communicate various forms of argument effectively, to develop the ability to analyze, evaluate, construct and refute arguments.

SYLLABUS:

1. Debate differences between a debate and group discussion. Essentials of a debate, conducting a debate.
2. Presentation Skills: Making effective presentations, expressions which can be used in presentation, use of non-verbal communication, coping with stage fright, handling question and answer session; use of audio-visual aids, Power point presentations.

3. Interview skills: Planning and preparing for interviews, facing interviews confidently, use of suitable expression during interview

Suggested Reading

1. E. Suresh Kumar et al, English for success (with CD), Cambridge University Press India Pvt. Ltd.2010
2. T. Balasubramanian. A Text book of English Phonetics for Indian Students, Macmillan, 2008
3. J Sethi et al. A Practical Course in English Pronunciation (with CD), Prentice Hall ndia, 2005.
4. Edgar Thorpe, Winning at Interviews, Pearso Education, 2006.
5. Priyadarshi Patnaik, Group Discussions and Interviews, Cambridge University Press Pvt. Ltd. 2011

PY 125

ENGINEERING PHYSISS LAB - II
(Common to all branches except Biotech)

Instruction	3 Periods per alternate week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

1. Plank's constant – Determination of Planck's Constant using photo cell
2. Solar Cell – Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistence
3. Hall Effect – Determination of Hall coefficient, carrier concentration & mobility of charge carriers of given semiconductor specimen
4. P-N Junction Diode – Study V-I characteristics and calculation of resistance of given diode in forward and reverse bias
5. B-H Curve-Determination of hysteresis loss given specimen
6. Dielectric Constant – Determination dielectric constant of given PZT sample at phase transition temperature
7. Energy gap – Determination of energy gap of given semiconductor
8. Thermistor – Determinaiton of temperature coefficient of resistance of given thermistor
9. e/m of Electron by Thomson's Method
10. Thermoelectric Power – Determinaiton of thermoelectric power of given sample

CY 123

ENGINEERING CHEMISTRY LAB - II
(Common to all branches except Chemical and Bio-Tech)

Instruction	3 Periods per alternate week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. To fundamental knowledge in handling the equipment/glassware and chemicals in the chemistry laboratory.
2. To offer hands on experience on the basic equipment related to engineering chemistry
3. For practical understanding of theoretical concepts of chemistry

I. Volumetric Analysis

1. Estimation of amount of copper ion using hypo solution
2. To find out saponification number of oil

II. Complexometry

3. Estimation of permanent and temporary hardness of water using EDTA solution
4. Ore nalysis –estimation of Mno_2 in pyrolusite

III. Organic Preparations

5. Preparation of aspirin
6. Preparation of azodye

IV Instrumental Chemical Analysis

Potentiometric Titrations

7. Strong acid vs strong base
8. Redox titration (estimation of Fe^{+2} using $KMnO_4$ solutions)

pH metric titration

Strong acid vs strong base

Polarimetry

Specific rotation of sucrose and inversion of sucrose

Suggested Reading

1. Vogel's text book of quantitative chemical analysis by J. Mendham & Thomas, Pearson education Pvt Ltd New Delhi, 6^{th} ed. 2002
2. Senior practical physical chemistry by BD Khosla, A. Ghulta, VC Garg, R. Chand and CD; New Delhi 10^{th} ed 2002.
3. Laboratory manual in engineering chemistry by S.. Bhanin and Sudha Rani, Dhanpath Rai pub., Co.,

CS 122

PROGRAMMING LAB - II
(Common to all branches)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

1. Program to implement function overloading
2. Program to implement function template
3. Program to implement types of constructions and destructor
4. Program to implement new and delete operators (Dynamic memory allocation)
5. Program to implement unary operator overloading
6. Creation of inheritance hierarchy for graphic shapes
7. Implementation of runtime polymorphism
8. Classes for Bank Account, Student information, Library catalog
9. Implementation of Streams
10. Implementation of Template Classes

ME 123

WORKSHOP - II
(Common to Civil, Mechanical & Production Engg)

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	2

1. Carpentry	2. Welding	3. House Wiring

Exercises in Carpentry

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

Exercises in Welding

1. To make a butt joint using arc welding on the given MS work pieces
2. To make a lap joint using arc welding on the given MS work pieces
3. To make a Tee fillet joint using arc welding on the given MS work pieces
4. To make a corner joint using arc welding on the given MS work pieces
5. To join two thin sheets of GI material using electric resistance welding

Exercises in House wiring

1. Wiring of one light point controlled by one single pole switch, a 3-pin socket controlled by a single pole switch and wiring of one buzzer controlled by a bell push
2. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs
3. Wiring of two light points connected in parallel from two single pole switches and a 3-pin socket.
4. Staircase wiring-wiring of one light point controlled from two different places independently using two 2-way switches
5. Go-down wiring

Demonstration of BOSCH tools

Note: A minimum of 12 exercises from the above need to be done

Chaitanya Bharathi Institute of Technology (Autonomous)
Department of Mechanical Engineering
SCHEME OF INSTRUCTION & EXAMINATION

B.E. II-Year (Mechanical Engineering)

I-Semester

THEORY										
S.No	Syllabus Ref.No	SUBJECT	Scheme of Instruction Per week				Scheme of Examination			Credits
			L	T	D	Lab	Duration in Hrs	Maximum Marks		
								University exam	Sessional	
1	MT 211	Fourier Analysis & Partial Differential Equations	4	-	-	-	3	75	25	3
2	ME 211	Material Science & Metallurgy	4	-	-	-	3	75	25	3
3	ME 212	Machine Drawing	-	-	6	-	6	75	25	4
4	ME 213	Mechanics of Materials	4	-	-	-	3	75	25	3
5	CE 112	Environmental Studies	3	1	-		3	75	25	3
6	MB 214	Managerial Economics & Accountancy	4	-	-	-	3	75	25	3
PRACTICALS										
1	ME 214	Material Science & Metallurgy Lab	-	-	-	3	3	50	25	2
2	ME 215	Computer Drafting Lab	-	-	-	3	-	-	25	1
3	ME 216	Mechanics of Materials Lab	-	-	-	3	3	50	25	2
		TOTAL	19	1	6	9	-	550	225	24

Service Course [B.E]

			Branch	Scheme of Instruction Per week				Scheme of Examination			Credits
				L	T	D	Lab	Duration in Hrs	Maximum Marks		
									University exam	Sessional	
1	ME 217	Elements of Mech. ENGG.	ECE	4	-	-	-	3	75	25	3
2	ME 218	Principles of Mech. Engg.	EEE	4	-	-	-	3	75	25	3

Service Course [B.Tech]

			Branch	Scheme of Instruction Per week				Scheme of Examination			Credits
				L	T	D	Lab	Duration in Hrs	Maximum Marks		
									University exam	Sessional	

1	ME 219/ EE 216	Basics of Mechanical and Electrical Engineering	Chem. Engg.	2	-	-	-	1.5	38	12	1.5
2	ME 210/ EE 218	Mechanical & Electrical Engineering Lab	Chem	-	--	- -	3	1.5	25	13	1

MT 211

FOURIER ANALYSIS AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to all branches except Biotech)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. Introduce the concepts of Fourier analysis & z-transforms in engineering applications.
2. Introduction of boundary value problems and their applications in Heat Transfer and wave propagation.

Course Outcomes:

1. Students must be able to apply mathematical concepts of Fourier series, Fourier Transforms in solving one dimensional wave equation, Heat equation and the two dimensional Laplace equations.

UNIT– I

Fourier series: Dirichlet's conditions - expansion of a given function in Fourier series. Expansion of even and odd functions in Fourier series. Change of interval, half range sine and cosine series. Complex form of Fourier series.

UNIT– II

Fourier Transforms: Fourier integral (statement only)-Fourier transform, Inverse Fourier transform, Fourier sine and cosine transform, definitions and properties.

UNIT– III

Partial differential equations:

Formation of Partial differential equations by elimination of arbitrary constants and by elimination of arbitrary functions. Partial differential equations of First Order- Lagrange's Linear equation and its solution. Partial differential equations of First order but of any degree-Standard types: I- $f(p,q) = 0$, $II - f(z,p,q) = 0$, III- $f(x,p) = f(y,q)$ and IV- $z = px + qy + f(p,q)$ General Method of solution: Two independent variables-Charpit's Method-three or more independent variables Jacobi's method.

UNIT– IV

Applications of Partial differential equations:

Solutions of Partial differential equations by the method of separation of variables- boundary value problems. One dimensional Wave equation, one dimensional Heat equation- related problems. Laplace equation.

UNIT – V

Z- Transforms: Introduction, Basic theory of Z-transforms. Z-transforms of some standard sequences, Existence of z-transform. Properties of z-transforms: Linearity, Translation, scaling properties. Initial and final value theorems. Differentiation of
Z-transforms, convolution theorem, Solution of difference equations using Z-transforms.

Text Books:

1. Kanti B Datta "Mathematical Methods of Science and Engineering (Aided with MATLAB)" CENGAGE Learning.
2. B.S.Grewal "Higher Engineering Mathematics", Khanna Publishers 42nd Edition.2013
3. M.D.Raisinghania , Text Book of ODE and PDE , S.Chand publishers 4th -2012

MATERIAL SCIENCE AND METALLURGY

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Enable the student to understand structure property relations, analyze the failures of metals and their prevention
2. To broad understanding of phase diagrams,
3. Student will acquire basic knowledge in various heat treatment operations, their purpose and applications
4. Student is exposed to various methods of extractive metallurgy techniques

Course Outcomes:

1. Know the fundamental science and engineering principles relevant to material
2. Suggest appropriate physical metallurgy methods (phase diagrams)
3. The type of heat treatment operation to be given to any metal in order to improve desire mechanical properties
4. Basic ability to plan an extraction process for given ore.

UNIT–I

Imperfections in crystals, dislocation in crystals, types of dislocations, critical resolved shear stress, effect of slip and twinning on the plastic deformation, Jogs and its effect on yield phenomenon, Hall–Petch equation, Orange peel effect, 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, cumulative fatigue and fatigue damage, experimental determination of fatigue strength (RR–Moore Test), factors to be considered for the improvement of the fatigue life.

Creep: Creep strength, creep curve, creep deformation mechanisms, creep test, differences between creep curve and stress rupture curve.

Diffusion: Fick's law of diffusion, application of diffusion theory in mechanical engineering.

UNIT–III

Structure of Alloys: Construction and interpretation of thermal equilibrium diagram of binary nonferrous alloys, study of eutectic, eutectoid, peritectic peritectoid reactions, iron–iron carbide equilibrium diagram, construction and interpretation.

Types of plain carbon steels, cast iron 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 & brief introduction of age 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, electric arc process, modern steel making process by electric slag refining.

Alloy Steels: Effects of alloying elements like nickel, chromium, manganese, silicon and tungsten, titanium, study about stainless steels, HSS, maraging steels, brass, bronze, muntz metal, invar, duralumin and Ti alloy (Ti–6Al–4V) their composition and properties.

Text Books:

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

Suggested Reading:

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

MACHINE DRAWING

Instruction	6 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	4

Course Objectives

1. Understand drawing and develop capacity to represent any object with the help of sketch .
2. To develop primary knowledge of working drawing.
3. To produce orthographic views of different machine parts.
4. To develop skill to produce assembly drawings from part drawing and vice versa

Course Outcomes

1. To apply knowledge of drawing in preparation of working drawings.
2. To draw missing views as well as to analyze and interpret drawings of machine components.
3. To use the techniques of drawing necessary for engineering practice.
4. Students will be able to apply their knowledge and skills of drawing to start and complete machine components

1. INTRODUCTION:
   Format of drawing sheet, title block, conventions of drawing lines and dimensions, First and third angles projections, convention for sectional views. Orthographic projections including sectional views of simple machine elements.

2. DRAWING OF FASENERS, JOINTS AND COUPLINGS:
   Practices of sketching work: Free hand sketches of typical machine elements for simple cases for riveted and screwed fastening, joints

3. ASSEMPBLY DRAWING:
   Preparation of assembly drawings from given details, Ability to supply additional views, the exercises will be drawings of typical machine parts viz., Connecting rod, Eccentric, Cross head, Stuffing box, Pipe vice, Screw jack, Ram's bottom safety valve, Lathe Tool Post, Tail stock, Revolving centre, Pedestal bearing (Plummer block), Swivel bearing.

Note: The test is for the ability of the student to read and interpret drawing. The drawing should include part list in standard format.

Text Books:

1. N. Siddeshwar, *Machine Drawing*, Tata McGraw Hill Publishing Co., Ltd., 5th edition, 2004.
2. N.D. Bhatt, V.M. Panchel, *Machine Drawing*, Cherotar Publishing house, Anand, New Delhi, 49th edition, 2014

Suggested Reading:

1. K.L. Narayan, P. Kanniah, K. Venkat Reddy, *Machine Drawing*, New Age International (P) Ltd., 2nd 2009.

2. K.C. John, *Text book of Machine Drawing*, PHI Learning, 2010.
3. Ajeet Singh, *Machine Drawing*, Galgotia Publications, 2010

ME 213 WITH EFFECT FROM THE ACADEMIC YEAR 2014-2015

MECHANICS OF MATERIALS

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Student is exposed to the concept of various types of stresses and strains
2. Student will acquire knowledge in drawing bending and shear force diagrams for various loads
3. Student is exposed to the concept of deflections for various configurations of the beams
4. Student will acquire knowledge in estimating stresses for thin and thick cylinders

Course Outcomes:

1. Basic knowledge in mechanics of material will be useful for future courses like buckling of columns, design of bridges and dams, design of sections for rails.
2. Student will use the knowledge of mechanics of materials for finite element analysis.
3. Student will demonstrate this knowledge in estimating the deflections of beams of various configurations.
4. Student use the knowledge of mechanics of materials in design of pressure vessels.

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

Shear force and bending moment: 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

Deflection of beams: Slope and deflections measurements of cantilever, simply supported beams with Macaulay's and double integration methods subjected to point loads and uniformly distributed loads.

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

UNIT–IV

Shear Stresses in beams: Distribution of shear stresses in rectangular, I- section and T-section for solid and hollow 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. Hoop and longitudinal stresses in cylinders.

Columns and struts: Euler and Rankine formulae for axial load applications. Secant and Perry formulae for eccentrically loaded columns.

Text Books:

1. D.S. Prakash Rao, Strength of Materials A Practical Approach, Universities Press, Hyderabad, 1999.
2. S. Ramamrutham, Strength of Materials, Dhanpat Rai & Sons, 1993.

Reference Books:

1. S.S. Bhavakatti, Strength of Materials, Vikas Publication, 2003.
2. B.C. Punmia, Strength of Materials and Theory of Structures, Laxmi Pub., 1992
3. G.H. Ryder, Strength of Materials, Third Edition in SI units, Macmillan India Limited, Delhi, 2002.

ENVIRONMENTAL STUDIES

Instruction	3L + 1T periods per week
Duration of University Examination	3 hours
University Examinations	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To equip the students with inputs on the environment, natural resources, ecosystems and Bio-diversity.
2. To enable the students become aware of environmental pollutions, causes, effects and control measures.
3. 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: Water resources, use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Effects of modern agriculture, fertilizer pesticide problems, water logging salinity. Energy resources: growing energy needs, renewable and non-renewable energy sources. Land resources; land as a resource, land degradation, soil erosion and desertification.

UNIT – II

Ecosystems: Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT – III

Biodiversity: Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity

UNIT – IV

Environmental Pollution: Cause, effects and control measures of air pollution, water pollution,
soil pollutions, noise pollution, thermal pollution and solid waste management. Environment protection act: Air, water, forest & wild life acts, issues involved in enforcement of environmental legislation.

UNIT – V

Social issues and the environment: Water conservation, watershed management, and environmental ethics. Climate change- global warming, acid rain, ozone layer depletion, Environmental protection act, population explosion

Disaster Management: Types of disasters, impact of disasters on environment, infrastructure and development, Basic principles of disaster mitigation, disaster management, and methodology disaster management cycle and disaster management in India

Text Books:

1. Y. Anjaneyulu, Introduction to Environmental Science, B.S. Publications, 2004
2. S.S.Dara, A Text book of Environmental Chemistry & Pollution Control, S.Chand & Comp. Ltd, 2000.

Suggested Reading:

1. De A.K. Environmental Chemistry, Wiley Eastern Ltd., 1989.
2. Odum E.P. Fundamentals of Ecology, W.B. Saunders Co., USA, 1975.
3. Rao M.N. and Datta A.K., Wastewater treatment, Oxford & IBH publishing Co., 1987.
4. Miller T.G. Jr. Environmental Science, Wordsworth Publishing Co., 1984.
5. Benny Joseph, Environmental Studies, Tata Mc. Graw Hill education Pvt. Ltd., 2000
6. Raman Siva Kumar, Introduction to Environmental Science and Engg., Tata Mc. Graw Hill education Pvt. Ltd., 2010

MB 214

MANAGERIAL ECONOMICS AND ACCOUNTANCY

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: The objective of the course is to provide the analytical tools and managerial insights that are essential for the solution of those business problems that have significant consequences for the firm and society.

UNIT – I

Introduction to Managerial Economics: Introduction to Economics and its evolution - Managerial Economics - its scope, importance, Its usefulness to engineers - Basic concepts of Managerial economics.

UNIT – II

Demands Analysis: Demands Analysis - Concept of demand, determinants, Law of demand, its assumptions, Elasticity of demand, price, income and cross elasticity, Demand Forecasting - Markets Competitive structures, price-output determination under perfect competition and Monopoly. (Theory questions and small numerical problems can be asked).

UNIT – III

Production and Cost Analysis: Theory of Production - Firm and Industry - Production function - input-out 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 - Break-even analysis. (Theory and problems)

UNIT– IV

Capital Management: Capital Management, its significance, determinants and estimation of fixed and working capital requirements, sources of capital - Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems.

(Theory questions are numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked).

UNIT – V

Accountancy: Book-keeping, principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments.
(Theory questions and numerical problems on preparation of final accounts, cash book, petty cash book, bank reconciliation statement).

Text Books:

1. Mehta P.L., Managerial Economics – Analysis, Problems and Cases, Sulthan Chand & Son's Educational Publishers, 2011
2. Maheswari S.N Introduction to Accountanc, Vikas Publishing House, 2005
3. Panday I.M. Financial Management, Vikas Publishing House, 2009

Suggested Reading:

1. Varshney and KL Maheswari, Managerial Economics, Sultan Chand, 2001
2. M Kasi Reddy and S Saraswathi, Managerial Economics and Financial Accounting, PHI, 2007
3. J C Pappas and EF Brigham, Managerial Economics

MATERIAL SCIENCE AND METALLURGY LAB

Instruction	3 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	50 Marks
Sessionals	25 Marks
Credits	2

Course Objectives:

1. Students will acquire basic knowledge by understanding iron-carbide diagram and its application in engineering
2. Student is exposed to Metallographic study and analysis of various metals,
3. Student will acquire knowledge in determining the hardness of metals before and after various heat treatment operations
4. Student is exposed to T-T-T curve and its application in engineering metallurgy

.

Course Outcomes:

1. Student can identify crystal structure of various metals,
2. Student can measure hardness and can correlate with microstructure
3. Student can perform a suitable heat treatment operation based on desired properties.
4. Student underlines the importance of grain size in evaluating the desired mechanical properties

List of the Experiments

1. Study of: Metallurgical Microscope, Allotropes of Iron, Iron-Iron carbide diagram, Procedure of specimen preparation.
2. Any Four experiments of the following: Metallographic study and analysis of : Steels- i) Low carbon steels, ii) Medium carbon steels, iii) Eutectoid steels, iv) High Carbon steels, v)Stainless steels, vi) Case carburized and vii) HSS, and determination of grain size using Image Analyzer.
3. Any Two experiments of the following: i) White, cast iron, ii) Gray cast iron, iii) Malleable cast iron and iv) Spheroidal cast iron and determination of grain size using Image Analyzer.
4. Any Three experiments of the following: Non-Ferrous Alloys– i) α–Brass, ii) α–β Brass, iii) Bronze, iv) Al–Si and iv) Babbitt determination of grain size using Image Analyzer.
5. Study of T–T–T curve
6. Any Three experiments of the following: Study of microstructure and measurement of hardness before and after i)) Annealing, ii) Normalizing, iii) Hardening, iv) Hardening and v)Tempering.

Text Books:

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

Suggested Reading:

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

COMPUTER DRAFTING LAB

Instruction	3 Periods per week
Sessionals	25 Marks
Credits	1

Course Objectives:

1. Student will acquire knowledge in solid modeling by exposing to Solidworks.
2. Student will acquire knowledge in graphic communication
3. Student is exposed to design methodologies
4. Student will acquire knowledge in concept of layers

Course Outcomes:

1. Graphics and design competencies are reinforced through lab exercises.
2. Student can apply these techniques for 2 D modeling.
3. From the concept of layers, students will develop an ability to think three dimensions and interpret data from blue prints and sketches.
4. Student is exposed to various types of drawing projections, which includes orthographic projections with the knowledge of graphic communication

1. INTRODUCTION TO SOLIDWORKS DRG EDITOR

XY Coordinate system, Angular measurement, Setting of Units, Absolute, Relative and Polar Coordinates

Draw tool bar options line, Circle, Rectangle, Ellipse, Spline and Arc

Modify tool bar options- Trim, Extend, Offset, Fillet, Chamfer, Mirror, Break, Array, Polar, Rectangular, Move, Copy, Stretch, Rotate

ESNAP, SNAP, Grid, Ortho

Dimension Tool bar- aligned, angular, linear and annotations

2. EXERCISES FOR PRACTICE include – Square, headed spanner, circular, rectangular, pocketing block, concentric square, circle inscribed in a square and rectangle, cover, housing, Geneva wheel. Layer and object properties; construction line, object line, hidden line, centre line, hatching, dimensioning, leader

3. PRACTICE EXERCISE

Shaft support

4. ADDITIONAL EXERCISES are also provided during class work

Text Book:

1. *Solidworks Drawing –Training Manual (Solidworks 2012).*

MECHANICS OF MATERIALS LABORATORY

Instruction	3 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessional	25 Marks
Credits	2

Course Objectives:

1. Student will acquire basic knowledge in testing properties of engineering materials.
2. Student is exposed to concept of determining various types of hardness.
3. Student will acquire basic knowledge in determining modulus of rigidity of engineering materials
4. Student is exposed to the concept of deflection and fatigue test

Course Outcomes;

1. The properties of materials determined by the tests in laboratory will be useful for design and analysis under various load conditions.
2. Student can estimate the hardness, which is essential property of materials
3. Student can demonstrate himself in determining the Young's modulus by deflection test
4. Student can perform fatigue test, which is an essential parameters to predict failure of any material

List of Experiments

Cycle – I

1. Direct tension test on metal rods
2. Young's modulus of metal specimen by direct tension test
3. Brinnel's and Rockwell's harness tests
4. Compression test
5. Impact test

Cycle – II

1. Test on a helical spring to determine the rigidity modulus.
2. Torsion test to determine the rigidity modulus of a shaft
3. Defection test on a cantilever beam to determine the Young's modulus
4. Deflection test on a simple beam to determine the Young's modulus
5. Deflection test on fixed beam to determine the Young's modulus
6. Fatigue test.

Text Books:

1. D.S. Prakash Rao, Strength of Materials A Practical Approach, Universities Press, Hyderabad, 1999.
2. S. Ramamrutham, Strength of Materials, Dhanpat Rai & Sons, 1993.

Reference Books:

1. S.S. Bhavakatti, Strength of Materials, Vikas Publication, 2003.
2. B.C. Punmia, Strength of Materials and Theory of Structures, Laxmi Pub., 1992
3. G.H. Ryder, Strength of Materials, Third Edition in SI units, Macmillan India Limited, Delhi, 2002.

ELEMENTS OF MECHANICAL ENGINEERING

(For ECE)

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. To understand the various laws of Thermodynamics & their significance
2. To understand the functioning of I.C Engines & Compressors.
3. To understand the different manufacturing process like Welding, Casting and Metal Forming Processes
4. To understand various power Transmitting devices like gears, gear train and belts.

Course Outcomes;

1. Students will demonstrate the knowledge in functioning aspects of Engines, Compressors, refrigerating and air conditioning equipment..
2. They will be able to appreciate the role of heat transfer in Transformers, Motors, Generators and cooling of Electronic components.
3. Will be able to demonstrate knowledge in production techniques related to welding, casting, metal forming Processes
4. Student can estimate the power transmitted by belts, gear and gear trains .

UNIT–I

Thermodynamics: Macroscopic & microscopic approaches, concepts of thermodynamic systems, processes, cycles and properties, quasi-static process, Zeroth law, first law of thermodynamics, application of first law to various thermodynamic processes & SFEE. Second law of thermodynamics- Kelvin–Planck & Clausius Statements., PMM1, PMM2.

I.C Engines: Working of four– stroke and two–stroke petrol and diesel engine with p–V diagrams, valve timing diagram, calculation of indicated power, brake power, specific fuel consumption, mechanical and thermal efficiencies.

Reciprocating Air Compressors: Uses of compressed air, principle of working and work done of single stage compressor– without & with clearance, multistage compressors, advantages, intercooler & aftercooler.

UNIT–II

Heat Transfer: Basic modes of heat transfer, Fourier's law of conduction, Newton's law of cooling, Stefan–Boltzmann law of radiation, one–dimensional steady state conduction heat transfer through plane walls without heat generation and with constant thermal conductivity.

Heat Exchangers: Classification and application of heat exchangers in industry, derivation of LMTD in parallel and counter flow heat exchangers and problems on LMTD.

UNIT–III

Refrigeration: Types of refrigeration systems–air refrigeration system using Bell–Coleman cycle. Simple vapor compression system, COP, T-s & p–h diagrams, types and properties of refrigerants, eco-friendly refrigerants., introduction to psychrometry, psychrometric processes, simple problems using psychrometric chart.

UNIT–IV

Basic Manufacturing Processes: Welding, brazing and soldering, brief description of process and associated principles, arc welding & gas welding.

Casting: Sand casting, die casting and principles, application.

Forming : Description of forging, extrusion, drawing & rolling.

Principles and Applications of Basic Machining Process: Turning, milling, drilling and grinding.

UNIT–V

Definition of kinematic link, pair, mechanism and machine.

Gears: Classifications of gears, nomenclature

Gear Trains: Simple, compound, inverted and epi–cyclic gear trains.

Belt Drives: Open and cross belt drives, length of belt, ratio of tensions for flat belt, condition for maximum power transmission for flat belt.

Text books:

1. R.K.Rajput, *Thermal Engineering*, Laxmi Publications (P) Ltd, 8th edition, 2011.
2. P.C.Sarma, *A Text book of Production Technology*, S. Chand & Company Ltd., 2008.
3. Thomas Bevan, *Theory of machines*, CBS Publishers, 2010.

Suggested Reading:

1. Mahesh M Rathor, *Thermal Engineering*, Tata McGraw Hill Publishers, 2013
2. R.K. Jain, Production Technology, Khanna Publishers, 2010.
3. S.S.Ratan, *Theory of machines*, Tata McGraw Hill Publishers, 2008.

PRINCIPLES OF MECHANICAL ENGINEERING

(EEE)

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessional	25 Marks
Credits	3

Course Objectives:

1. Students will acquire basic knowledge in thermodynamics and its applications,
2. Student will acquire basic knowledge in different modes of heat transfer and its applications in engineering
3. Student is exposed to mechanisms of power transmitting devices
4. Student will acquire knowledge in working principles of hydraulic turbines and pumps.

Course Outcomes:

1. Students can estimate the power developed by an IC engine
2. Student can understand the application and importance of refrigeration and air conditions and with this knowledge, student can estimate the rating of a air conditioner
3. Student can estimate the power transmitted by belt and gear train
4. Student can specify power developed by turbine and power required for pump.

UNIT–I

Heat Transfer: Modes of heat transfer–conduction and convection, radiation, steady state conduction–heat transfer through plane walls, cylinders, critical radius of insulation for cylinders, concept of black body radiation.

Heat Exchanger: Classification, industry applications, LMTD for parallel flow and counter flow.

Refrigeration System: COP, ton of refrigeration, air refrigeration, simple vapour compression cycle and properties of refrigerants, eco friendly refrigerants, introduction to psychometry, psychrometric processes, simple problems using psychrometric chart.

UNIT–II

IC Engines: Working of four–stroke and two–strike petrol and diesel engines with P–v diagrams, calculation of indicated power, brake power, specific fuel consumption, mechanical and thermal efficiencies.

Reciprocating air compressors: Uses of compressed air, principle of working and work done of single stage compressor–without and with clearance, multistage compressors, advantages, intercoolers and aftercooler.

Generation of Steam: Classification of boilers, Fire tube boilers–Locomotive boilers, Cochran boiler, Water tube boiler–Babcock & Wilcox boiler.

Gas Turbines: Classification, performance of simple gas turbine cycle (Joule cycle).

UNIT–III

Gears: Classification, Gear trains, types–single compound, Inverted & epi cyclic gear trains, belt& rope drives, open and cross belt, length of belt, ratio of tensions for flat belts, condition for maximum power.

UNIT–V

Fluid Dynamics: Introduction to Bernoulli's equation, applications–venturi meter, orifice meter, flow through pipes– Hagen's formula, friction loss in pipes, Darcy's formula, Reynolds number and its significance.

Hydraulic Turbines: Classification-working principle-Francis, Kaplan, Pelton Wheels, work done, power output, efficiency, specific speed, Unit quantities, Draft Tube, Performance characteristic curves.

UNIT–V

Pumps: Working principles and construction details of Centrifugal and reciprocating pumps, Effect of friction, acceleration head, work done, power required with and without air vessels, Problems faced in pumps, precaution, cavitation, primary velocity triangles of centrifugal pumps

Text Books:

3. R.K.Rajput, *Thermal Engineering,* Laxmi Publications (P) Ltd, 8th edition, 2011.
4. Thomas Bevan, *Theory of machines,* CBS Publishers, 2010.
5. P.N.Modi & S.M.Seth, *Hydraulics and Fluid Mechanics including Hydraulic machines*, Standard Book House, 18th edition, 2011.

Suggested Reading:

1. Mahesh M Rathor, *Thermal Engineering,* Tata Mc.Graw-Hill Publishers 2013
2. S.S.Rattan, *Theory of Machines*, Tata Mc.Graw-Hill Publishers 3rd Edition, 2009.

Jagdish Lal, *Hydraulics & Fluid mechanics*, Metropolitan Book Co. Pvt. Ltd., 2004

BASICS OF MECHANICAL AND ELECTRICAL ENGINEERING

(Chemical)

MECHANICAL ENGINEERING (Part A)

Instruction	2 Periods per week
Duration of Semester Examination	1.5 Hours
Semester Examination	38 Marks
Sessional	12 Marks
Credits	1.5

Course Objectives:

1. Student will acquire basic knowledge in mechanics of materials by understanding various types of stresses and strain
2. Student is exposed to the concept of shells and design of shaft
3. Student will acquire basic knowledge in understanding the working principle of fire tube boiler and water tube boiler
4. Student is exposed to the concept of power transmitted by belts

Course Outcomes:

1. Student can demonstrate the knowledge of mechanics of materials in evaluating the strength of material
2. The knowledge about design of cylinders will be useful for pressure vessels.
3. The knowledge about fire and water tube boilers will be useful for chemical industries, process industries and power generation.
4. Student can demonstrate knowledge of various power transmitting devices like belts in industries where power is to be transmitted from one shaft to the other.

UNIT–I

Stresses and Strains: Kinds of stress–strains, elasticity and plasticity, Hooks law, stress – strain diagram, modules of elasticity, Poission's ratio, linear and volumetric strain, relation between Young modulus, Bulk modulus and Rigidity modulus, bars of uniform strength. Compound bars and temperature stresses.

UNIT–II

Thin Cylindrical Shells: Stress in cylindrical shells due to internal pressures, circumferential stress, longitudinal stress, design of thin cylindrical shells, spherical Shells, change in dimension of the shell due to internal pressure, change in volume of the shell due to internal pressure. Shafts: Torsional stress and strains, strength of a solid shaft, power transmitted by shaft strength of a hollow shaft.

UNIT – III

Steam Boilers: Classification of boilers , study of boilers, Cochran boiler, Locomotive boiler, Babcock and Wilcox boiler, boiler mountings and accessories.

Internal Combustion Engines: Working principle of four stroke diesel and petrol engines.

Belts: velocity ratios, slip, length of belt, open belt and cross belt drives. ratio of tensions, centrifugal tension in belt, power transmitted by bells, initial tensions in the belt and simple problems.

Text Books:

1. S.Ramamrutham, *Strength of Materials*, Dhanpath and Sons, 10th Edition, 2005
2. S.S Rattan, *Theory of Machines*, Tata McGraw Hill Publishers, 2009
3. Mahesh M Rathor, *Thermal Engineering*, Tata McGraw Hill Publishers, 2013

Suggested Reading

1. S.S. Rattan, *Strength of Materials*, Tata McGraw Hill Education, 2011

2. Thomas Bevan, *Theory of Machines*, CBS Publishers, 2009.
3. A.S. Sarao, *Thermal Engineering*, Satya Prakasham, 5th Edition, 2005.

MECHANICAL & ELECTRICAL ENGINEERING LAB

(Chem)

Instruction	3 Periods per week Duration of Semester
Examination	1.5 Hours
Semester Examination	25 Marks
Sessionals	13 Marks
Credits	1

Course Objectives:

1. Students will acquire basic knowledge in determining the properties of materials like modulus of elasticity and modulus of rigidity
2. Student is exposed to the concept of determination of various hardness of material
3. Student can evaluate the performance of four-stroke diesel/petrol engine with varied engine parameters
4. Student can understand the working principle of fire tube and water tube boilers Course Outcomes:
5. Student can estimate the strength of materials from the knowledge of mechanics of materials.
6. Student can demonstrate knowledge in evaluating mechanical properties of material by determining the hardness of the material.
7. Student can estimate the power and thermal efficiency developed by an IC engine
8. The knowledge about fire tube boiler and water tube boiler is useful for power plants and pressure vessel industry.

List of the Experiments

Note: Minimum of FOUR experiments should be conducted in the semester selecting at least TWO from each cycle

Cycle-1:

1. Determination of Modulus of Elasticity (E) and salient point on stress – strain curve of given material by direct tension on universal Testing Machine (UTM)
2. Determination of rigidity modulus of a shaft by torsion test
3. Brinell's hardness Test of material
4. Determination of rigidity modulus of a leaf spring
5. Determination of the Compressive strength of bricks on compression testing Machine/.

Cycle-2:

1. To evaluate the performance of four-stroke single cylinder Diesel Engine.
2. Study of Boiler – Cochran boiler, Lancashire boiler, Wilcox boiler
3. To conduct heat balance on four-Stroke single cylinder Diesel Engine.
4. Determination of the valve time diagram for a four-Stroke Vertical Diesel Engine

Text Books:

1. S.Ramamrutham, *Strength of Materials*, Dhanpath and Sons, 10th Edition, 2005
2. S.S Rattan, *Theory of Machines*, Tata McGraw Hill Publishers, 2009
3. Mahesh M Rathor, *Thermal Engineering*, Tata McGraw Hill Publishers, 2013

Suggested Reading

1. S.S. Rattan, *Strength of Materials*, Tata McGraw Hill Education, 2011
2. Thomas Bevan, *Theory of Machines*, CBS Publishers, 2009.
3. A.S. Sarao, *Thermal Engineering*, Satya Prakasham, 5th Edition, 2005.

Chaitanya Bharathi Institute of Technology (Autonomous)
Department of Mechanical Engineering

SCHEME OF INSTRUCTION & EXAMINATION

B.E. II Year (Mechanical Engineering)

II - Semester

THEORY										
S.No	Syllabus Ref.No	Subject	Scheme of Instruction Per week				Scheme of Examination			Credits
							Duration in Hrs	Maximum Marks		
			L	T	D	Lab		University exam	Sessional	
1	MT 221	Complex Variables and Probability Statistics	4	-	-	-	3	75	25	3
2	ME 221	Kinematics of Machines	4	2	-	-	3	75	25	4
3	ME 222	Thermodynamics	4	-	-	-	3	75	25	3
4	ME 223	Fluid Dynamics	4	-	-	-	3	75	25	3
5	EE 221	Electrical Circuits and Machines	4	-	-	-	3	75	25	3
6	EC 221	Basic Electronics	4	-	-	-	3	75	25	3
PRACTICALS										
1	EE 222	Electrical Circuits & Machines Lab	-	-	-	3	3	50	25	2
2	EC 222	Basic Electronics Lab	-	-	-	3	3	50	25	2
3	EG 221	Soft Skills and Employability Enhancement	-	-	-	2	3	50	25	1
		TOTAL	24	2	0	8	-	600	225	24

Service Course

			Branch	Scheme of Instruction Per week				Scheme of Examination			Credits
				L	T	D	Lab	Duration in Hrs	Maximum Marks		
									University exam	Sessional	
1	ME 224	Mechanical Technology	CE	3	-	-	-	1.5	37	13	2
2	ME 225	Mechanical Engineering Lab	EEE	-	-	-	3	3	50	25	2
		Total		3	0	0	3	--	87	38	4

L= Lecture; T=Tutorial; D=Drawing

MT 221

COMPLEX VARIABLES AND PROBABILITY STATISTICS

(common to all branches, except ECE & Biotech)

Instruction	4L Periods per week
Duration of University Examination	3 Hours
University Examination	75 marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. Extension of Laplace transforms in solving the Integral equations
2. Introduction of the Concept of analyticity of complex functions and contour Integrations and conformal Mapping.
3. Introduction of Basic Probability, Probability distributions and sampling theory.

Course Outcomes:

1. Students must be able to apply the concepts learned in potential Theory, electromagnetic theory.
2. Students must realize the Probability & Statistics and its wide applications in various Branches of Engineering and science. Students must be able to analyze the Random phenomena of any Physical system.

UNIT-I

Applications of Laplace transforms to Integral equations:

Laplace transforms of special functions-Bessel function and error functions. Definitions of Integral transforms, kernel of the transform. Solution of Integral equations; Abel's integral equation, Integral equation of the convolution type and Integro-differential equations. Solutions of partial differential equations- Boundary value problems.

UNIT- II

Complex Variables:

Analytic function, Cauchy Riemann equations (Cartesian and polar forms) - construction of Analytic functions. Harmonic function, derivatives of Analytic functions.

Complex line integrals, Cauchy's Integral theorem, Cauchy's Integral formula and its derivatives and problems related to the above theorems.

UNIT-III

Complex Variables:

Taylor's and Laurent's expansions-zeros, types of singularities and residues. Cauchy's Residue theorem. Evaluation of real definite integrals by Cauchy's residue theorem.

Elementary transformations and conformal Mapping.

UNIT-IV

Statistics and Basic Probability

Correlation -Correlation coefficient between two variables, Rank correlation and Regression- lines, random variables, distributions-probability mass function and probability density function. Conditional distributions-Bayes' Theorem-Mathematical expectation-expected values- moments and moment generating function- Characteristic function.

UNIT-V

Probability Distributions: Binomial, Poisson, and Uniform (rectangular), Normal, exponential, Gamma and Beta distributions. Test of hypothesis using Chi-square test for goodness of fit, t-test, F-test.

Text Books:

1. Mathematical Methods of Science and Engineering (Aided with MATLAB) By KantiB.Datta CENGAGE Learning.
2. Fundamentals of Mathematical Statistics by Gupta and Kapoor
3. Higher Engineering Mathematics by B.S.Grewal.

KINEMATICS OF MACHINES

Instruction	Lectures: 4 Periods per week
	Tutorial: 2 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	4

Course Objectives: Student will acquire acknowledge in

1. analysis of mechanisms,
2. drawing displacement diagrams for followers with various types of motions,
3. cam profile drawing for various followers,
4. estimation of transmission of power by belts and application of various gears and gear trains.

Course Outcomes:

Student will demonstrate knowledge in

1. designing a suitable mechanism depending on application
2. Drawing displacement diagrams and cam profile diagram for followers executing different types of motions and various configurations of followers,
3. Drawing velocity and acceleration diagrams for different mechanisms,
4. Selecting gear and gear train depending on application .

UNIT–I

Definition of link, element, pair, kinematic chain, mechanism and machine, Grubler's criterion, single and double slider chains, inversions of quadratic cycle chain, inversions of single and double slider crank chains. mechanism with lower pairs and straight line motion mechanism, Pantograph, Peaucerlier, Hart, Davis and Ackerman's Steering gear 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 four bar linkage synthesis.

UNIT–III

Laws of Friction: Friction in screw threads, pivots, collars and clutches, friction axis of link and friction circle.

Belts and Ropes : Open and closed belt drives, length of belt drive, ratio of tensions, effect of centrifugal tension and initial tension over power transmission, condition for maximum power.

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 contour. 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, comparision of involute and cycliodal tooth profile.

Helical Gears: Helical gear tooth relations, contact of helical gear teeth, gear trains–simple and compound, reverted and epicyclic gear trains.

Text Books:

4. Thomas Bevan, *Theory of Machines*, CBS Publishers, 2009.
5. S.S. Rattan, *Theory of Machines*, Tata McGraw Hill Publishers, 3rd Edition, 2009.

Suggested Reading:

1. J.E.Shigley, *Theory of Machines*, Tata Mc.Graw Hill Publishers, New Delhi, 3rd Edition, 2005.
2. C.S. Sharma and Kamlesh Purohit, *Theory of Mechanisms and Machines*, PHI Learning Pvt. Limited, 2006
3. Amitabh Ghosh and A.K.Mallik, *Theory of Machines*, East West Publications, 3rd Edition, 2009.

THEROMODYNAMICS

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives:

1. Student will acquire knowledge by understanding basic laws of thermodynamics and their applications in engineering and science
2. Student is exposed to various thermodynamics flow and non–flow processes and its applications to nozzles, diffuser, turbines and compressors
3. Student will acquire knowledge in understanding the concept of entropy and its applications
4. Student is exposed to the concept of various types of air cycles, their deviation from actual cycles and their applications.

Course Outcomes:

1. Student can apply various laws of thermodynamics for given thermodynamic process and application.
2. The knowledge and various laws used in thermodynamics are useful to thermal turbo machines
3. Student can demonstrate the knowledge of entropy in various thermodynamic applications
4. The actual performance of IC engine can be estimated by understanding the concept of air cycles. .

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 & diffuser, throttling device, turbine & 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, TdS equations, difference in heat capacities , ratio of heat capacities and energy equation.

UNIT–V

Air Standard Cycles: Air standard cycles- Otto, Diesel, Dual Combustion Cycle, and simple Rankine cycle.

Mixture of Gases: Mole fraction and mass fraction, partial pressure and Dalton's law, Amagat–Leduc law of partial volumes, relation between partial pressure, mole fraction and volume fraction; gas constant, molecular mass and specific heats of the gas mixtures, relation between volumetric and gravimetric analysis.

Text books:

6. P.K. Nag, *Engineering Thermodynamics*, Tata McGraw Hill Publishers, 4th edition, 2008.
7. D.S. Kumar, *Thermal science and Engineering*, S.K.Kataria & Sons, 4th edition, 2009.

Suggested Reading:

1. Y.A. Cengel and M.A. Boles, *Thermodynamics: An Engineering Approach*, Tata McGraw Hill Publishers, 7th edition, 2012.
2. R.K. Rajput, *Thermal Engineering*, Laxmi Publications (P) Ltd, 8th edition, 2011.
3. Mahesh M Rathor, *Thermal Engineering*, Tata McGraw Hill Publishers, 2013

FLUID DYNAMICS

Instruction	4 Periods per week
Duration of Semester Examination	3 Hours
Semester Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: Student will acquire knowledge in fundamentals of fluid kinematics, fluid statics, fluid dynamics, various instrumentation related to measurement of pressure, discharge, velocity and concepts of boundary layer

Course Outcome: Student can use the knowledge of this subject in future courses like computational fluid dynamics, turbo machines and heat transfer.

Course Objectives:

1. To understand the fundamentals of fluid properties.
2. To understand the fluid statics, kinematics, & fluid dynamics, through continuity, momentum and energy equations.
3. To develop fundamental principle of boundary layer theory, laminar & turbulent fluid flows.
4. To understand the working principles of pressure, velocity, discharge measuring devices

Course Outcome:

1. Student can use this knowledge of fluid dynamics for advanced courses like computational fluid dynamics, heat transfer, turbo machines
2. To design a pump and water pipe with the knowledge of fluid dynamics
3. To solve the problems pertains to fluid dynamics using the continuity, momentum, and energy equations.
4. To estimate drag and lift coefficients for design of aerodynamic bodies using the concept of boundary layer equations

UNIT–I

Properties of fluids: Definition of fluid and concept of continuum. Fluid properties: pressure, density, specific weight, specific volume, dynamic and kinematic viscosity. classification of fluids, ideal and real fluids.

Fluid Kinematics: General concepts of path line, stream line and stream tube. Classification of fluid flow: steady and unsteady, uniform and non-uniform, laminar and turbulent, rotational and irrotational, one, two and three dimensional flows, definition and properties of stream function and velocity potential function and use of flow nets.

UNIT–II

Fluid Statics: Total pressure, centre of pressure, total pressure on plane surface, total pressure on horizontal plate, total pressure on vertical plate, total pressure on curved surface.

Buoyancy and Floatation: Buoyancy, buoyant force, centre of buoyancy, meta centre, stability of submerged bodies.

UNIT–III

Fluid Dynamics: Energy of fluid body, potential energy and potential head, pressure energy and pressure head, kinetic energy and kinetic head, energy equation, derivation of Euler's and Bernoulli's equations and their applications, impulse momentum equation and applications.

UNIT–IV

Measurement of Fluid Flows: Measurement of pressure and use of pressure measuring devices such as manometers, Bourdon's pressure gauge and transducers, measurement of velocity and use of velocity measuring devices such as pitot tube and hot wire anemometers, measurement of discharge, use of discharge measuring devices such as venture meter, orifice meter and rotometer, derivation of relevant formulae, discharge formulae for weirs and notches.

UNIT–V

Laminar and Turbulent flow through pipes: Distinction between laminar and turbulent flows, Reynold's number and its significance, upper and lower critical values of Reynold's number for flow in pipes, development of laminar and turbulent flow in circular pipes. Hagen–Poiseuille equation, frictional losses in pipes, Darcy equation, estimation of Darcy's friction factor, empirical formulae and Moody's chart.

Boundary Layer Theory: Development of laminar and turbulent boundary layers on flat plate, pressure gradient and phenomenon of separation. Fluid flow over an aerofoil, flow around a cylinder at rest, rotational flow around a cylinder, lift and drag forces and coefficients, circulation and Magnus effect.

Text Books:

1. P.N.Modi and S.M.Seth, *Hydraulic and Fluid Mechanics*, Standard Book House, 2010
2. R.K.Rajput, *Fluid Mechanics and Hydraulic Machines*, S. Chand & Company, 2010.

Suggested Reading:

1. K.L.Kumar, *Engineering Fluid Mechanics*, Eurasia Publishing House, 2005
2. V.L.Streeter, *Fluid Mechanics*, Mc.Graw Hill Co. Ltd., 2005
3. D.S.Kumar, *Fluid Mechanics*, S.K. Kataria & Sons, 2010

EG 221

SOFT SKILLS AND EMPLOYABILITY ENHANCEMENT

Instruction	2 Periods per week
Duration of University Examination	3 Hours
University Examination	50 Marks
Sessionals	25 Marks
Credits	1

Course Objectives: To help the students

1. Participate in group discussions with confidence and to make effective presentations. Also to learn the art of communication.
2. With- resume packaging, preparing and facing interviews.
3. Build an impressive personality through effective time management & goal setting, self confidence and assertiveness.
4. Understand what constitutes proper grooming and etiquette in a professional environment. Also to understand academic ethics and value systems.

Course Outcomes: The students will be able to

1. Be effective communicators and participate in group discussions with confidence. Also be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals. Also learn to mange time effectively and deal with stress.
4. Make the transition smoothly from campus to corporate. Also use media with etiquette and know what academic ethics are.

Exercise 1

Communicative Competence – The Art of Communication, basic grammar, Indianisms, Effective listening skills, using English in different situations

Exercise 2

Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence

Elements of effective presentation – Structure of presentation – Presentation tools – Body language

Creating an effective PPT

Exercise 3

Interview Skills – Resume' writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets

Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, mock interviews

Exercise 4

Personality Development – Effective Time Management, setting realistic goals, self confidence and assertiveness, stress management, moral values.

Exercise 5

Corporate Culture – Grooming and etiquette, communication media etiquette

Academic ethics and integrity

Suggested Reading:

1. Madhavi Apte , “A Course in English communication”, Prentice-Hall of India, 2007
2. Leena Sen , “Communication Skills”, Prentice-Hall of India, 2005
3. Dr. Shalini Verma, “Body Language- Your Success Mantra”, S Chand, 2006
4. Edgar Thorpe and Showick Thorpe , “Objective English”, 2nd edition, Pearson Education, 2007
5. Ramesh, Gopalswamy, and Mahadevan Ramesh, “The ACE of Soft Skills”, New Delhi: Pearson, 2010
6. Gulati and Sarvesh, “ Corporate Soft Skills”, New Delhi: Rupa and Co. , 2006
7. Van Emden, Joan, and Lucinda Becker, “Presentation Skills for Students”, New York: Palgrave Macmillan, 2004
8. Covey and Stephen R, “The Habits of Highly Effective People”, New York: Free Press, 1989

PART-B

MECHANICAL TECHNOLOGY

(For Civil Engineering)

Instruction	3 Periods per week
Duration of Semester Examination	1 ½ Hrs
Semester Examination	37 Marks
Sessionals	13 Marks
Credits	2

Course Objectives:

1. Exposure and utility & specification of the earth moving equipment used in construction activity with relevant examples.
2. Exposure to the handling of conveying & hoisting cost & benefits of the equipment usage, logistics and maintenance of the equipment.
3. Understanding of the aggregate and pneumatic machinery working capability and specifications.

Course Outcome:

1. Awareness of the equipment is created, utility along with specific activity of the equipment is understood,
2. Economics, specification, application & capacity issues, are understood
3. Operation and maintenance issues are understood.

UNIT–I

General Description, operation, maintenance and selection of the following: Earth moving and excavating equipment, shovels, dragline, clamshell, cable excavator, bucket wheel excavator, tractor, bulldozer, scraper, trenchers, grader, earth compactors.

UNIT–II

Conveying Equipment: Belt conveyor, screw conveyor, bucket conveyor, apron conveyer, and aerial ropeway.

Hoisting Equipment: Hoist winch, differential and worm geared chain hoists, fork lift trucks, guyed and stiffly derricks, swing and non-swing mobile crane, whirler, crane, construction elevator, passenger lift, bucker elevators.

UNIT–III

Aggregate and concrete Production Equipment: Crusher's jaw, gyratory, hammer and roll crusher, screens–stationary, shaking and vibrating screens, concrete mixers, concrete pumps.

Pneumatic Equipment: Reciprocating air compressor, construction pneumatic jack hammer, paving breaker, rock drill, concreter vibrator.

*Text Book*s:

1. Mahesh Varma, *Construction Equipment and its Planning and Applications*, Metropolitan Books Co, Delhi, 2004.

Suggested Books:

1. R.L.Peurifoy, *Construction Planning Equipment and Methods*, McGraw Hill Publishers, 2000
2. Goodes Spence, *Building and Civil Engineering Plant*, Crossby Lock Wood, 2005

MECHANICA ENGINEERING LAB

(For EEE)

Instruction	3 Periods per week
Duration of Semester Examination	3 Hrs
Semester Examination	50 Marks
Sessionals	25 Marks
Credits	2

Coarse Objectives:

1. Student will acquire knowledge in evaluating the performance of IC engines,
2. Student is exposed to in evaluating the performance of hydraulic turbines,
3. Student will acquire knowledge in estimating overall efficiency of pumps
4. Student is exposed to the concept of heat conduction

Course Outcomes:

1. Student is exposed to carry out the investigations on IC engines with varied engine parameters,
2. Student can select and evaluate the hydraulic performance of hydraulic turbine
3. Student can select a pump based on the application and estimate the overall efficiency of the pump.
4. Student can demonstrate the knowledge in determining the thermal conductivity of insulating materials

List of the Experiments (Any Twelve of the following)

1. Performance test on multi cylinder petrol or diesel engine.
2. Measurement of discharge by venturimeter.
3. Measurement of velocity by pitot tube.
4. Measurement of discharge by orifice meter/ rotameter.
5. Determination of flash and fire point of lubricants.
6. Determination of thermal conductivity of composite wall.
7. Determination of heat transfer coefficient under natural convection phenomenon.
8. Determination of volumetric efficiency of multi stage reciprocating air compressor.
9. Study of construction details of a gear box .
10. Performance of (a) Francis (b) Kaplan (c) Pelton Wheel turbines.
11. Performance characteristics of reciprocating and centrifugal pumps.

Text Books:

6. R.K.Rajput, *Thermal Engineering,* Laxmi Publications (P) Ltd, 8th edition, 2011.
7. P.N.Modi & S.M.Seth, *Hydraulics and Fluid Mechanics including Hydraulic machines*, Standard Book House, 18th edition, 2011.

Suggested Reading:

3. Mahesh M Rathor, *Thermal Engineering*, Tata Mc.Graw-Hill Publishers 2013
4. Rajput, R.K., "*Heat and Mass Transfer*", S.Chand & Company Ltd, New Delhi, 2010
5. Jagdish Lal, *Hydraulics & Fluid mechanics*, Metropolitan Book Co. Pvt. Ltd., 2004

Chaitanya Bharathi Institute of Technology (Autonomous)
Department of Mechanical Engineering

SCHEME OF INSTRUCTION & EXAMINATION

B.E. III-Year (Mechanical Engineering)

I-Semester

THEORY										
S. No	Syllabus Ref.No	SUBJECT	Scheme of Instruction Per week				Scheme of Examination			Credits
			L	T	D	Lab	Duration in Hrs	Maximum Marks		
								End Exam	Sessional	
1	ME 311	Dynamics of Machines	4	1	-	-	3	75	25	3
2	ME 312	Applied Thermodynamics	4	-	-	-	3	75	25	3
3	ME 313	Manufacturing Processes	4	-	-	-	3	75	25	3
4	ME 314	Heat Transfer	4	-	-	-	3	75	25	3
5	ME 315	Design of Machine Elements	4	1	-	-	3	75	25	3
6	CE 444	Human Values and Professional Ethics	3	-	-	-	3	50	-	-
PRACTICALS										
1	ME 316	Dynamics & Vibrations Lab	-	-	-	3	3	50	25	2
2	ME 317	Thermodynamics Lab	-	-	-	3	3	50	25	2
3	ME 318	Manufacturing Processes Lab	-	-	-	3	3	50	25	2
		TOTAL	**23**	**2**	**-**	**9**	**-**	**-**	**-**	**21**

ME 311 DYNAMICS OF MACHINES

Instruction	4 Periods + 1 Tutorial per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To find static and dynamic forces on planar mechanisms.
2. To know the causes and effects of unbalanced forces in machine members.
3. To determine natural frequencies of undamped, damped and forced vibrating systems of one, two and multi degree freedom systems.

Outcomes:

1. Graduates are expected to demonstrate the ability of the analysis of forces in mechanism which provide them the required inputs to design the systems which withstand operating conditions
2. Graduates will have the ability to identify the unbalance in rotors and engines and will get the knowledge of balancing.
3. Graduates are expected to understand the turning moment diagram, cyclic fluctuation in speed, fluctuation in energy and get the ability of designing flywheel.
4. Graduates will understand concepts of vibration thereby they are able to design the systems free from ill effects of vibration.

UNIT-I

Static and Dynamic Force analysis: Force analysis of Four bar and slider crank mechanisms: Study of dynamically equivalent system, Inertia forces on connecting rod.

Gyroscope: Gyroscopic couple, gyroscopic effects in vehicles.

UNIT-II

Governors: Classification of governors, Watt, Porter, Hartnell and Hartung governors, Controlling Force, Stability, Isochronism, Sensitivity, Power and Effort of governors.

Flywheels: Functions, Differences between flywheel and governor. Turning moment diagrams, flywheels analysis for I.C. Engines and Presses.

UNIT-III

Balancing: Forces on bearings due to rotating shaft carrying several masses in several planes. Determination of balance masses from the forces on the bearings, Shaking forces in single cylinder engine, Partial balancing of reciprocating engine. Balancing of two cylinder locomotive engine. Balancing of multi cylinder in-line engines. Balancing of radial engines by direct and reverse cranks method.

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 is isolation and Transmissibility.

UNIT-V

Torsional Vibrations: Torsional Vibrations of Two rotor, Three rotor and Geared systems.
Natural frequencies of two degree freedom systems. Modes of vibration.
Approximate methods: Dunkerley's method and Rayleigh's method.
Holzer's method: for multi rotor system.

Text Books:

1. S.S. Rathan, *Theory of Machines*, Tata-Mc Graw Hill, 1995.
2. John.J.Vicker, Gordon R. Pennock, Joseph E. Shigley, *Theory of Machines & Mechanisms*, Oxford University Press, 2003.

Suggested Reading

3. A. Ghosh and Mallick, *Theory of mechanisms and machines*, Affiliated to E-W Press, 1988.
4. Ashok G Ambedkar, Mechanism and Machine Theory, PHI, 2013.
5. Benson H. Tangue, Principles of Vibration, 2nd Edn., Oxford University Press, 2007
6. Robert L. Norton, *Design of Machinery*, Tata Mc Graw Hill, 2005.
7. Charles E Wilson, J. Peter Sadler *Kinematics and Dynamics of Machinery* Pearson Education, 2008.
8. Banal, R.K. Brar, J.S, 'Theory of Machines', Laxmi Publications, 3rd Edition., 2004.
9. J.S. Rao and Gupta, 'Theory and Practice of Mechanical Vibrations, PHI, 1984

APPLIED THERMODYNAMICS

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To demonstrate basic knowledge by understanding the basic working principles of reciprocating air compressor and its applications in engineering.
2. Students will come to know the working principle of diesel and petrol engines, their combustion phenomena and problems pertaining to abnormal combustion
3. Students will understand working principle of various fire tube and water tube boilers along with functions of their mountings.
4. To demonstrate basic knowledge by understanding various thermodynamic cycles used power steam power plants along with steam nozzles.

Outcomes:

1. Students will be able to estimate power required for reciprocating air compressor, used for many engineering applications.
2. Students will be able to evaluate the performance of diesel and petrol engines and suggest some suitable methods for remedy of abnormal combustion.
3. Students will be able to select the boiler depending on application and specify the mountings
4. Students will be able to estimate thermodynamic efficiency of steam power cycles and design steam nozzles.

UNIT-I

Reciprocating Air Compressors: Uses of compressed air, Classification of compressors-single stage and multistage compressors, Derivation of work done with and without clearance volume, Workdone of multistage compressors- effect of clearance volume on work done -Inter-cooling and After-cooling

UNIT-II

Internal Combustion Engines- Classification, working principle, Deviation of actual cycles from air standard cycles, Index of compression and expansion for variable specific heats, Battery and Magneto ignition systems, Multipoint fuel injection system, Lubrication systems, Cooling systems, Carburetors-Simple and Zenith carburetors-Valve and Port-timing diagrams- Performance of I.C. engines- Determination of Indicated power, brake power, frictional power, brake thermal efficiency, mechanical efficiency, indicated thermal efficiency, relative efficiency, volumetric efficiency, specific fuel consumption based on brake power and indicated power, air intake- Heat balance sheet .

UNIT-III

Combustion in I.C. engines Combustion phenomena in spark ignition engines and compression ignition engines-Premixed and diffusion flames, Mechanics of propagation, Self ignition process, Limits of self ignition. Fuel requirements and fuel rating- Anti-knock additives, Effect of engine variables- Stages of combustion- Delay period, Period of uncontrolled combustion, Period of controlled combustion, After burning. Types of combustion chambers in spark ignition and compression ignition engines-Air pollution from IC engines- Effects and control of exhaust from engines.

UNIT-IV

Steam Boilers : Classification of boilers-Fire tube boilers- Cochran boiler, Locomotive boiler and Lancashire boiler, Water tube boilers- Babcock and Wilcox boiler Boiler mountings and accessories. Boiler performance and boiler draught-Chimney design, Types of condensers- Jet and Surface condensers, Cooling towers.

UNIT-V

Steam power plant: Working Carnot and Rankine cycles, cycle analysis, Modified Rankin cycle, Cycle efficiency improvement methods, Reheating, Regeneration and Cogeneration

Steam nozzles: Types of nozzles, Nozzle efficiency, Velocity of steam flowing through the nozzle, Mass of steam discharged from the nozzle, Condition for maximum discharge, Critical pressure ratio, Diameters of nozzle throat and exit for maximum discharge

Text Books

1. Ganeshan, V., " *Internal Combustion Engines*", TMG, New Delhi, 2004
2. Rajput, R. K.,"*Thermal Engineering*", Laxmi Publishers, New Delhi, 2004
3. Mahesh M. Rathore, "Thermal Engineering," TMH, New Delhi, 2010

Suggested Readings:

4. Heywood, J.B. *"Internal Combustion Engine Fundamentals",* TMH, New York, 2004
5. Ballaney, P.L., "*Thermal Engineering*", Khanna Publishers, New Delhi, 2010
6. Soman, Thermal Engineering, PHI, 2011.
7. Kulshrestha S.K., 'Thermal Engineering', Vikas Publishing, 2nd Edition, 2011

ME 313 **With Effect from the Academic Year 2015-2016**

MANUFACTURING PROCESSESS

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To provide the basic understanding of casting, welding and forming processes along with their relative merits, limitations and their applications.
2. To make the students familiar with design aspects and design calculations for pattern, gating system and riser.
3. To make the students to understand the defects, their causes and remedies in castings and weldments
4. To impart the ability to students to carry out load calculations for forming of simple shapes.

Outcomes:

1. Students are able to select the suitable manufacturing process for a given component.
2. Students are able to design pattern, gating system and rises for a simple casting.
3. Students are capable of indentifying defect and suggest the remedy for the same
4. Students can suggest minimum capacity of the machine for a given forming operation

UNIT-I

Casting: 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, Modules method and NRL method.

UNIT-II

Casting : Moulding sand: ingredients, required properties; melting furnaces: cupola, induction & arc furnace; casting defects and remedies, inspection & testing of castings, Special casting processes: die casting, shell moulding, investment casting and CO_2 moulding.

UNIT-III

Welding : Introduction, Classification, Arc Welding: Physics of arc, DCSP, DCRP, AC, arc initiation, arc stability , parts of arc, arc-length characteristics, static V-I characteristics of power source; arc welding processes such as SMAW, SAW, GTAW, GMAW, PAW; Resistance welding: spot, projection, seam, butt and percussion welding processes; oxy-acetylene welding , Thermit welding, laser beam welding, Electron beam welding.

UNIT-IV

Welding: Soldering & brazing, weld defects, solid state welding: forge welding, friction welding, ultrasonic welding and explosive welding.

Fundamentals of Metal Forming: True stress & True strain, volume constancy, flow curve, condition for instability, yield criteria: Von-Mises & Tresca criteria, cold working hot working

UNIT-V

Bulk Metal Forming Processes: Forging: open die, closed die and isothermal forging processes; Rolling: Nomenclature, Roll strip contact length, condition for maximum draft, types of rolling mills; Extrusion: forward & backward extrusion hydrostatic extrusion, Impact extrusion, extrusion load calculations by uniform deformation energy method. Wire drawing: Wire drawing die, load calculations by uniform deformation energy method.

Sheet metal forming processes: Shearing: Various shearing operations, load and energy required for shearing, Methods of load reduction. Bending: bend allowance. Cup drawing :types, LDR, drawing force, calculation of blank diameter for circular cups

Text Books:

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

Suggested Reading:

3. Schey, " Introduction To Manufacturing Processes" 2nd Edn, Mcgraw-hill Education,.
4. Serope Kalpakjian, "Manufacturing Engineering and Technology", Addision, Wesley Publishing Company, 2006.
5. George E.Dieter, "Mechanical Metallurgy", SI Metric Edition McGraw-Hill
6. Mikell P.Grover "Fundamentals Of Modern Manufacturing : Materials, Processes And Systems" 3rd Edition, Willey Asia.

ME 314

HEAT TRANSFER

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Note : During examination necessary charts and tables will be supplied.

Objectives:

1. To demonstrate basic knowledge by understanding different modes of heat transfer
2. Students will acquire the basic knowledge in estimating the effectiveness of extended surfaces
3. Students will acquire knowledge in estimating the relationship between various dimensionless numbers for free convection and forced convection
4. Students will acquire the basic knowledge in understanding the principles of radiation and also the application of heat exchangers

Outcomes:

1. Students will be able to understand the differences between conduction, convection and radiation heat transfer
2. Students will be able to estimate the necessity of providing fins for different situations and importance of unsteady state heat transfer in engineering applications
3. Students will be able to differentiate free convection from forced convection and deduce various equations pertaining to convection heat transfer
4. Students will be able to estimate the importance of black body in radiation heat transfer and design heat exchanger by various methods.

UNIT-I

Modes of heat transfer, Laws of heat transfer - Fourier, Newton, Stefan-Boltzmann General conduction equation in cartesian, cylindrical and spherical coordinates, One dimensional steady state conduction through slabs, hollow cylinders and spheres with and without heat generation, Effects of variable thermal conductivity in heat transfer of one dimensional steady state conduction of plates, cylinders and spheres, Steady state heat transfer through composite slabs, cylinders and spheres, Critical radius of insulation,

UNIT-II

Fins: Heat transfer analysis of fins with heat dissipation environment - rectangular straight and pin fins, Application of fin to temperature measurement, Unsteady state conduction, Lumped parameter analysis of a body with negligible internal temperature gradients, Transient heat transfer analysis of finite slab with specified temperature and convective boundary conditions, Use of Heisler charts for solving problems of infinite slabs, cylinders and spheres.

UNIT-III

Convection: Dimensional analysis and its use in free and forced convection, Buckingham theorem, Physical significance of different dimensionless numbers, Application of Von-Karman integral equation for the analysis of thermal boundary layer in forced convection of flat plate, Reynold's analogy for flow over plane surfaces, Calculation of heat transfer for flow over plates, cylinders and for flow through tubes in free and forced convection using empirical formulae.

UNIT-IV

Radiation: 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, Monochromatic and total emissive power, radiant heat exchange between two gray surfaces, Shape factor, Thermal circuit for radiant heat exchange between infinite parallel plates and between concentric cylinders, Enclosures with black and gray surfaces, Radiation shields .

UNIT-V

Heat Exchangers: Classification and applications of heat exchangers in industry, Analysis and design of counter flow and parallel flow heat exchanger, Fouling factors, Solving problems for multi pass heat exchanger using non dimensional parameter plots,

Change of Phase: Boiling-pool boiling regimes, nucleate pool boiling, effect of surface wettability on bubble contact angle, Critical heat flux, boiling in forced convection, Condensation: Film condensation, Drop wise condensation, Condensation film thickness, Heat transfer coefficient in film condensation.

Text Books

1. Holman, J.P., "Heat Transfer", McGraw Hill Publication, New Delhi, 2004
2. Rajput, R.K., "Heat and Mass Transfer", S. Chand & Company Ltd, New Delhi, 2004.

Reference Books

3. Sachdeva,R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International (P) Ltd Publishers, New Delhi, 2004
4. Sukhatme,S.P., "A Text Book on Heat Transfer,", University Press, 2005.
5. Senegal, " A Text Book on Heat Transfer," TMG, New Delhi
6. Ghoshdastida, Heat Transfer, 2nd Edn., Oxford University Press, 2012.

ME 315 **With Effect from the Academic Year 2015-2016**

DESIGN OF MACHINE ELEMENTS
(USAGE OF DATA BOOK IS COMPULSORY)

Instruction (Periods per week)	4 Periods + 1 Tutorial per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To understand the basics of mechanics of materials and design of a machine for static and fatigue strength, rigidity and wear criterions, use of codes and standards.
2. To know the principles of ergonomic design.
3. To learn the principles to design shafts, keys, belt drives, joints and couplings.
4. To Develop, set-up, and solve mechanical component design problems based upon given data and requirements

Outcomes:

1. Students will be able to design machine elements and systems of machine elements to Successfully satisfy the function of the machine.
2. Student will develop corrective action (define the cause for a problem and the design fixes) for field problems.

Unit-I

Introduction, Materials used in machine design and their specifications to Indian standards. Important mechanical properties of materials used in design. Codes and standards used in design. Reliability, Principles of good Ergonomic Design, Manufacturing considerations. Preferred numbers. Value analysis. Analysis of Stress and Strain : Definition of stress and strain, Types of loading, Direct normal stress, bending stress, Torisonal stress, crushing and bearing stresses, Biaxial stress and Triaxial stress. 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 keys, shafts – solid hollow stepped shafts and splined shafts under torsion and bending loads. Design of belt drive systems, selection of belts and design of pulleys.

Unit-IV

Design of cotter and knuckle joints, riveted and welded joints under direct and eccentric loading. Design of couplings – Muff and Split Couplings, Flange, Flexible and Marine type of couplings.

Unit-V

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, *Machine Design*, Tata Mc Graw Hill Publication, 2010.
2. J.E. Shigley, C.R. Mischne, *Mechanical Engineering Design*, Tata Mc Graw Hill Publications, 2011.
3. Siraj Ahmed, 'Mechanical Engineering Design, PHI, 2014.

Suggested Reading

4. Robert L. Norton, *Machine Design: An Integrated Approach*,2/e Pearson Education, 2013
5. P. Kannaiah, *Machine Design*, Science-Tech Publications, 2010
6. M.F. Spotts, *Design of Machine Elements*, Prentice Hall of India, 2013.

Machine Design Data Books:

1. Design Data Hand book for Mechanical Engineers, K. Mahadevan, K. Balaveera Reddy, CBS Publisher 3rd Edition.
2. Design Data book by PSG College – 2012

With Effect from the Academic Year 2015-2016

CE 444 HUMAN VALUES AND PROFESSIONAL ETHICS

Instructions	: 21 Periods (7*3)
Duration of End Examination	: 3 Hours
End Examination	: 50 Marks
Credits	: Nil

Objectives:

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

Outcomes:

1. Students develop the capability of shaping themselves into outstanding personalities, through a value based life.
2. Students turn themselves into champions of their lives.
3. Students take things positively, convert everything into happiness and contribute for the happiness of others.
4. Students become potential sources for contributing to the development of the society around them and institutions / organisations they work in.
5. Students 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 judgment 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 Publications , 2007
3. Dinesh Babu S., " Professional Ethics and Human Values " , Laxmi Publications , 2007

Reference Books:

4. SantoshAjmera and Nanda Kishore Reddy " Ethics , Integrity and Aptitude " ,McGrawhill Education Private Limited , 2014
5. GovindaRajan M., Natarajan S., Senthil Kumar V.S." Professional Ethics and Human Values " Prentice Hall India Private Limited ,2012
6. Course Material for Post Graduate Diploma In "Value Education & Spirituality " Prepared by Annamalai University in Collaboration with Brahma Kumaris , 2010

ME 316

DYNAMICS AND VIBRATIONS LAB

Instruction	3 Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessionals	25 Marks
Credits	02

Objectives:

1. To demonstrate basic principle and exposure to evaluate CAM Follower Motion and Gyroscopic.
2. Students will understand the importance of static and dynamic balancing
3. Students will acquire the knowledge in evaluating the stability of dynamic systems.

Outcomes:

1. Students will be able to evaluate the effect of gyroscopic couple and CAM Follower Motions in machines.
2. Students will be able to estimate the performance of governers
3. Students will be able to evaluate the static and dynamic balancing of rotating and reciprocating machines.
4. Students will be able to evaluate the stability of systems under dynamic loading.

List of experiments:

(1) To study the motion of follower with the given profile of the cam. (To plot the n-q (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 vibration.

(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 single rotor system.

(8) Undamped torsional vibrations of double rotor system.

(9) To study the longitudinal vibrations of helical coiled spring.

(10) To study the undamped forced vibration of spring mass system.

(11)To study the force damped vibration of spring mass system.

(12)Determination of critical speed of the given shaft with the given end conditions. (Whirling of Shafts)

(13)Frequency response of spring mass system with and without damping.

(14)Frequency response with random excitations (Seismic response).

Note: Any 12 experiments need to be conducted

ME 317

THERMODYNAMICS LAB

Instruction	3 Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessionals	25 Marks
Credits	2

Objectives:

1. To demonstrate basic knowledge and exposure to evaluate the performance of the internal combustion engines of petrol engine and diesel engine
2. Students will understand the importance of heat distribution of internal combustion engine
3. Students will acquire knowledge in evaluating the performance of multi-stage reciprocating compressor
4. Student will come to know to estimate the properties of fuel.

Outcomes:

1. Students will be able to evaluate the performance of petrol and diesel engine
2. Students will be able to estimate the actual heat utilized by petrol and diesel engine
3. Students will be able to evaluate the performance of multi stage reciprocating air compressor and its importance over single stage air compressor
4. Students will be able to evaluate the properties of test fuels for internal combustion engines.

List of experiments:

1. To determine volumetric efficiency, isothermal efficiency and mass flow rate of a two stage reciprocating air compressor.
2. To determine valve/ port timing diagram of a Diesel engine.
3. To conduct performance test on a Diesel engine.
4. To conduct heat balance test on a Diesel engine.
5. To conduct Morse test on multi cylinder Petrol engine.
6. To conduct performance test on multi cylinder Petrol engine.
7. To conduct performance test on a two-stroke Petrol engine.
8. To conduct performance test on multi cylinder Diesel engine.
9. To study the performance of a Petrol engine with variable compression ratios and speeds
10. To determine CO and UBHC emissions from a Petrol engine.
11. To measure smoke emissions from a Diesel engine.
12. Determination of viscosity of lubricating oil.
13. Determination of flash and fire points of a fuel

Note: Any 12 experiments need to be conducted

With Effect from the Academic Year 2015-2016

ME 318

MANUFACTURING PROCESSES LAB

Instruction	3 Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessionals	25 Marks
Credits	2

Objectives:

1. To make the students acquaint with the welding equipment, forming dies & equipment and the sand casting process.
2. To give the students a feel of working with their hands in the areas of welding, casting and forming.

Outcomes:

1. Students can select the welding processes for a given fabrication.
2. Students are able to suggest the various testing methods required for the moulding sand
3. Students can select the die and can give suitable lay out for shearing operation.

Casting

1. Design and manufacturing 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, DSS Permeability and shatter index.
5. Testing of Bentonite: gel index and swell index.
6. Finding out the GFN, Moisture content and clay content for a given sand sample
7. Melting & Pouring of Aluminum
8. Dimensional inspection & visual inspection of the casting and analysis of dimensional variation & defects.

Welding

1. Study of gas welding equipment and process. Identification of flames, making Butt joint with gas welding.
9. Study of Arc welding process, comparison of the bead geometry with DCSP, DCRP and A.C.
10. Study of resistance welding process and plot the variation of spot area with time and current variation
11. Study of TIG welding process and plotting cooling curve in TIG welding process.
12. Study of SAW Welding process and finding out deposition efficiency of the process.
13. Study of MIG welding process and testing of weld bead formed by MIG welding.

Metal Forming

14. Evaluation of formability using Ericson coupling test.
15. Design study of progressive die, strip layout and making washers with it.
16. Design study of compound die and making washers with it.
17. Design study of combination die and making cups with it.
18. Study of cup drawing process and formulation of cup with simple die
19. Study of blanking operation and cutting the blanks with simple die

Note: Minimum 12 experiments to be conducted

Chaitanya Bharathi Institute of Technology (Autonomous)
Department of Mechanical Engineering
SCHEME OF INSTRUCTION & EXAMINATION

B.E. III Year (Mechanical Engineering)

II - Semester

S.No	Syllabus Ref.No	Subject	Scheme of Instruction Per week				Scheme of Examination			Credits
			L	T	D	Lab	Duration in Hrs	Maximum Marks: End Exam	Maximum Marks: Sessionals	
THEORY										
1	ME 321	CAD and CAM	4	-	-	-	3	75	25	3
2	ME 322	Metal Cutting & Machine Tool Engineering	4	-	-	-	3	75	25	3
3	ME 323	Hydraulic Machinery & Systems	4	-	-	-	3	75	25	3
4	ME 324	Refrigeration & Air Conditioning	4	-	-	-	3	75	25	3
5	ME 325	Machine Design	4	1	-	-	3	75	25	3
6		ELECTIVE - I	4	-	-	-	3	75	25	3
PRACTICALS										
1	ME 326	CAD and CAM Lab	-	-	-	3	3	50	25	2
2	ME 327	Metal Cutting & Machine Tool Engineering Lab	-	-	-	3	3	50	25	2
3	ME 328	Hydraulic Machinery & Systems Lab	-	-	-	3	3	50	25	2
4	ME 329	Industry Visit	-	-	-	-	-	-	-	-
		TOTAL	**24**	**1**	-	**9**	-	**-**	**-**	**24**
ELECTIVE - I										
1	ME 351	Control Systems Theory	4	-	-	-	3	75	25	3
2	PE 324	Additive Manufacturing	4	-	-	-	3	75	25	3
3	ME 555	Human Rights & Legislative Procedure	4	-	-	-	3	75	25	3
4	PE 353	Value Engineering	4	-	-	-	3	75	25	3
5	PE 354	Surface Engineering	4	-	-	-	3	75	25	3
6	ME 353	Mechanical Vibrations	4	-	-	-	3	75	25	3

* Grade: Excellent / Good/Satisfactory/Unsatisfactory

ME 321 **With effect from the academic year 2015-16**

CAD and CAM

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End Examination	75	Marks
Sessional	25	Marks
Credits	3	

Objectives:

1. Understand the basic and advanced concepts of computer aided design. Learn the application of CAD in geometric modeling.
2. Students will develop an understanding of the theory and construct the elements of curved surface representation.
3. Explain solid modeling representation schemes and the Euler operators. Understand and be able to perform two-dimensional and three-dimensional geometric transformations on objects.
4. Have an overview of advantages and disadvantages of modeling and analysis packages..

Outcomes:

1. Students will understand the concepts of CAD and understand the programming concepts Ability to apply mathematics and students learn the theory behind the CAD software they use in the laboratory.
2. Solve engineering problems on the topics included in this theory - geometry manipulation, curve and surface representations.
3. Evaluate mathematical transformation, design and model curves, surfaces and solids.
4. Differentiate between the modeling techniques, and apply the principles of geometric modeling, effectively employ solid modeling tools.

UNIT-I

Design Processes: Design criteria, Alternative solutions, Alternative design, Computer aided design and review

Drafting techniques: Basic geometrics elements and their creation

Geometric 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 NURBS.

UNIT-II

Surface modeling: analytic surfaces: definition of planar, surface of revolution, tabulated cylinder, synthetic surfaces: cubic and Bezier surfaces. Solid modeling: C – rep and B – rep approaches

Design application: mass property calculations, mechanical tolerancing, finite element analysis, design review 2 D transformations: translation, scaling and rotation about arbitrary point, shear and reflection, homogenous representation, concatenation

UNIT-III

CAD database and data exchange: CAD database and structure, IGES, STEP and STL format Numerical control machine tools: features and elements of NC, positional, paraxial and contouring types. Definition of axes.Definition of interpolation, post-processor, preparatory and miscellaneous functions, canned cycles, tool length and cutter radius compensation. Manual and computer aided part programming (APT) for simple components. Programming with MACROS.

UNIT-IV

Computer numerical control: CNC, DNC, adaptive control systems. Typical configurations and relative features. Machining centers. Introduction to FANUC, SINUMERIC controllers. Industrial robots: robot anatomy, configurations, controls, drivers, programming methods and applications.

UNIT-V

GT: Part families, layout, part classification and coding system, Optiz, MICLASS code system. CAPP: variant and generative process planning. FMS and CIM: building blocks of flexible manufacturing system and their control. Elements of CIM. Computer aided inspection and QC: Co-ordinate measuring machine, non contact inspection: machine vision, scanning laser beam devices, Quality control: CAD/CAM integration, Turnkey CAD/CAM systems, Introduction to rapid prototyping technique, reverse engineering.

Text Books:

1. Ibrahim Zeid, CAD/ CAM "theory and practice" , McGraw Hill Inc , New York, 2011
2. Grover MP and Zimmers EW "CAD/CAM" Prentice Hall of India, 1989

Suggested Reading:

3. Arvid R Eide , Roland D Jenison, Lane H Mashaw, Larry L Northup, "introduction to engineering design" McGraw Hill 1998
4. Rao PN "CAD/CAM : Principles and applications" 2nd edition, Tata McGraw Hill, New Delhi, 2004
5. YoramKoren, "Computer control of manufacturing systems" McGraw Hill Int, New York, 1994
6. Elanchezhian C Sunder Selwyn , T Shanmuga Sunder G" Computer Aided manufacturing" , Laxmi Publications (P) Ltd, 2nd edition, New Delhi 2007

ME 322 **With effect from the academic year 2015-16**

METAL CUTTING & MACHINE TOOL ENGINEERING

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessional	25 Marks
Credits	3

Objectives:

1. To provide the basic understanding of cutting tools, geometry in machining processes
2. To make students familiar with cutting forces in turning drilling, milling operations.
3. To make the students to understand various machine tools, like lathe, drilling, milling shaper, planner,
4. To impart knowledge of Thread manufacturing and gear manufacturing

Outcomes:

1. Students are able to select tool geometry for various materials
2. Students are able to calculate forces in turning, drilling and milling processes
3. Students are capable of identifying the machine tools for manufacturing of various components.
4. Students are able to understand thread cutting and gear cutting operations

UNIT-I

Cutting tool materials: High carbon steel HSS, Stellite, Carbides, Diamonds, Tool materials properties

Tool Geometry: Nomenclature of single point cutting tool by ASA& ORS systems, Geometry of drills, milling cutters

Chip formation: Types of chips, BUE, Chip breakers.

Machining: Orthogonal and oblique cutting, Merchants 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 of temperature, cutting fluids and applications

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.

Economics of machining: Tool life for maximum production, minimum cost.

UNIT-III

Lathes: 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

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.

UNIT-IV

Boring machines-Horizontal, Vertical and Jig boring machines and constructional features. Differences between Shaper, Planner and slotter, Quick return mechanisms

Grinding Machines: Types, Classification Abrasives and bonds used for grinding wheel, Selection of grinding wheel, cylindrical grinding and center less grinding.

Screws and Thread production – Thread rolling, thread chasing , thread milling and thread grinding. Gear shaping, gear hobbing, gear shaving and gear grinding

UNIT-V

Jigs and Fixtures: Design principles for location and clamping. Quick clamping devices. Types of jigs and fixtures

Unconventional machining: Principles of working and applications USM,AJM,EDM,ECM,LBM and EBM(Mechanisms and theory MRR and Process parameters in each case)

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 Culling & Machine Tools",* Vol. 2, Tata McGraw Hill Education Pvt. Ltd, 2010.

Suggested Reading:

3. Jain K.C Chitale, A.K., 'Production Engineering', 2nd Edn., PHI, 2014.
4. M.C. Shaw, "Metal Cutting Principles", Clarendon Press, Oxford 1984.
5. P.C.Pandey & Shan HS "Modern Machining process" Tata McGraw-Hill Education 1980
6. A. Bhattacharya "Metal Cutting Theory and Practice" New Central Book Agency (p) Ltd Calcutta, 1996

ME 323

HYDRAULIC MACHINERY AND SYSTEMS

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. The purpose of this course is to learn the Fluid properties and fundamentals of Fluid statics and fluid flow
2. To introduce the concepts of flow measurements and flow through pipes
3. To introduce the concepts of momentum principles
4. To impart the knowledge on pumps and turbines

Outcomes:

1. Graduates will become familiar with the impact force of jet on different types of vanes.
2. Graduates demonstrate the ability of servicing of reciprocating and centrifugal pumps.
3. Graduates are expected to have ability to design the turbines for power generation.
4. Graduate demonstrate the ability of designing various hydraulic appliances.

UNIT-I

Hydraulic Machines- Classification- Impulse-momentum equation- Lay-out of hydraulic power plant-working principle- Impact jet on vanes- 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

UNIT-II

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-III

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- Troubles (operational difficulties), reasons and remedies in CF pumps- Cavitation- effects of Cavitation- Precautions against Cavitation

UNIT-IV

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- Comparison between Impulse and reaction turbines- Comparison between Francis and Kaplan turbines- Specific speed- Physical

significance of specific speed- Unit testing -Unit quantities- Model testing of turbines- Conditions for similarity of turbines- Draft tubes (functions and types only)- Surge tanks(functions and types only) - Performance characteristic curves

UNIT-V

Hydraulic Systems (appliances): Working and simple problems on hydraulic press- force applied on the plunger to lift a load- power required to drive the plunger- number of strokes performed by the plunger to lift a load- accumulator- capacity of accumulator- load on the ram- intensifier- Ram-D'Aubuison's and Rankine's efficiency of the ram- jack- lift- direct acting hydraulic lift- Suspended hydraulic lift- crane- efficiency of the crane- air lift pump- gear wheel pump- Control vales (functions and classification only)

Text Books:

1. Bansal, R.K., "*A Text Book of Fluid Mechanics and Hydraulic Machines*", Laxmi Publication (P) Ltd., New Delhi,2004
2. Modi, P.N. and Seth. S.M., "*Hydraulics and Fluid Machines*", Standard Book House, New Delhi, 2004

Suggested Reading

3. Ramamrutham, S., "*Hydraulics,Fluid Mechanics and Fluid Machines*", Dhanpat Rai & Sons, New Delhi,2004
4. Kumar, K.L., "*Engineering Fluid Mechanics*", Eurasia Publishing House (P) Ltd., New Delhi,2004
5. White, Frank. M., Fluid Mechanics, 5th Edn., McGraw Hill 2003.
6. Madan Mohan Das., "Fluid Mechanics and Turbomachines", PHI Learning Private Limited, New Delhi, 2009

ME 324

REFRIGERATION AND AIR CONDITIONING

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives

1. Students will acquire the basic knowledge about the importance of refrigeration and its applications in engineering practice
2. To demonstrate basic knowledge of various types of refrigeration processes like air refrigeration, simple vapor compression refrigeration and absorption refrigeration, steam jet refrigeration and un-convectional refrigeration
3. Students will acquire the basic knowledge on various psychrometric processes
4. Students will acquire knowledge in estimating air conditioning loads

Course Outcomes

1. Students will be able to differentiate refrigeration from air conditioning
2. Students will be able to understand merits and demerits of various refrigeration processes
3. Students will be able to apply a suitable psychrometric process depending on requirement or application
4. Students will be able to design air conditioning system for a particular application

UNIT-I

Introduction to Refrigeration: Definition of Refrigeration and Air-conditioning, Necessity of Refrigeration and its applications, Methods of Refrigeration, Unit of Refrigeration and C.O.P. Reversed Carnot cycle, Limitations, Effect of operating temperatures,

Properties of Refrigerants: Survey, Designation, Desirable properties of refrigerants, Thermodynamic, Chemical and Physical properties, Classification of Refrigerants, Alternative refrigerants, Substitute for CFC Refrigerants, Global warming, Green House Effect and Future of Refrigerants.

Air Refrigeration Systems: Analysis of Bell-Coleman Cycle, Reversed Brayton cycle, Open and Dense air system, Application to aircraft refrigeration, Simple cooling system, Bootstrap simple evaporating system, Regenerative cooling system and Reduced ambient cooling system.

UNIT-II

Vapour compression system: Working principle and essential components of Simple vapor compression Refrigeration cycle, Compressor, condenser, evaporator, and expansion devices, Analysis of cycle, C.O.P, Representation of the cycle on T-S, P-H and H-S charts

Dry and wet compression, 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 absorption refrigeration system, Lithium bromide absorption system, Electrolux refrigerator, Common refrigerants and absorbents properties, Comparison with vapor compression refrigeration system

Steam Jet Refrigeration: Principle of working**, A**nalysis of the system, Advantages, limitations and applications.

Non-Conventional Refrigeration Systems: Principle and operation of Thermoelectric Refrigeration Systems, Seebeck effect - Peltier effect - Thomson effect, Analysis, Pulse tube refrigeration system.

Introduction to Cryogenics- Advantages, Limitations and applications

UNIT-IV

Psychrometry- Psychrometric properties, Psychrometric chart, construction, Representation of Psychrometric processes on the chart, Heating and Cooling with Humidification and Dehumidification, Adiabatic dehumidification, Adiabatic chemical dehumidification and mixing processes

Introduction to Air Conditioning Requirements of comfort air conditioning, Thermodynamics of human body, Body temperature, Metabolism, Body defense and Human tolerance, Effect of heat on performance, ASHRE comfort chart, Effective temperature.

UNIT-V

Cooling Load Calculations in Air Conditioning: Concept of bypass factor, Sensible heat factor, Apparatus Dew Point, Room Sensible Heat Factor (RSHF), Gross Sensible Heat Factor (GSHF), Different heating and cooling loads, Problems.

Design of air conditioning systems: All fresh air, Re-circulated air with bypassed air, Design of Summer, Winter and Year round air conditioning systems, Energy conservation in air conditioned building,

Air Conditioning Systems: Types, Components of air conditioner equipments, Humidifier, Dehumidifier, Filter. **Applications of Refrigeration and Air conditioning** Food Preservation, Transport air conditioning, and Industrial applications

Text Books

1. Arora C.P., " *Refrigeration and Air conditioning*", Tata McGraw Hill, New Delhi, 2004.
2. Stocker, W.S., "*Refrigeration and Air conditioning*", McGraw Hill, New Delhi, 2004.

Suggested Reading

3. Jain, V.K., "*Refrigeration and Air Conditioning*", S Chand & Company, New Delhi, 2004.

4. Manohar Prasad, "*Refrigeration and Air Conditioning*", New Age International, Allahabad, 2007.
5. Rajput, R.K., "*Refrigeration and Air Conditioning*" Laxmi Publications, New Delhi, 2007
6. Edward G Pita, Air conditioning Principles and Sytems: An Energy Approach,4th edn,PHI,2012

With Effect from the Academic Year 2015-2016

ME 325

MACHINE DESIGN
(USAGE OF DATA BOOK IS COMPULSORY)

Instruction	4 Periods + 1 Tutorial per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To learn design criteria of machine components, selection of materials and manufacturing process.
2. To learn application of principles to design helical coiled and leaf springs, gears, curved beams, sliding contact and rolling element bearings and IC engine components.
3. To provide the design concepts of helical and leaf springs.
4. To provide the students the knowledge of design of IC engine parts.

Outcomes:

1. Graduates will become familiar with the design of springs, gears, bearings, engine parts and curved beams.
2. Graduates demonstrate the ability of designing helical springs and leaf springs for static and fluctuating costs.
3. Graduates are expected to have ability to design gears for power transmission considering beam strength, dynamic factors and wear life.
4. Graduate demonstrate the ability of designing curved beams likec-clam and crane hooks.

Unit-I

Mechanical springs: Introduction. Different types of springs. Materials used for springs.

Helical Springs: Whal factor, calculation of stress, Deflection and energy stored in spring. Design for static and fluctuating loads.

Leaf Springs: Stress and Deflection. Nipping of Leaf springs. Design for static and fluctuating loads.

Unit-II

Gears: Introduction of gear drives, different types of gears, Materials used for gears. Standards for gears and specifications.

Spur Gear Design: Lewis equation, Beam strength of gear tooth and static design. Wear load and design for Wear. Dynamic loads on gear tooth. Design of Helical, Bevel and Worm gears, concepts of Design for manufacturability.

Unit-III

Bearings: Introduction. Materials used for Bearings. Classification of bearings and mounting of bearings.

Design of sliding contact bearings: Properties and types of Lubricants, Design of Hydrostatic and Hydrodynamic sliding contact bearings.

Design of Rolling Contact Bearings: Different types of rolling element bearings and their constructional details, static load carrying capacity. Dynamic load carrying capacity. Load-life relationship, selection of bearing life. Design for cyclic loads and speeds. Design of Ball and Roller bearings.

Unit-IV

I.C. Engine parts: Introduction. Materials used. Design of piston, connecting rod and crank for I.C. Engines.

Unit-V

Design of curved beams: Introduction stresses in curved beams, expression for radius of curvature of neutral axis for rectangular, circular, trapezoidal and T-sections. Design of crane Hook, C-clamp.

Design of chain drives: Power rating of roller chains. Strength of roller chains.

Text Books:

1. Bhandari V.B. *Machine Design*, Tata Mc Graw Hill Publications, 2010.
2. J.E. Shigley , C.R. Miskhe, *Mechanical Engineering Design*, Tata Mc Graw Hill Publication, 2010.

Suggested Reading:

3. P. Kannaiah, *Machine Design*, Science-Tech Publications, 2010.
4. M.F. Spotts, *Design of Machine Elements*, Prentice Hall, 2013.
5. Robert L. Norton, *Machine Design: An Integrated Approach*,2/e Pearson Education, 2013.
6. Siraj Ahmed, 'Mechanical Engineering Design, PHI, 2014.

Machine Design Data Books:

7. Design Data book by PSG College – 2012
8. Mahadevn .K, Balaveera Reddy. K, 'Design Data Hand Book, 4th Edn., CBS Publishers & Distributors, 2013.

ME 326

CAD and CAM LAB

Instruction	3	Periods per week
Duration of End Examination	3	Hours
End Examination	50	Marks
Sessionals	25	Marks
Credits	2	

Objectives:

1. 3D Part modeling – protrusion, cut, sweep, draft, loft, blend, rib , Editing – Move, Pattern, Mirror, Round, Chamfer
2. Assembly (Coupling, Screw jack) – creating assembly from parts – assembly constraints
3. Conversion of 3D solid model to 2D drawing - different views, sections, isometric view and dimensioning , mass property calculations
4. To learn and develop the skill in creating a component by utilizing the Automated Machines.

Outcomes:

1. Draw complex geometries of parts in sketcher mode.
2. Generate freeform shapes in part mode to visualize parts.
3. Create complex engineering assemblies using appropriate assembly constraints.
4. Develop various machine components and their assembly using modeling software
5. Write part programs using G and M codes for lathe and milling operations

Detailed Syllabus:

1. Introduction to Solid Modeling & Solid Works Package, Working with sketch mode of Solid Works
2. Working with creating features and applying on various part models
3. Part modeling of cotter, Knuckle Joints and Couplings
4. Generating, editing and modifying drawings in SolidWorks.

5-8. Assembly modeling of the following
   (a) Screw Jack (b) Stuffing Box (c) Plumber Block (d) Eccentric

9. Generating design drawings with tolerencing from part and assembly modeling

10-11. Step Turning, Taper Turning and Multiple Turning On CNC Lathe Machine

12. Contouring and Facing on CNC Milling Machine

13. Rectangular & Circular pocketing on CNC Milling Machine.

14-15. User of CAM software for various maching operations

Note: Any 12 experiments need to be conducted

ME 327

METAL CUTTING & MACHINE TOOL ENGINEERING LAB

Instruction	3 Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessionals	25 Marks
Credits	2

Objectives

1. To grind single point cutting tool using HSS as cutting tool
2. To have work shop practice on lathe drilling and milling machines
3. To understand gear cutting and to cut gear on milling machine
4. To measure cutting forces during machining on Lathe machine, milling

Out comes:

1. Student is able to grind single point cutting tool with various angles
2. Student is able to produce various components on lathe, milling machines
3. Student is able to manufacture a gear using milling machine
4. Student is able to measure cutting forces during machining on Lathe machine, milling

List of 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 using universal dividing head
9. Measurement of Cutting forces during machining on Lathe machine, milling machine
10. Finding Shear angle experimentally in turning operation
11. Grinding flat surfaces using surface grinding machine and measurement of surface finish
12. Study of Electro Discharge Machining (EDM)
13. Measuring the temperature during machining in lathe and milling

Note: Any 12 experiments need to be conducted

ME 328

HYDRAULIC MACHINERY AND SYSTEMS LAB

Instruction	3 Periods per week
Duration of End Examination	3 Hours
End Examination	50 Marks
Sessionals	25 Marks
Credits	2

Objectives:

1. The purpose of the lab course is to support the understanding of the application of theoretical concepts of hydraulics machinery.
2. To conduct performance tests on pumps, turbines and other hydraulic machines.

Outcomes:

1. Student is able to verify the Bernoulli's equation and reasons for it.
2. Student is able to determine the friction factor for a pipe made of a material
3. Student is able to determine impact force of jet on vanes
4. Student is able to determine the performance of (efficiency) of pumps and turbines.

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 Orificemeter
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: Any 12 experiments need to be conducted

ME 329

INDUSTRY VISIT

At least 3 days in a semester	3 x 8 = 24 Hours
Sessionals	Grade*

A minimum of two industrial visits will be arranged by department and students have to attend the visits and prepare a data report of their visits to the industries and submit to the department. Students are required to present a seminar based on their report which is evaluated by Head of the Department and two senior faculty to award the grade.

***** Excellent / Very Good / Satisfactory / Unsatisfactory

ME 351

CONTROL SYSTEMS THEORY (Elective-I)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To introduce students to the fundamental of feedback control system theory.
2. Use of analytical design methods in designing, analyzing various physical systems and to apply the gained knowledge in developing solutions for real world systems.
3. To develop the ability of formulating mathematical models and designing feedback control systems.
4. To provide students with necessary tools to analyze linear feedback control systems.

Outcomes:

1. Students should be able apply major equations of linearized models and their transfer function
2. Student are learned to apply Final-value Theorem to determine the steady-state response
3. Students should be able to understand how to construct Bode and polar plots for transfer functions
4. Students should be able to understand the applications of Nyquist criteria to find Gain and phase margins

Unit-I

Control Systems Classification: Open Loop & Closed Loop Systems. Mathematical models and Transfer functions from governing equations of mechanical, electrical, hydraulic, pneumatic, thermal systems. AC, DC servomotors & Electromechanical servo systems.

Unit-II

Block diagrams, Block diagram reduction. Signal flow graphs, Mason's gain formula. Transient response. Time domain specifications of 1^{st} and 2^{nd} order systems. Steady state error, Error coefficients, sensitivity and Performance indices.

Unit-III

Routh criteria, Root Locus method. Frequency Response: Bode, Polar plots. Correlation between transient and frequency response, Bandwidth, Experimental determination of transfer functions.

Unit-IV

Nyquist criteria. Gain and phase margins, Lead. Lag and Lead-lag compensator design, PID controller, linearization of Non linear systems.

Unit- V

State space representation: Concept of state, State variable, state models of linear time invariant systems, derivation of state model from transfer functions and differential equations. State transition matrix, solution of state equations by time domain method. Concept of controllability and observability.

Text Books:

1. Ogata, K., *"Modern Control Engineering",* Prentice Hall, 2004
2. M. Gopal, *"Control Systems",* Tata McGraw Hill, 2004.

Suggested Reading:

3.Anand kumar.A “control systems”, Prentice Hall of India,2014
4. Norman S. Nise, *"Control Systems Engineering",* John Wiley & Sons, Inc., 2001
5. M. Gopal, ‘Modern Control System Theory’, New Age International, 1993
6. K.R. VARMAH, ‘Control Systems’ McGraw Hill, June, 2010

PE 324 ADDITIVE MANUFACTURING (Elective-I)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To make students understand the basic concepts of various rapid prototyping technologies.
2. To understand and apply criterion for selecting appropriate RPT technique for any given application.
3. To competently use tools to explore digital manufacturing techniques and CAD modeling software

Outcomes:

1. Describe various CAD issues for rapid prototyping and related operations for STL model manipulation, formulate and solve typical problems on reverse engineering
2. Explain and summarize the principles and key characteristics of RP technologies and commonly used RP systems& typical rapid tooling processes for quick batch production of plastic and metal parts
3. The students will be able to critically explore technologies used for rapid prototyping in terms of their parameters, application, limitations, cost, materials, equipment, outcomes and implications

UNIT-I

Introduction to rapid manufacturing, customization and mass customization, classification of rapid manufacturing processes (additive,/subtractive/formative), process chain for additive and other rapid manufacturing processes. Classification of additive (layered) prototyping/ tooling/ manufacturing processes.

UNIT-II

Extruder deposition system, laminated object manufacturing and laminated tooling systems, shaped deposition manufacturing and modular configuration, stereolithography and other liquid based systems. Laser sintering based technologies and their related details

UNIT-III

Construction and basic AM machines: construction of CNC machine – axes, linear motion guide ways, ball screws, motors, bearings, encoders/glass scales, process chamber, safety interlocks, sensors

UNIT-IV

Pre-processing in AM: Pre-processing of CAD model- STL conversion, STL error diagnostics, support generation, transformations, slicing, surface preparation of materials, pre-heating of powders.

UNIT-V

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.

Text Books:

1. Gibson I, Rosen DW and Stucker B; Additive manufacturing methodologies : Rapid prototyping to direct digital manufacturing , Springer , 2010
2. Venuvinod, PK; Ma, W; Rapid prototyping – Laser based and other technologies, Kluwer , 2004

Suggested Reading:

3. Chee Kai Chua, Kah Fai Leong , 3D printing and additive manufacturing : principles and application: fourth edition of rapid prototyping
4. Rapid tooling : Technologies and industrial applications by Jacob, Paul F
5. Andreas Gebhanrdt, Understanding Additive Manufacturing,Hanses,2012
6. Alain Brnard, Georges Talliander,Additive Manufacturing,Wiley,2014

ME 555 **With effect from the academic year 2015-16**

HUMAN RIGHTS AND LEGISLATIVE PROCEDURE (Elective-I)

Instruction	4 Periods per week
Duration of End Examination	3 Hrs
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: To help students

1. To understand the value of human rights
2. To understand the Lawful rights available to him and others
3. To create understanding the rights of under privileged and respect them
4. To understand role of an individual in the Civil Society

Course Outcomes:

1. At the end of the course student will understand the process of evolution of human rights
2. Will understand constitutional protection available
3. Will understand the conditions of under privileged persons and will adopt a positive attitude towards.
4. Will understand the role of Law in protecting environment and will recognize right to life.

Unit-I

Meaning and concept of Human Rights: Notion and classification of Rights, Moral and Legal Rights, Three generations of rights (Civil, and Political Rights, Economic Social and Cultural Rights, Collective/Solidarity Rights). Indian Bill of Rights and Sarodaya. Preamble of Indian Constitution, Fundamental Rights-Directive Principles-Fundamental Duties

Unit-II

Human Rights enforcement mechanism Human Rights Act, 1993, Judicial organs-Supreme Court (Art 32) and High Court (Art 226), Human Rights Commission, National and State Commission of Women/Children/Minority/SC/ST

Unit-III

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

Unit-IV

Environment Rights such as right to clean environment and public safety: Issues of Industrial Pollution, Prevention, Rehabilitation: Safety aspects of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment.

Unit-V

Role of Advocacy Groups: (a) Professional bodies: Press, media role of Lawyers – Legal Aid., (b) Educational Institutions (c) Role of Corporate Sector (d) N.G.Os

Text Books:

1. The history of Human rights by M.r. Ishay, Orient Longman, Newdelhi, 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.
4. P.M. Katare and B.C. Barik, Development, Deprivation and Human Rights, Violation, New Delhi: Rawat, 2002.

Reference Books:

5. Venket Iyer, (ed.), Democracy, Human Rights and the Rule of Law: Essays in Honour of Nani Palkhivala, New Delhi: Butterworth's, 2000.
6. R.J. Cook and C.G. Ngwena (ed.), Health and Human Rights, OUP, Clarendon, 2007.
7. UNESCO, Ethics of Science and Technology: Explorations of the Frontiers of Science and Ethics, OUP, Clarendon, 2006.
8. K.P. Saksena, (ed.), Human Rights and the Constitution: Vision and the Reality, New Delhi: Gyan Pub.,

With effect from the academic year 2015-16

PE 353

VALUE ENGINEERING (Elective-I)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To enable students to understand the concepts & applications of Value Engineering.
2. To know various alterations processing techniques & materials used in manufacturing.

Outcomes:

1. Ability to apply the concepts of Value Engineering in the context of engineering
2. Ability to apply the concepts of value engineering to various products to be manufactured in industries and in turn to minimize the cost

UNIT-I

An overview of value engineering (VE)-Definition, concepts and approaches of value analysis, concepts and approaches of value analysis and engineering-evaluation of VE. Evaluation of function, problem setting system, problem solving system, setting and solving management decision.

UNIT-II

Type and Services problem, evaluation of value. Results accelerators, basic steps in using the systems value analysis.

UNIT-III

Understanding the decision environment, effect of value analysis on other work in the business. VE Team, coordinate, designer, different services, definitions.

UNIT-IV

Construction Management Contracts Value Engineering Case studies, effective organization for value work, function analysis system techniques- FAST diagram.

UNIT-V

Case Studies: A student is expected to associate with any local industry where Value Engineering is applied and submit a report (or) a question may be set involving a case study where a student has to apply creative idea to reduce the cost without compromise to the end use of the product.

Text Books:

1. Value Engineering by L.D. Miles, Mc-Grawhills
2. Value Engineering Theory by D.E. Parker, Sundarm Publications

Suggested Readings:

3. Value Engineering – practical applications for design, construction and operations by ALPHONSE DELL'LSOLA
4. Value Engineering Practical applications by Dr. John N. Parrigin
5. Value Engineering Mastermind Concept to Value Engineering certification by Anil Kumar Mukhopadhyaya

6. Value Engineering A plan for invention by Richard Park

With effect from the academic year 2015-16

PE 354

SURFACE ENGINEERING (Elective-I)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 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.

Outcomes:

1. Engineering and surface modification methods which are necessary to solve the industrial practical problems that arise and also for the research.
2. It helps the students to get familiarized with the various theories and practice on surface.

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. Rabinowicz.E, “Friction and Wear of materials”, John Willey &Sons ,UK,1995

Suggested Readings

3. Halling, J. (Editor) – “Principles of Tribology “, Macmillian – 1984.
4. Williams J.A. “Engineering Tribology”, Oxford Univ. Press, 1994.
5. S.K.Basu, S.N.Sengupta & B.B.Ahuja ,”Fundamentals of Tribology”, Prentice –Hall of India Pvt Ltd ,

New Delhi, 2005
6. Fontana G., "Corrosion Engineering", McGraw Hill, 1985

With Effect from the academic Year 2015-16

ME 353 MECHANICAL VIBRATIONS (Elective-I)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End Examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. To gain the 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. To study the response of a vibrating system with periodic excitation and understand the principle of vibration isolation.
3. To develop the equations of motion for a continuous system in elongation, bending and torsion to find the natural frequencies and mode shapes.

Outcomes:

1. Develop a mathematical model for a physical system and derive the governing differential equations.
2. Determine the natural frequencies of single and two degrees of freedom systems without and with damping.
3. Determine and analyze the response of machine members or structures in forced vibration with different excitation frequencies.
4. Determine the natural frequencies and mode shapes of bars in elongation and torsion and beams in bending.

UNIT-I

Fundamentals of Vibrations Analysis- Introduction; Elements of vibration; vibration analysis procedure; spring elements-equivalent stiffness; Mass or inertia elements; Damping elements-equivalent damping-Types of damping, Definitions and Terminology, Simple harmonic motion.
Free Vibration Analysis-Single Degree of Freedom Systems Undamped Vibrations: Different methods for equation of motion-Newton's Second Law, D'Alembert's Principle of Virtual displacement, Principle of Conservation of Energy, Rayleigh's method.
Damped Vibrations: Differential equation of motion, critical damping coefficient and damping ratio; Damped natural frequency; Logarithmic decrement; Energy dissipated in viscous damping.

UNIT-II

Forced Vibration Analysis (Single Degree of Freedom System):Response of damped and undamped systems to harmonic excitation; frequency response curve; magnification factor; Harmonic excitation of the base, vibration isolation, transmissibility, force transmission to foundation; response of a damped system under rotating unbalance.

Vibration measuring instruments-working principle of Seismic mass, Vibrometer, Accelerometer.

UNIT-III

Damped and Undamped Vibrations: Free and forced vibration analysis of two degree of freedom system-different methods for the formulation of equation equations of motion, natural frequencies,

Principal modes-physical interpretation and orthogonality, General method, Eigen value method, Influence coefficients.

UNIT-IV

Torsional Vibrations: Torsional vibration of one, two and three rotor system, Equivalent shafting, Torsional vibration of a geared system, Coordinate coupling-static and dynamic coupling, whirling of rotating shafts.

UNIT-V

Vibrations of Continuous Systems: Vibrations of strings, bars and beams, formulation of equation of motion, characteristic equation, Eigen values, identification of node and mode shape

Text Books:

1. G.S. Grover & Nigam ,Mechanical Vibrations,Nem Chand & Bros, 6th edn,1998
2. S.S. Rao ,Mechanical vibration, 4th edn, Pearson, 2009

Suggested Readings:

3. Thomson , William T, Theory of Vibration with Application,4th edn, Pearson Education,2007
4. V.P. Singh , Mechanical vibration, Dhanpath Rai &Co.,3rd edn,2006
5. Graham Kelley,S., Mechanical vibration – Schaums Outline Series, TMH
6. F.S. Tse, Morse & Hinkle ,Mechanical vibration, Allyn and Bacon, 1978

With Effect from the Academic Year 2016 - 2017

Chaitanya Bharathi Institute of Technology (Autonomous)
Department of Mechanical Engineering

SCHEME OF INSTRUCTION & EXAMINATION

B.E. IV-Year (Mechanical Engineering)

I-Semester

S. No	Syllabus Ref. No	SUBJECT	Instruction Per week				Scheme of Examination			Credits
			L	T	D/P	Lab	Duration in Hrs	Maximum Marks: End Exam	Maximum Marks: Sessional	
THEORY										
1	ME 411	Thermal Turbo Machines	4	1	-	-	3	75	25	3
2	ME 412	Metrology and Instrumentation	4	-	-	-	3	75	25	3
3	ME 413	Finite Element Analysis	4	1	-	-	3	75	25	3
4	ME 414	Operations Research	4	-	-	-	3	75	25	3
5		ELECTIVE - II	4	-	-	-	3	75	25	3
PRACTICALS										
1	ME 415	Thermal Engineering Lab	-	-	-	3	3	50	25	2
2	ME 416	Metrology and Instrumentation Lab	-	-	-	3	3	50	25	2
3	ME 417	Computer Aided Engineering Lab	-	-	-	3	3	50	25	2
4	ME 418	Project Seminar	-	-	3	-	-	-	25	1
		TOTAL	**20**	**2**	**3**	**9**	**-**	**-**	**-**	**22**
ELECTIVE - II										
1	ME 461	Renewable Energy Sources	4	-	-	-	3	75	25	3
2	ME 462	Computational Fluid Dynamics	4	-	-	-	3	75	25	3
3	ME 463	Automobile Engineering	4	-	-	-	3	75	25	3
4	ME 464	Entrepreneurship	4	-	-	-	3	75	25	3
5	PE 461	Robotics	4	-	-	-	3	75	25	3
6	CE 461	Disaster Mitigation and Management	4	-	-	-	3	75	25	3
Service course [B.E]										
1	ME 419	Industrial Administration and Financial Management (ECE)	4	-	-	-	3	75	25	3
2	ME 464	Entrepreneurship (EEE, CSE, Civil)	4	-	-	-	3	75	25	3

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ME 411

Thermal Turbo Machines

Instruction	4	Theory + 1 Tutorial Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives:

1. Student will demonstrate basic knowledge by understanding concepts of various gas dynamics equations, necessary for CFD
2. Student will acquire basic knowledge in designing of nozzles and diffusers used in rockets and aircrafts
3. Student will come to know the design of ducts, combustion chambers and various types of shocks
4. Student will come to know the working principles of various rotary compressors like centrifugal compressor and rotary compressor
5. Student will understand the applications of various steam turbines and velocity triangles in order to calculate power developed by them
6. 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, students will be able to

1. Design various configurations of steam nozzles by the principles of gas dynamics which are essential or pre-requisite to computational fluid dynamics
2. Understand Fanno curves along with shock waves
3. Understand the importance of Rayleigh curves in gas dynamics
4. Calculate power required by various types of rotary compressors with the principles of gas dynamics
5. Specify steam turbine as per the application and also calculate power developed by them
6. Calculate thermal efficiency of gas turbines with the principles of gas dynamics and suggest suitable methods to improve work output and efficiency of the plant.

UNIT-I

Introduction to compressible flows: Speed of propagation of pressure waves, Mach number, Acoustic velocity 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 in constant area ducts with friction-Fanno flow, variation of flow properties, variation of Mach number with duct length, isothermal flow with friction

UNIT-II

Flow in constant area duct with Heat Transfer, -The Rayleigh liner, Rayleigh flow relations, variation of flow properties, Maximum heat transfer. Flow with Shock Waves-Development of Normal Shock waves, governing equations, Prandtl -Meyer relation, Rankine-Hugoniot equations, Stagnation pressure ratio across shock.

UNIT-III

Blade nomenclature of an aerofoil, Rotodynamic compressors: Introduction and general classification, Comparison of Reciprocating and Rotary compressors, 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: Classification, flow over blades, pressure velocity variations, Compounding of steam turbines- pressure compounding, velocity compounding and pressure-velocity compounding, Impulse turbine with several blade rings, Nozzle efficiency, Blade efficiency and Gross stage efficiency of Impulse turbine, Velocity diagrams for Impulse turbine-De Laval Turbine, blade efficiency of Impulse turbine, Optimum blade speed ratio, Maximum work done and blade efficiency of Impulse turbine, Degree of reaction of Reaction turbine, Parson Reaction turbine, Velocity diagram for Parson Reaction turbine, blade efficiency of Parson Reaction turbine, Maximum work done and blade efficiency of Parson Reaction turbine, Height of blades of Reaction turbine, Balancing of End thrust

UNIT-V

Gas Turbines: Applications and Classification of Gas Turbines- constant pressure and constant volume gas turbines, 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-Rocket applications

Text Books:

1. Yahya S M, *Fundamentals of Compressible Flow,* New Age International Publishers, Third Edition, 2007.
2. Mathur ML, & Mehta F S, *Thermal Engineering,* Jain Brothers, New Delhi, 2003
3. Dennis G Shepherd, *Aerospace Propulsion,* Elsevier Publishing Company, New York, 1995.

Suggested Reading:

1. Cohen H Rogers G F C, Saravana Mutto H I H, *Gas Turbine Theory,* Longman 5th Edition, New York, 2004.
2. Ganeshan V, *Gas Turbines*, Tata Me Graw Hills, New Delhi, 2003
3. Yadav, R *Steam and Gas Turbines*, Central Publishing House Ltd, Alllahabad, 2003

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ME 412

Metrology and Instrumentation

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. Student will understand the need for measurement and fundamental concepts of measurement.
2. Student will get familiarize with limits, Fits& tolerances and the instruments used to measure these limits.
3. Student will able to have knowledge of various precision linear and angular measuring instruments.
4. Student will learn the importance of Geometric form and how to measure form errors.
5. Equip the student to have knowledge in the concepts of classification of instrument errors and their characteristics.
6. Student will enable to understand the working principles of various instruments used for the measurement of strain, forces, 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. Acquire the knowledge about fundamentals of linear and angular measurements and various instruments used for measuring the different parameters.
4. Demonstrate an ability to select and use the appropriate measuring instruments to measure surface roughness and other geometric form errors.
5. Recognize the concepts of errors, classification and instrument characteristics.
6. Apply the skills in measuring various quantities like strain, force, pressure & temperature.

UNIT-I

Limits, Fits and Tolerances: Types of fits, Selective assembly and interchangeability, Taylor's Principle for plain limit gauges, Use of Plug, Ring and Snap gauges, Introduction to Linear and Angular measurements, Slip gauges and End bars, Gauge material and manufacturing methods, Different types of Micrometers, Height gauges, Tomlinson gauges, Sine bar.

UNIT-II

Comparators: Dial indicator, Sigma Mechanical comparator, Back pressure type Pneumatic comparator. Optical projector and its Principle and Applications, Tool maker's Microscope and its Principle and applications, measurement of straightness and flatness, Auto collimator, Roundness measurement with bench centers and talyround, Coordinate Measuring Machine.

UNIT-III

Surface Roughness Measurements: Profilometer, Taylor Hobson Talysurf, Application of screw Thread metrology - 2 wire and 3 wire methods, Best wire size, Spur Gear nomenclature, Gear tooth thickness measurement by gear tooth vernier, Parkinson gear tester.
Introduction to Interferometry and its applications, The N.P.L. flatness Interferometer.

UNIT-IV

Elements of instrumentation system: Static and Dynamic characteristics of instruments, Types of errors, Strain measurement, Wire and foil type resistance strain gauges, Rosette Gauges, Bonding procedure, Strain Gauge Factor, Application of strain gauges, Strain gauge load cells, measurement of axial load and torsion by strain gauges, Piezo electric load cell.

UNIT-V

Introduction to Transducers: Displacement and acceleration measurement, L.V.D.T, Pressure measurement by Bourdon pressure gauge, Bulk modulus pressure gauge and Pirani gauge, Temperature measurement by thermo couples, Laws of thermo electricity, Types of materials used in thermocouples, Series and parallel circuits.

Text Books:

1. R.K. Jain, *Engineering Metrology*, Khanna Publications, 1996.
2. Doeblin, *Measurement Systems Application and Design*, TMH, 5th Edn., 2004.
3. Anand Bewoore & Vinay Kulkarni, *Metrology & Management*, McGrawhill Education India, 2014.
4. I B.C. Nakra & K.K. Chaudhary , *Instrumentation Measurement and Analysis* , 3rd Edn., 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.

ME 413 **Finite Element Analysis**

Instruction	4	Theory + 1 Tutorial Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	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, beam and 2d problems
3. Enable the students to formulate the heat conduction and dynamics problems
4. Able to understand use of numerical integration and Gaussian quadrature
5. Enable the students to understand the convergence requirements and to formulate torsional and 3D problems
6. Enable the students to 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; 2D structural problems using CST element and analyze the axi-symmetric problems with triangular elements
3. Write shape functions for 4 node quadrilateral, isoparametric elements and apply numerical integration and Gaussian quadrature to solve the problems
4. Solve linear 1D and 2D heat conduction and convection heat transfer problems, analysis of torsion of circular shaft
5. Evaluate the Eigen values and Eigenvectors for stepped bar and beam, formulate 3D elements, check for convergence requirements
6. Apply FE for 1D transient heat conduction, use of FEA software ANSYS 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 coordinates and shapes 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. Torsion: 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 axi-symmetric solids subjected to axi- symmetric loading with triangular elements.

UNIT-IV

Quadrilateral Elements and Numerical Integration: Two dimensional Four nodded iso-parametric Elements, Numerical Integration and Gaussian Quadrature

Dynamic Analysis: Formulation of finite element model, element mass matrices, Evaluation of Eigen values and Eigen vectors for a stepped bar and a beam

UNIT-V

Heat Transfer Analysis: Steady State Heat Transfer Analysis: One dimensional analysis of a fin and two dimensional analysis of thin plate. Time dependent field problems: Application to one dimensional heat flow in a rod.

3D Elements and FEA Software: Introduction to finite element formulation of three dimensional problems in stress analysis, Convergence requirements, Finite Element Analysis Software: Modeling, Analysis and Post Processing.

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 Finite Element Analysis*, 4th Edition. Wiley

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ME 414

Operations Research

(for Mech, Prod and I.T)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives:

1. Students will understand the significance of Operations Research concept and techniques
2. Students will come to know the formulation of LPP models
3. Students will understand the Algorithms of Graphical and Simplex Methods
4. Students will understand the Transportation and Assignment techniques
5. Students will come to know the procedure of Project Management along with CPM and PERT techniques
6. Students will understand the concepts of sequencing and queuing theory

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

1. Recognize the importance and value of Operations Research and mathematical formulation in solving practical problems in industry;
2. Formulate a managerial decision problem into a mathematical model;
3. Apply Operations Research models to real time industry problems;
4. Build and solve Transportation Models and Assignment Models.
5. Apply project management techniques like CPM and PERT to plan and execute project successfully
6. 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*, Sixth Edition, 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*, Second Edition, Prentice Hall of India Ltd., 1980.
2. R. Paneer Selvam, *Operations Research*, Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008.
3. Nita H. Shah, Ravi M. Gor, Hardik Soni, *Operations Research*, PHI Learning Private Limited, 2013

With Effect from the Academic Year 2016 - 2017

ME 415

Thermal Engineering Lab

Instruction	3	Periods per week
Duration of End Examination	3	Hours
End examination	50	Marks
Sessionals	25	Marks
Credits	2	

Objectives:

1. Student will acquire basic knowledge in determining thermal conductivity of an insulating powder in composite slab or cylinder.
2. Student will demonstrate basic knowledge in evaluating the heat transfer coefficients under natural convection and forced convection phenomena
3. Student will determine the necessary constants pertaining to radiation
4. Student will acquire basic knowledge in understanding the working principles of axial flow fan and its overall efficiency.
5. Student will come to know in estimating overall efficiency of a centrifugal compressors
6. Student will demonstrate basic knowledge the importance of pressure distribution over cylinder and an aerofoil section on turbo machines

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

1. Estimate thermal conductivity of insulating powder in composite slab or cylinder
2. Measure the heat transfer coefficients under natural and forced convection phenomena
3. Know the properties associated with radiation heat transfer
4. Determine overall efficiency of axial flow fan
5. Determine overall efficiency of centrifugal fan
6. Determine pressure distribution over cylinder and an aerofoil section and the effect of lift and drag forces on them.

Experiments:

1. Determination of COP of Air Conditioning System
2. Determination of percentage relative humidity and study of Humidification and Dehumidification process in Air Conditioning Systems
3. Determination of COP of Refrigeration Systems using Capillary tube/thermostatic expansion valve
4. Determination of Overall efficiency of Centrifugal Blower
5. Determination of Overall efficiency of Axial Flow Fan
6. Pressure distribution on symmetrical and non-symmetrical specimen in Wind tunnel
7. Measurement of Lift and Drag force of the models in wind tunnel test section
8. Determination of Thermal conductivity of metal bar
9. Determination of efficiency of pin-fin subjected to natural and forced convection
10. Determination of effectiveness of heat parallel flow and counter flow heat exchanger
11. Determination of Emissivity of given test plate
12. Determination of Stefan-Boltzmann constant

Note: Student should complete a minimum of 10 experiments.

Suggested Reading:

1. Yahya S M, *Fundamentals of Compressible Flow*, New Age International Publishers, Third Edition, 2007.
2. Mathur ML, & Mehta F S, *Thermal Engineering*, Jain Brothers, New Delhi, 2003

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ME 416

Metrology and Instrumentation Lab

Instruction	3	Periods per week
Duration of End Examination	3	Hours
End examination	50	Marks
Sessionals	25	Marks
Credits	2	

Objectives:

1. Student will choose the proper measuring instrument for the precise measurement of Length, Height and diameter
2. Student will able to select the proper measuring instrument for the angular measurement.
3. Student will indentify gear & screw thread parameters using optical projector and tool makers microscope.
4. Student will get familiarize with limits & fits, gauge selection and design.
5. Student will enable to understand the working principles in the measurement of Flatness, Roundness and Surface roughness.
6. Student will equip with various aspects regarding displacement.

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 and design.
5. Acquire adequate knowledge in the measurement of flatness, roundness and surface roughness.
6. Demonstrate the measurement of displacement.

Experiments:

1. Measurement with inside, outside and depth micrometers.
2. Measurement with height gauges, height masters, etc.
3. Measurement of Linear and Angular dimensions with Tool Maker's Microscope – Diameter of a thin wire and single point cutting tool angle.
4. Measurement with Dial Indicator and its calibration.
5. Measurement of angles with Sine bar and Bevel protractor.
6. Measurement of roundness errors with bench centers.
7. Measurement of flatness errors (surface plate) with precision level.
8. Measurement with optical projector.
9. Checking machined components with plug gauges and adjustable snap gauges.
10. Surface roughness measurement by Taylor Hobson -Talysurf.
11. Measurement of Gear tooth thickness.
12. 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. B.C. Nakra & K.K. Chaudhary , *Instrumentation Measurement and Analysis*, , 3rd Edn. McGrawhill, 2014

ME 417

Computer Aided Engineering Lab

Instruction	3	Periods per week
Duration of End Examination	3	Hours
End examination	50	Marks
Sessionals	25	Marks
Credits	2	

Objectives: Students will understand

1. The fundamental knowledge on using analytical tools like ANSYS for Simulation.
2. Various fields, where these tools can be used to improve the output of a product.
3. How these tools are used in Industries by solving some real time problems.
4. Models of trusses, plate structure, beams using ANSYS general purpose software
5. The solve heat transfer problems using ANSYS
6. Evaluating and interpret FEA results for design

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

1. Use FEA software to analyze complex structural systems.
2. Perform modal analysis of parts
3. Perform steady-state and transient heat transfer analysis
4. Produce graphical displays, including animations, of the results.
5. Perform buckling analysis
6. Acquire knowledge on utilizing ANSYS.

Experiments:

1. Analysis of plane truss & special truss with various cross sections and materials
2. 2D & 3D 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*, 1st Edition, Elsevier Butterworth-Heinemann publications, 2007

2. ANSYS Inc. *User Manuals for Release 15.0*

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ME 418

Project Seminar

Instruction	3	Periods per week
Sessionals	25	Marks
Credits	1	

The objective of the project seminar is to actively involve the student in the initial work required to undertake the final year project. Dealing with a real time problem should be the focus of the under graduate project.

It may comprise of

- Problem definition and specifications.
- A broad understanding of the available techniques to solve a problem of interest.
- Presentation (Oral & written) of the project.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students as project batch(a maximum of 3 in group)
- Allotment of projects and project guides
- Project monitoring at regular intervals.

Each project group/batch is required to

1. Submit a one page synopsis of the seminar to be delivered for display on notice board.
2. Give a 30-40 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write up on the talk delivered.

Three (3) teachers will be associated with the evaluation of the project seminar for the award of the sessional marks which should be on the basis of performance on all the three items stated above.

With Effect from the Academic Year 2016 - 2017

ME 461

Renewable Energy Sources (Elective – II)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	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 ocean and geothermal energy
5. Advantages and disadvantages of bio-energy over conventional energy
6. 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 and alternative renewable energies in place of fossil energies
2. Know the absorption, conversion and utilization of solar energy
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, the generation of tides and how to harness their power
6. Understand the environmental impact of OTEC plants

Unit-I

Statistics on conventional energy sources and supply in developing countries, Definition-Concepts of RES, Limitations of RES, Classification of NCES-Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources.

Unit-II

Solar Energy- Solar Radiation – Energy available from Sun, Solar Thermal Collectors – Flat Plate and Concentrating Collectors –Solar Applications, Solar engines-Stirling, Brayton engines, fundamentals of photo Voltaic Conversion – p-n junction – PV solar cells and its materials-solar satellite system

Unit-III

Wind energy- merits and demerits-Wind power plant-site selection-classification of wind power plants-Windmill rotors- Horizontal axis and vertical axis rotors-.working principle-New developments.

Unit-IV

Geothermal energy- Layers in earth-Definition and classification of resources.

Biomass energy-Biomass- Source, Composition, Conversion technologies – Direct combustion-Pyrolysis–Gasification, Biomass gasifier –float and fixed dome types

Unit V

Wave, Tidal and OTEC energy- Difference between tidal and wave power generation-single basin and double basin tidal plants-progressive wave.

OTEC power plants- Open and closed OTEC Cycles- 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. Mittal K M, *Non-Conventional Energy Systems*,Wheeler Publishing Co. Ltd, New Delhi, 2003.
2. Ramesh R & Kumar K U, *Renewable Energy Technologies*, Narosa Publishing House, New Delhi, 2004
3. Shali Habibulla, *Non-Conventional Energy Sources*, State Institute of Vocational Education, Hyderabad, 2005
4. Ashok V Desai, *Non-Conventional Energy*, Wiley Eastern Ltd, New Delhi, 2003
5. R.K. Hegde, *Power Plant Engineering*, Pearson Education India, 2015

With Effect from the Academic Year 2016 - 2017

ME 462

Computational Fluid Dynamics (Elective – II)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives:

1. Understanding of governing equations of fluid flow.
2. Student understand finite difference and finite volume methods to solve fluid flow equations.
3. Issues that arise in the solution of such equations.
4. Various methods to overcome those issues and modern trends in CFD.
5. Get exposure to grid generation.
6. Various boundary conditions and their implementation.

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

1. Classify basic equations of fluid flow
2. Choose appropriate boundary conditions
3. Choose proper numerical technique to solve equations.
4. Critically analyze different mathematical models and computational methods for flow simulations
5. Interpret computational results.
6. Acquire the required knowledge to take advanced courses in CFD.

UNIT-I

Basic Equations: Continuity, momentum and energy equations, navier-stokes equations, Heat transfer conduction 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 and boundary 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, Viscous incompressible flow, Stream-function-vorticity method

Introduction to grid generation- types of grids O, H, C

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. J.D. Anderson, Jr., *Computational Fluid Dynamics: The Basic with Applications* McGraw Hill, Inc., 2012
2. H. Versteeg and W. Malalasekra, *An Introduction to Computational Fluid Dynamics*: The Finite Volume Method, Pearson,2nd edn. 2011

Suggested Reading:

1. John F. 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.
3. K. Muralidhar and T. Sundarajan.. *Computational Fluid Flow and Heat Transfer*, Narosa Publishing House. 2008
4. C.J.Date , *Introduction to CFD*, Dorling Kindersley Pvt Ltd, 2007

With Effect from the Academic Year 2016 - 2017

ME 463

Automobile Engineering (Elective – II)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: The student will learn

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

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

1. Identify the different parts of the automobile
2. Explain the working of various parts like engine, transmission, clutch, brakes
3. Describe how the steering and the suspension systems operate.
4. Understand the environmental implications of automobile emissions
5. Develop a strong base for understanding future developments in the automobile industry

Unit I

Types of automobiles: Normal, Hybrid and Hydrogen Fuel vehicles. Engine location and its components, chassis layout; crank shaft proportion, firing order, piston and piston rings, cylinder liners, valves and operation mechanism, inlet and exhaust manifolds, carburetion and fuel injection system, Mechanical Fuel Injection system & 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 - Types of Ignition Systems, Modern Ignition systems, Types of Batteries and charging systems, starting motors, lighting and electrical accessories, automobile air-conditioning.

Unit III

Steering systems: Linkage arrangements and its components modified Ackerman linkage, wheel alignment, caster and camber. Rack and pinion assembly, recent trends, Wheel and tyres: Tyre construction, specification. Tyre wear and causes, wheel balancing, Types q/' Suspension system, 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: Description and operation of hydraulic brake, leading and trailing shoe layout, disc brakes, master cylinder and hand brake linkage, Recent Trends.

Unit V

Maintenance: Pollution control, trouble shooting and servicing procedure overhauling, engine tune up, tools and equipment for repair and overhaul testing equipment, pollution control technologies used for petrol and diesel engines. Types and study of catalytic converters, Euro norms 2 & 3 and Bharat Norms – Recent Trends.

Text Books:

1. *Crouse & Anglin, Automotive Mechanics*, TataMcGraw Hill. Publishing Co. Ltd., New Delhi, Tenth Edition – 2004
2. Kirpal singh., *Automobile Engineering Vol. I & II* Standard Publishers, Delhi.

Suggested Reading:

1. Joseph Heitner, *Automotive Mechanics*, Affiliated East West Pvt. Ltd.
2. C.P Nakra, *Basic Automobile Engineering*, Dhanpat Rai Publishing Co(P) Ltd., New Delhi, 2003.
3. G.B.S. Narang, *Automobile Engineering*, Khanna Publishers, New Delhi, 2014
4. R.K. Rajput, *A Textbook of Automobile Engineering*, Laxmi Publications, New Delhi, 2012

With Effect from the Academic Year 2016 - 2017

ME 464

Entrepreneurship (Elective – II)
(for Mech, Prod, Civil, EEE, ECE, I.T, Chemical, BioTech and CSE)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. The essence of Entrepreneurship
2. The environment of industry and related opportunities and challenges
3. Concept a procedure of idea generation
4. Elements of business plan and its procedure
5. Project management and its techniques
6. Behavioral issues and Time management

Outcomes: After completing this course, students will be able to:

1. Apply the entrepreneurial process
2. Analyze the feasibility of a new business plan and preparation of Business plan
3. Evaluate entrepreneurial tendency and attitude
4. Brainstorm ideas for new and innovative products or services
5. Use project management techniques like PERT and CPM
6. 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

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, *Entrepreneurship*, Tata Me Graw Hill Publishing Company Ltd., 5lh Ed., 2005
2. Stephen R. Covey and A. Roger Merrill, *First Things First*, Simon and Schuster Publication, 1994.
3. Sudha G.S., *Organizational Behavior*, National Publishing House, 1996.

PE 461

Robotics (Elective – II)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Students will understand

1. The configuration, work envelop and motion controls and applications
2. Familiarities with the kinematics of robots.
3. Robot end effectors and their design.
4. Familiarities with the dynamics of robots.
5. Robot Programming methods & Languages of robot.
6. Various Sensors and drives and their applications in robots

Outcomes: At the end of the course, the students will be

1. Equipped with robot anatomy, work volume and robot applications
2. Familiarized with the kinematic motions of robot
3. Having good knowledge about robot end effectors and their design concepts
4. Familiarized with the robot dynamics
5. Equipped with the Programming methods & drives used in robots
6. Equipped with the principles of various Sensors and their applications in robots.

Unit I

Robots: History and evolution of robots, Laws of Robotics, basic configuration, degree of freedom, work envelope, motion control methods, Application in industry, material handling, loading & unloading, processing, welding & painting applications, assembly and inspection, Robot specification requirements

Unit II

Rotation matrix: Homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles, RPY reprensation, Direct and inverse kinematics for industrial robots for position and orientation, Redundancy

Unit III

Manipulator Jacobian: Joint, End effector velocity, direct and inverse velocity nalysis, Trajectory Planning, interpolation, cubic polynomial, linear segments with with parabolic blending, static force and moment transformation, solvability, stiffness, singularities

Unit IV

Robot dynamics: Lagrangian formulation, link inertia tensor and manipulator inertia tensor, Newton-Euler formulation for RR & RP manipulators, Control: Individual joint, computed torque

Unit V

End effectors: position and velocity measurement, Sensors: Proximity and range, tactile, force and torque, Drives for Robots: Electrical, Hydraulic and Pneumatic, Robot vision: Introduction to technique, image acquisition and processing, introduction to robot programming languages

Text Books:

1. Spong and Vidyasagar, *Robot Dynamics and Control*, John Wile and Sons, 1990
2. R.K. Mittal, I.J. Nagrath, *Robotics and control*, Tata Mcgraw-Hill Publishing Company Ltd. 2003
3. Groover, *Industrial Robotics*, Mcgraw-Hill Publishing Company Ltd. 2003

Suggested Reading:

1. Asada and Siotine, *Robot analysis and Intelligence*, Wiley Interscience, 1986
2. K.S. Fu Gon ZalezRC., lEEc.S.G., *Robotics, Control Sensing Vision and Intelligence*, McGraw Hill, Int. Ed., 1987
3. Richard S. Paul, *Robot Manipulators: Mathematics, Programming, and Control*, MIT Press (MA)

With Effect from the Academic Year 2016 - 2017

CE 461

Disaster Mitigation and Management (Elective – II)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: Students will understand

1. The basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. The nature, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.
3. Risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. The knowledge of various chronological phases in the disaster management cycle.
5. The disaster management framework and legislations in the context of national and global conventions.
6. The applications of geospatial technologies like remote sensing and geographical information systems in disaster management.

Course Outcomes:

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local level
2. Ability to choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Ability to understand various mechanisms and consequences of natural and human induced disasters for the participatory role of engineers in disaster management.
4. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans
5. Ability to understand various participatory approaches/strategies and their application in disaster management
6. Ability to understand the concepts of remote sensing and geographical information systems for their effective application in disaster management.

UNIT-I:

Introduction to Natural, human induced and human made disasters – Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR)

UNIT-II:

Natural Disasters– Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.; Geographical based disasters: Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

UNIT III:

Human induced hazards: Risks and control measures in a chemical industry**,** Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; 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 and traffic accidents .

UNIT IV:

Use of remote sensing and GIS in disaster mitigation and management; Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications& Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

UNIT V:

Concept of Disaster Management: Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

Text Books :

1. Rajib, S and Krishna Murthy, R.R, *Disaster Management Global Challenges and Local Solutions,* Universities Press Hyderabad, 2012
2. *Notes / Reading material published by National Disaster Management Institute*, Ministry of Home Affairs, Govt. of India.

Suggested Reading:

1. Navele, P & Raja, C.K., *Earth and Atmospheric Disasters Management, Natural and Manmade*. B.S. Publications, Hyderabad, 2009
2. Fearn-Banks, K, *Crises computations approach: A case book approach*. Route ledge Publishers, Special Indian Education, New York & London, 2011
3. Battacharya, T., *Disaster Science and Management*. Tata McGraw Hill Company, New Delhi., 2012

With Effect from the Academic Year 2016 - 2017

ME 419

Industrial Administration and Financial Management (for ECE and EEE)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Students able to learn

1. The roll importance and functions of Management in Industrial Organization
2. Various types of business organizations and organization structures.
3. Importance of plant location and plant layout
4. Importance of industrial engineering like method study and work measurement.
5. The importance of project management techniques
6. The total cost of a product based on elements of cost

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

1. Understand the role and importance of management and its principles.
2. Understand the need and importance of various types of layouts used in manufacturing industries
3. Apply the techniques of method study and work measurement in industry to enhance productivity
4. Apply the techniques of project management in industry
5. Understand the importance of quality control and plot the control charts
6. Calculate the total cost of the product based on its elements.

UNIT-I

Industrial Organization: Definition of an organization, types of various business organizations, organization structures 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 merits and 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, jobs evaluation and performance appraisal, wages, incentives, bonus, wage payment plans

UNIT-III

Inspection and quality control: Types and objectives of inspection, S.Q.C., its principles. Quality control chart and sampling plans, quality circles, introduction to ISO.

Production planning and control: Types of manufacture, types of production, principles of PPC and its function, production control charts.

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. Pandey I.M. , *Elements of Financial Management*, Vikas Publ. House, New Delhi, 1994
2. James C Van Horne, John M Wachowicz, Jr., *Fundamentals of Financial Management*, 13th edition, Prentice Hall Financial Times
3. Khanna O.P., *Industrial Engineering and Management*, Dhanapat Rai & Sons

Suggested Reading:

1. S.N. Chary, *Production and Operations Management*, Tata McGraw Hill, 3rd Edition, 2006.
2. Paneer Selvam, *Production and Operations Management*, Pearson Education, 2007.
3. Joseph Monk, *Operations Management*, TMH Publishers, New Delhi, 2004.
4. Buffa Elwood S, *Modern Production /Operations Management* , John Wiley Publishers, Singapore, 2002
5. Everrete E. Adama & Ronald J. Ebert, *Production & Operations Management*, Prentice Hall of India, 5th Edition, 2005.
6. S.D. Sharma, *Operations Research*, Kedarnath, Ramnath & Co., Meerut,2009

With Effect from the Academic Year 2016 - 2017

Chaitanya Bharathi Institute of Technology (Autonomous)

Department of Mechanical Engineering

SCHEME OF INSTRUCTION & EXAMINATION

B.E. IV-Year (Mechanical Engineering)

II-Semester

S. No	Syllabus Ref. No	SUBJECT	Instruction Per week				Scheme of Examination			Credits
								Maximum Marks		
			L	T	D/P	Lab	Duration in Hrs	End Exam	Sessional	
THEORY										
1	ME 421	Production and Operations Management	4	-	-	-	3	75	25	3
2	ME 422	Production Drawing	-	-	6	-	3	75	25	3
3		ELECTIVE - III	4	-	-	-	3	75	25	3
4		ELECTIVE - IV	4	-	-	-	3	75	25	3
PRACTICALS										
1	ME 423	Seminar	-	-	3	-	-	-	25	1
2	ME 901	Project	-	-	6	-	-	100	50	9
		TOTAL	**12**	**-**	**15**	**-**	**-**	**-**	**-**	**22**
ELECTIVE - III										
1	ME 471	Power Plant Engineering	4	-	-	-	3	75	25	3
2	ME 472	Intellectual Property Rights	4	-	-	-	3	75	25	3
3	ME 473	Mechatronics	4	-	-	-	3	75	25	3
4	ME 474	Mechanics of Composite Materials	4	-	-	-	3	75	25	3
5	ME 475	Supply Chain Management	4	-	-	-	3	75	25	3
6	PE 471	Manufacturing Systems and Simulation	4	-	-	-	3	75	25	3
ELECTIVE - IV										
1	PE 412	Modern Machining and Forming Methods	4	-	-	-	3	75	25	3
2	PE 481	Micro Manufacturing	4	-	-	-	3	75	25	3
3	PE 482	Non - Destructive Testing and Evaluation	4	-	-	-	3	75	25	3
4	PE 483	Product Design and Process Planning	4	-	-	-	3	75	25	3
5	PE 484	Nano Materials and Technology	4	-	-	-	3	75	25	3
6	CSE 481	Information Security	4	-	-	-	3	75	25	3
Service Course [B.E.]										
1	ME 414	Operations Research	IT	4	-	-	-	3	75	25	3
2	ME 419	Industrial Administration and Financial Management	EEE	4	-	-	-	3	75	25	3
3	ME 464	Entrepreneurship	ECE, IT, Chem	4	-	-	-	3	75	25	3
4	ME 472	Intellectual Property Rights	ECE, Civil, EEE, CSE, IT	4	-	-	-	3	75	25	3

With Effect from the Academic Year 2016 - 2017

ME 421

Production and Operations Management

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives:

1. Understand plant layout design to facilitate material flow and processing of a product in the most efficient manner
2. Understand work study methods to improve the performance of workers
3. 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.
4. Understand how Materials Requirement Planning and MRPII systems are used in managing operations
5. Recognize the importance of Inventory control to ensure their availability with minimum capital lock up.
6. 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 an d 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, methods of rating, work sampling, wages and incentives, types of incentive plans.

UNIT-II

Forecasting: Introduction, forecasting objectives and uses, demand patterns, qualitative models, market survey, Delphi, quantitative models, moving average, weighted moving average, simple exponential smoothing, trend adjusted exponential smoothing, least square method, simple regression, multiple 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, MRP calculations, 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 and inventory model with probabilistic demand.

UNIT-V

Quality Control: Introduction, history and early contributions by quality gurus, quality tools, process capability, quality control by control charts, control charts for variables and attributes, sampling plans, operating characteristic curves, introduction to total quality management

Text Books:

1. Stevenson, *Production 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*, Prentice Hall of India, 5th Edition, 2005
2. Panneer Selvam R, *Production and Operations Management*, Second Edition, 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*, Tata McGraw Hill, 3rd Edition, 2006.

With Effect from the Academic Year 2016 - 2017

ME 422

Production Drawing

Instruction	6 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Students will understand

1. The need and the importance of production drawing
2. How to make part drawing from given assembly drawings.
3. Indication of size, form and positional tolerances on the drawing sheets
4. Surface finish and heat treatment process on the drawing sheets.
5. Writing process sheets
6. 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 finished and heat treatment process on the parts drawn for a given assembly drawings.
5. Write process sheet for every part that is drawn from given assembly drawings
6. Interpret a 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), Non return valve, Blow off cock), 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

Suggested Reading:

1. Venkata Reddy, *Production Drawing*. New Age International. ISBN 978-81-224-2288-7, 2009
2. Farazdak Haideri, *Machine Drawing & Computer Graphics*, Nirali Prakashan. ISBN 978-93-8072-527-7
3. R.L. Murthy, *Precision Engineering in Manufacturing*, New Age International Private Ltd., 1996
4. Doeblin, *Measurement Systems Application and Design*, TMH, 5 th Edn., 2004.

With Effect from the Academic Year 2016 - 2017

ME 423

Seminar

Instruction	3 Periods per week
Sessionals	25 Marks
Credits	1

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of 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 following aspects of seminar presentations.

- Literature survey
- Consolidation of available information
- Power point Preparation
- Technical writing

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.

2. Give twenty(20) minutes presentation through OHP/ PPT/ Slide Projector followed by Ten(10) minutes discussion

3. Submit a report on the seminar topic with list of references and hard copy of the slides.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule should 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 should be from any peer reviewed recent journal publications.

With Effect from the Academic Year 2016 - 2017

ME 901

Project

Instruction	6 Periods per week
Duration of End Examination	Viva Voce
End Examination	100 Marks
Sessionals	50 Marks
Credits	9

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a project monitoring committee of faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the project report, the students are directed to download from the website regarding the guidelines for preparing the project report and the project report format.

The project report shall be evaluated for 100 Marks by the External Examiner.

If the project work found inadequate in the end examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

Break up for 100 Marks in the end examination:

1. Power point presentation 30 Marks
2. Thesis/Report preparation 20 Marks
3. Viva-voce 30 Marks

With Effect from the Academic Year 2016 - 2017

ME 471

Power Plant Engineering (Elective – III)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	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 plant, 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
6. The 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 flow-sheet of hydro-power plant
4. Explain working principle of different types of nuclear power plant.
5. Know the various factors of plant load and economy
6. Indicate 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 handling systems

UNIT II

Steam power plant: Combustion Process - Overfeed and Underfeed stokers-traveling grate stokers, spreader stokers, retort stokers- Pulverized fuel burning system-cyclone furnace-Fluidized bed combustion (FBC).

UNIT III

Hydro electric power plant: Hydrological cycle, flow measurement, Hydrographs - drainage area characteristics, Types of hydroelectric power plants- storage and pondage - classification 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* 4th edition, Laxmi Publications (P) Ltd., New Delhi, 2015
2. P.K. Nag, *Power Plant Engineering* 4th edition, 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

With Effect from the Academic Year 2016 - 2017

ME 472

Intellectual Property Rights (Elective – III)

(for Mech, Prod, Civil, ECE, EEE, CSE, IT)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 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
6. About 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. Capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IP. .
6. Capable of converting creativity into IP 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

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*, Sweet, Maxwell 4th Edition.

With Effect from the Academic Year 2016 - 2017

ME 473

Mechatronics (ELECTIVE - III)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. How to identify, formulate, and solve engineering problems
2. The design a system, component, or process to meet desired needs within realistic constraints
3. The how to use the techniques, skills, and modern engineering tools necessary for engineering practice
4. The use of drive mechanisms and fluid power systems
5. The use of industrial electronic devices
6. The demonstrate the design of modern CNC machines, and Mechatronics elements

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

1. Model and analyze electrical and mechanical systems and their interconnection
2. Integrate mechanical, electronics, control and computer engineering in the design of mechatronics systems
3. Do the complete design, building, interfacing and actuation of a mechatronics system for a set of specifications
4. Be proficient in the use of fluid power systems in various mechatronics applications
5. Demonstrate the use of industrial electronic devices
6. Demonstrate the design of modern CNC machines, and mechatronics elements

UNIT-I

Introduction to mechanization & automation: Need of interface of electrical & electronic devices with mechanical elements, the concept of Mechatronics, Flow chart of Mechatronics system, elements of Mechatronics system, drive mechanisms, actuators, feedback devices and control system, application in industries and systems development

UNIT-II

Drive mechanisms: Feeding and indexing, orientation, escapement and sorting devices, conveyor systems

Introduction to electrical actuators: A.C. servomotors, D.C. servomotors, stepper motors

UNIT-III

Introduction to fluid power systems: Industrial Pneumatics and hydraulics, merits of fluid power, pneumatic & hydraulic elements symbols, study of hydraulic control valves, pumps & accessories, hydraulic circuits & mechanical servo control circuits, Electro-hydraulic and Hydro-pneumatic circuits

UNIT-IV

Introduction to industrial electronic devices: Diodes, Transistors, Silicon Controlled Rectifiers (SCR), Integrated Circuits (IC), Digital Circuits, Measurement systems & Data acquisition systems: sensors, digital to analog and analog-to-digital conversion, signal processing using operational amplifiers, introduction to micro processor & micro controller, Temperature measurement interface and LVDT interface, Systems response

UNIT-V

Design of modern CNC machines and Mechatronics elements: machine structures, guide ways, spindles, tool monitoring systems, adaptive control systems, Flexible manufacturing systems, Multipurpose control machines, PLC programming

Text Books:

1. William Bolton, *Mechatronics*: *Electronic control systems in mechanical and electrical engineering*, 6th edition, Pearson Education
2. HMT Ltd, *Mechatronics*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998

Suggested Reading:

1. Michaels Histand & David G, Alciatore, *Introduction to Mechatronics and Measurement Systems*, Tata McGraw-Hill International Edition
2. Devdas Shetty, Richard A. Kolk, *Mechatronics System Design*, Cengage Learning
3. S.R. Majumdar, *Oil Hydraulic Systems – Principles & Maintenance*, McGraw-Hill Publishing Company Limited, New Delhi
4. Godfrey Onwubolu, *Mechatronics: Principles and Applications*, Butterworth-Heinemann

With Effect from the Academic Year 2016 - 2017

ME 474

Mechanics of Composite Materials (ELECTIVE - III)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will understand the

1. Properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques.
2. How to predict the elastic properties of long fiber composites based on the constituent properties. An ability to rotate stress, strain and stiffness tensors using ideas from matrix algebra.
3. Linear elasticity with emphasis on the difference between isotropic and anisotropic material behavior. An ability to analyze a laminated plate in bending using classical lamination theory.
4. How to predict the failure strength of a laminated composite plate. A knowledge of issues in fracture of composites.
5. Exposure to recent developments in composites, including metal and ceramic matrix composites.
6. How to use the ideas developed in the analysis of composites towards using in industrial application.

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

1. Understand the various fabrication methods of composite materials.
2. Understand the specifics of mechanical behavior of layered composites compared to isotropic materials.
3. Determine stresses and strains in composites.
4. Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro level.
5. Understand the failure of composites including fracture.
6. Understand the theory of plate and shell; understand the bending analysis of composite beams.

Unit-I

Introduction: Fibers, matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites and carbon composites.

Unit-II

Micromechanics of lamina and mechanical properties: Prediction of elastic constants, micromechanical approach, Halpin-Tsai equations, thermal properties, hygro properties, mechanics of load transfer from matrix to fibre.

Unit-III

Macro-mechanics of lamina: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, inter-laminar stresses and edge effects, simplified composite beam solutions, bending of laminated beams.

Unit-IV

Strength, fracture, fatigue and design: Tensile and compressive strength of unidirectional fibre composites, fracture modes in composites: single and multiple fractures, de-bonding, fibre pullout and de-lamination.

Strength of an orthotropic lamina: Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria, designing with composite materials

Unit-V

Manufacturing processes: Hand lay-up, prepregs, bag molding, autoclave processing, RTM, pultrusion, filament winding, gel time test for resins, curing cycle,

Measurement of basic composite properties: Fiber and matrix tests, tensile test, compressive test, in-plane shear test, inter-laminar shear test, flexure test.

Text Books:

1. Jones, R.M., *Mechanics of Composite Materials*, Mc Graw Hill Co., 1967
2. B.D. Agarwal et.al, *Analysis and performance of fiber composites*, 3rd edition, Wiley sons., 2013
3. P.K. Mallick, *Fiber Reinforced Composites Materials*, Manufacturing, and Design, Taylor & Francis, Third Edition 2007 ,

Suggested Reading:

1. Ever J Barbero, *Introduction to composite materials design*, Taylor &Francis, 1999.
2. Hyer, M.W., *Stress Analysis of Fibre Reinforced Composite Materials*, McGraw Hill Co., 1998.
3. Carl. T. Herakovich, *Mechanics of Fibrous Composites*, John Wiley Sons Inc., 1998.

With Effect from the Academic Year 2016 - 2017

ME 475

Supply Chain Management (Elective – III)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. The significance of supply chain management in engineering.
2. The awareness about transportation and warehouse management systems.
3. The designing supply chain networks.
4. The concept of demand and supply and integrating it with supply chain management.
5. The acquainted with planning and managing inventories.
6. The pricing and revenue management

Outcomes: At the end of the course, the student is able to

1. Apply supply chain management concepts in engineering applications
2. Plan an effective transportation and warehouse management systems
3. Design an effective supply chain networks
4. Integrate and optimize demand and supply gaps
5. Apply inventory management techniques
6. Understand and design a 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*, 3rd edition, 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*, 5th edition, 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

PE 471

Manufacturing Systems and Simulation (Elective – III)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will understand

1. The systems, subsystems for manufacturing techniques
2. The information technologies relevant to manufacturing systems
3. The discrete and continuous systems
4. The system simulation and associated concepts
5. The queuing theory concepts applied to system simulation
6. The awareness about programming with GPSS and SIMSCRIPT

Outcomes:

1. Student is able to have overall view of various manufacturing processes
2. Capable of applying information systems and automation to manufacturing
3. Ability to build various models suitable for appropriate manufacturing facility
4. Able to understand and conceptualize systems simulations
5. Ability to simulate discrete and continuous systems
6. Capable of programming with GPSS and SIMSCRIPT

UNIT-I

Manufacturing Systems: Definition of systems, basic concepts and problems concerning systems, systems design, decision making procedures, Structural, transformational and procedural aspects of manufacturing, modes of production, process systems for manufacturing, logistic systems, material flow & technological information flow, management & information systems for manufacturing, managerial information flow in manufacturing systems

UNIT-II

Information Systems: Fundamentals of information technology, information systems, information networking, parts oriented production information systems and computerized production scheduling, online production control systems, Computer based production management systems, Automation systems for manufacturing, Industrial automation, Kinds of automation, principles of CIM, effectiveness of CIM, factory automation, automatic machine tools for mass production, NC machine tools, computer controlled manufacturing systems, FMS, automated assembly, automatic material handling, automatic inspection & testing, computer integrated automation systems- unmanned factory

UNIT-III

System Models: Concepts, continuous and discrete systems, systems modeling, type of models, subsystems, corporate model and system study

System simulation: Techniques, comparison of simulation and analytical methods, types of simulation, distributed log model, cobweb models

UNIT-IV

Continuous system Simulation: Numerical solution of differential equation, analog computers, hybrid computers, continuous system simulation languages CSMP, system dynamic growth models, logistic curves

Discrete systems simulation: Events generation of arrival patterns, simulation programming tasks, analysis of simulation output

Queuing theory: Arrival pattern distribution, service times, queuing disciplines and measure of queues

UNIT-V

GPSS and SIMSCRIPT: General description of GPSS and SIMSCRIPT, programming in GPSS simulation programming techniques: Data structures, implementation of activities, event and queues, event scanning, simulation algorithms in GPSS and SIMSCRIPT

Text Books:

1. Geofery Gordan, *Systems Simulation*, Prentice Hall, 1980
2. Allan Carrie, *Simulation of Manufacturing Systems*, John Wiley & Sons Ltd,1998

Suggested Reading:

1. Adelaide Marzano, *Manufacturing system simulation*, VDM Verlag
2. Davi Bedworth & James Bailey, *Integrated Production Control system Management, analysis & design*, 2nd edition, John Wiley & Sons Ltd.,2010
3. Ronald Zskin & Charles Standridge, *Modeling and Analysis of Manufacturing Systems*, John Wiley & Sons Ltd.,2011
4. Deo. N., '*ystem simulation with Digital Computers*, Prentice Hall, 1980

PE 412

Modern Machining and Forming Methods (ELECTIVE – IV)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will learn

1. The importance of non-conventional machining processes
2. Various non-conventional machining processes and their process parameters
3. The relative merits, limitations and applications of various non-conventional machining processes
4. The knowledge regarding working media and its functions of non-conventional machining processes
5. The concepts of non-conventional forming processes such as rubber pad forming, hydro forming, stretch forming, etc.,
6. 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. Select the non-conventional machining process for a particular application
2. Demonstrate the capability of comparison of various non-conventional machining methods
3. Describe the various non-conventional machining processes
4. Exhibit the proficiency of selecting working media for various non-conventional machining processes
5. Exhibit the basic understanding of non-conventional forming processes
6. Compare various non-conventional forming processes based on their merits, limitations and applicability

UNIT-I

Mechanical Energy Methods:

Ultrasonic Machining (USM): Introduction, Process description, abrasive slurry, Abrasive materials and their characteristics, 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 on MRR and accuracy, equation for MRR, 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

Thermal methods: Electro Discharge Machining (EDM): Process description with schematic diagram, process parameters, functions and characteristics of dielectric medium, dielectric fluids, over cut and side taper, flushing, mechanism of metal removal, crater volume, 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 of electron beam, equipment used, advantages, disadvantages and applications,

UNIT-III
Electro chemical, Chemical and other machining processes: Electro-chemical machining (ECM): Schematic of process parameters, function and characteristics of electrolyte, chemistry of the process, 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, hot machining, high speed machining, process parameters, advantages and applications

UNIT-IV
High Energy Rate Forming Processes (HERF): Introduction, applications, advantages,
Explosive Forming: Principles, explosive materials, Equipment, types of explosive forming, standoff operation and contact operation, the pressure pulse, gas bubble and the process applications
Electro-Hydraulic Forming (EHF): Schematic of process, description and its applications,
Electro-Magnetic Forming (EMF): Process description, merits, limitations and applications

UNIT-V
Other Forming Processes:
Rubber Pad Forming: Principle of the process, process details and its types, Guerin, wheelon, Mar forming and Hydro forming processes and applications,
Stretch Forming: Introduction, types of stretch forming, stretch draw forming, rotary stretch forming or stretch wrapping, compression forming, radial draw forming.
Tube spinning: introduction, methods of tube spinning, backward spinning, forward spinning, machines and tools used, machine variables, speeds and feeds, effect of tube spinning on work metal properties and applications.

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*, 1st Edition, Woodhead Publishing in Mechanical Engineering

Suggested Reading:

1. Hassan Abdel-Gawad El-Hofy, *Advanced Machining Processes, Nontraditional and Hybrid Machining Processes*, McGraw Hill Publishing Co. Ltd.,
2. Davies and Austin, *Developments in High Speed Metal Forming*, The Machinery Publishing Co. Ltd., 1985
3. Production Technology, HMT
4. A. Bhattacharya, *New Technology*, The Institution of Engineers (India), 1984

With Effect from the Academic Year 2016 - 2017

PE 481

Micro Manufacturing (ELECTIVE - IV)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. The importance of micromachining, Nano polishing, Micro forming and Micro welding.
2. Micromachining processes
3. The Nano polishing methods
4. The micro forming processes
5. The concepts of micro welding to the students
6. The recent trends and applications of micro manufacturing

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

1. Suggest suitable micromachining process to a particular application.
2. Select the process parameters of particular micro machining process
3. Describe the various micro, machining, welding and forming processes
4. Compare various micro machining / forming/ welding processes based on relative merits and demerits.
5. Demonstrate the understanding of various nano machining operations.
6. Exhibit the knowledge regarding the recent trends in micro-manufacturing processes

UNIT I

Micro Machining I: Introduction, scaling laws, mechanical micro machining, ultra sonic micro machining, abrasive jet micro machining, water jet micro machining, abrasive water jet micro machining, micro turning, chemical and electro chemical micro machining, electric discharge micro machining, electro discharge grinding.

UNIT II

Micro Machining II: Beam energy based micro machining, electron beam micro machining, laser beam micro machining, ion beam micro machining, plasma beam micro machining, hybrid micro machining, electro chemical spark micro machining, electrolytic in process dressing.

UNIT III

Nano Polishing: Abrasive flow finishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing, magnetic float polishing, elastic emission machining, chemo-mechanical polishing

UNIT IV

Micro Forming and Welding: Micro extrusion, micro and nano structured surface development by nano plastic forming and roller imprinting, micro bending with laser, laser micro welding, electron beam for micro welding.

UNIT V

Recent Trends and Applications: Metrology for micro machined components, ductile regime machining, AE based tool wear compensation, machining of micro gear, micro nozzle, micro pins and applications.

Text Books:

1. Jain V. K., *Micro Manufacturing Processes*, CRC Press, Taylor & Francis Group, 2012
2. Janocha H., *Actuators – Basics and applications*, Springer publishers, 2012
3. Jain V.K., Introduction to Micro machining, Narosa Publishing House, 2011

Suggested Reading:

1. Bharat Bhushan, *Handbook of nanotechnology*, springer, Germany, 2010.
2. Bandyopadhyay. A.K., *Nano Materials*, New age international publishers, New Delhi, 2008, ISBN:8122422578.
3. Jain V.K., *Advanced Machining Processes*, Allied Publishers, Delhi, 2002
4. Mcgeoug.J.A., *Micromachining of Engineering Materials*, CRC press 2001, ISBN-10:0824706447.

PE 482

Non - Destructive Testing and Evaluation (ELECTIVE - IV)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student has to understand the

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. Technology of acoustic emission (AE), the associated instrumentation and applications
4. Technologies like neutron radiography; laser induced ultrasonics, surface analysis and thermography
5. Merits and demerits of the different NDT Technologies
6. Latest research and developments in NDT

Outcomes: At the end of the course, the students will be able to demonstrate

1. the knowledge of different NDT techniques.
2. clear understanding of liquid penetrant inspection and magnetic particle inspection.
3. view and interpret radiographs, utilize the various principles of radiography for different components of different shapes.
4. the knowledge of acoustic emission for NDT and the instrumentation used for NDT.
5. the ability to analyze and prepare a technical report.
6. the knowledge of latest research, developments and trends in NDT.

UNIT-I

Liquid penetrate inspection: Principles of penetrate inspection, characteristics of a penetrate, water washable system, post emulsification system , solvent removable system, surface preparation and cleaning, penetrate application, development, advantages limitations, and applications.

Magnetic particle instruction: 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, coil arrangements, 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 ultrasonics, 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. Dove and Adams, *Experimental Stress analysis and Motion Measurement*, Prentice Hall of India, Delhi

Suggested Reading:

1. *Non-Destructive Examination and Quality Control*, ASM International, Vol.17, 9th edition (1989)
2. J. Prasad and C. G. K. Nair, *Non-Destructive Test and Evaluation of Materials*, Tata McGraw-Hill Education, 2nd edition (2011).
3. B. Raj, T. Jayakumar and M. Thavasimuthu, Practical *Non Destructive Testing*, Alpha Science International Limited, 3 rd edition (2002).
4. T. Rangachari, J. Prasad and B.N.S. Murthy, *Treatise on non-destructive testing and evaluation*, Navbharath Enterprises, Vol.3, (1983

PE 483

Product Design and Process Planning (ELECTIVE – IV)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will understand

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

Outcomes: At the end of the course, the student is able to

1. Have overall view of Product Design and Process Planning
2. Apply creativity techniques in Product Development
3. Applying ergonomically enabled concepts in developing a new product
4. Have awareness and apply Intellectual Property Rights
5. Integrate various stages of developing a new product
6. Develop and execute an effective Process Plan

UNIT-I

Product Design and Process Design functions: selection of right product, systematic procedure of product innovation, factors contributing to successful technological innovation, need for creativity and innovation, techniques of innovation like brain storming and Delphi techniques

UNIT-II

Product Selection and Evaluation: Function of design, design with Human Machine Interaction (HMI) and collection of ideas and purpose of project, selection criteria, screening ideas for new products using evaluation techniques, principles of ergonomics.

UNIT-III

New Product Planning: Interaction between the functions of design, manufacture, quality, testing and marketing, design and material selection, steps for introducing new products after evaluation.

UNIT-IV

New Product Development: Research and new product development, patents, definitions, patent search, patent laws, international code for patents, Intellectual Property Rights (IPR).

UNIT-V

Process Selection and Planning: Process selection, process planning, process sheets, selection of manufacturing process, estimation of machining time in various cutting operations, estimation of costs for manufacture, value engineering in product design, group technology, concepts of concurrent engineering.

Text Books:

1. Niebel BW & Draper AB, *Production Design & Process Engg*, McGraw Hill, Kogakusha, 1974
2. K. G. Swift & J. D. Booker, *Process Selection*: From Design to Manufacture", Butterworth-Heinemann Ltd; 2nd Revised edition, 2003
3. Bhaskaran Gopalakrishnan, *Product Design and Process Planning in CE (Design & Manufacturing*", Chapman and Hall publishers, 1994

Suggested Reading:

1. Harry Nystrom, *Creativity and Innovation*, John Wiley & Sons,
2. Brain Twiss, *Managing Technological Innovation*, Pittrnan Publications, 1992
3. Harry, B.Waton, *New Product Planning*, Prentice Hall Inc., 1992
4. Chitale, A. K. & Gupta RC., *Product Design & Manufacturing*, PHI, 1997

With Effect from the Academic Year 2016 - 17

PE 484

Nano Materials and Technology (Elective – IV)
(for Mech, Prod and Chemical)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will learn the

1. Nanotechnology approach and challenges
2. Materials of nanotechnology
3. Nano structures
4. Nano fabrication
5. Special nano materials
6. Bio materials

Outcomes: At the end of the course

1. Understand the developments and challenges in nano technology
2. Understand synthesis and properties of nanostructured materials
3. Analyze magnetic and electronic properties of nano materials
4. Analyze nano fabrication methods and their applications
5. Understand the characterization of nano and bio materials and their use
6. Analyze the synthesis and characterization of nano wires and tubes

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 (HI-V) group materials, Nanotribology and materials, characterization using Scanning Probe Microscope, AFM, FFM

Unit III

Nano Structures: Zero dimensional Nanostructure (Nano particles), synthesis procedure, characterization techniques, properties and applications of Nano particles

One dimensional Nanostructures (Nano Wires, Nano Tubes), various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes

Unit IV

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

Unit V

Special Nano Materials: Nano Composites: Introduction, Synthesis procedures, various systems (metal-polymer, metal-ceramics and Polymer-ceramics), Characterization procedures, applications,

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

Text Books:

1. A.K. Banopadyay, *Nano Materials*, New Age Publications
2. T. Pradeep, *Textbook of Nanoscience and Nanotechnology*, McGraw Hill Education (India) Private Limited, New Delhi
3. Dieter Vollath, *Nanomaterials: An Introduction to Synthesis, Properties and Applications*, Wiley, 2013

Suggested Reading:

1. Carl C. Koch, *Nano Materials Synthesis, Properties and Applications*, Jaico Publishing House
2. Willia Tllsey Atkinson, *Nano Technology*, Jaico Publishing House
3. George W. Hanson, *Fundamentals of Nanoelectronics*, Pearson Education, 2009
4. T. Pradeep, *Nano: Essentials-understanding Nano Science and Technology*, TMH, 2007
5. Sabu Thomas, Nandakumar Kalarikkal, A. Manuel Stephan, B. Raneesh, *Advanced Nano-materials*: Synthesis, Properties, and Applications, Apple Academic Press

With Effect from the Academic Year 2016 - 2017

CSE 481

Information Security (Elective – IV)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will understand the

1. Information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
2. Several ethical issues in information system
3. Principal concepts, major issues, technologies, and basic approaches in information security.
4. Prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.
5. Cryptography, how it has evolved, and some key encryption techniques used today.
6. Security policies (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges.

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

1. Basic concepts and goals of Information security such as Confidentiality, Integrity, Authentication, Non-Repudiation, Authorization, and Availability and their relevance in various Contexts.
2. Classical cryptosystems and techniques used to break them.
3. Ideas of public key cryptosystems and digital signature schemes
4. Different network issues as well as database security issues and the solutions for them through firewall, intrusion detection system
5. Critical evaluation of a range of access control and authentication mechanisms
6. Legal privacy and ethical issues in computer security

Unit I

Introduction: History, critical characteristics of information, NSTISSC SECURITY MODEL, Components of an information system, securing the components, balancing security and access, The SDLC, The Security SDLC

Need for security: Business needs, Threats, Attacks-secure software development

Unit II

Legal, Ethical and Professional Issues: Law and Ethics information security, relevant U.S. laws, international laws and legal bodies, Ethics and information security

Risk Management: Overview, Risk Identification, risk assessment, Risk Control Strategies, selecting a risk control strategy, Quantitative versus qualitative risk control practices, Risk Management discuss points, recommended risk control practices

Unit III

Planning for security: Security policy, standards and practices, security blue print, security education, continuity strategies, Security technology

Firewalls and VONs: Physical design, firewalls, protecting remote connections

Unit IV

Security Technology: Intrusion detection, access control and other security tools, Intrusion detection and prevention systems, scanning and analysis tools, access control devices

Cryptography: Foundations of cryptology, cipher methods, crypryptographic algorithms, cryptographic tools, protocols for secure communications, attacks on cryptosystems

Unit V

Implementing Information Security: Information security project management, technical topics of implementation, Non-technical aspects of implementation, security certification and accreditation,

Security and personnel: Positioning and staffing security function, Employment policies and practices, internal control strategies

Information Security Maintenance: Security management models, the maintenance model, digital forensics

Text Books:

1. Michael E. Whitman and Hebert J. Mattord, *Principles of Information Security*, 4th edition, Ed. Cengage Learning, 2011
2. Thomas R. Peltier, Justing Peltier, John Blackley, *Information Security Fundamentals*, Auerbacj Publications, 2010

Suggested Reading:

1. Detmar W Straub, Seymor Goodman, Richard L Baskerville, *Information Security Policy Processes and Practices*, PHI, 2008
2. Marks Merkow and Jim Breithaupt, *Information Security, Principle and Practices'*, Pearson Education, 2007
3. Mark Rhodes-Ousley, *Information Security, The Complete Reference* McGraw-Hill Education, New York, 2013
4. Alberts, Christopher and Dorofee, Audrey, *Managing Information Security Risks*: *The OCTAVE Approach* Addision-Wesley Publications, 2003