SCHEME OF INSTRUCTION AND SYLLABI (R-26)

OF

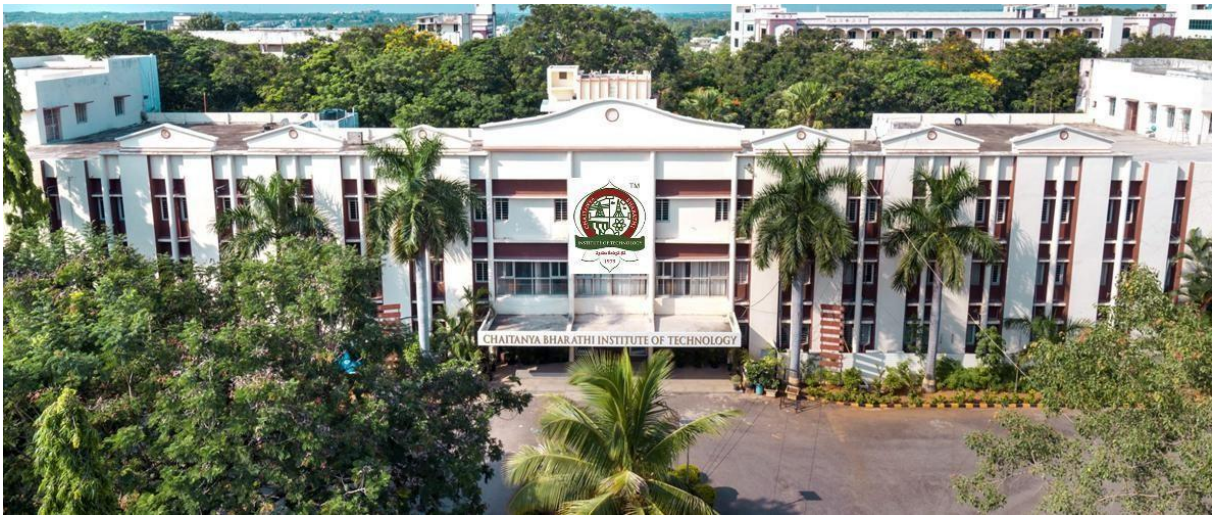
B.E. I to VIII SEMESTERS OF FOUR YEAR DEGREE COURSE

IN

MECHANICAL ENGINEERING

(Inline with AICTE Model Curriculum with effect from AY 2026-27)

(R–26 Regulation)



DEPARTMENT OF MECHANICAL ENGINEERING
CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

Affiliated to OU, Approved by AICTE, Accredited by NBA, NAAC (A++)

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CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)

OUR MOTTO: SWAYAM TEJASWIN BHAVA

Institute Vision	To be a Centre of excellence in technical education and research.
Institute Mission	To address the emerging needs through quality technical education and advanced research.
Department Vision	To be the destination for aspiring young minds to become globally competitive, enlightened, innovative, immediate contributors to the industry and successful in higher studies in the field of mechanical engineering.
Department Mission	1. To impart quality and innovative education in mechanical engineering with basic and specialised training, internships to meet the current and emerging needs of the industry. 2. To prepare the students for successful professional career by inculcating ethical, entrepreneurial and leadership qualities. 3. To foster Research and Development environment by disseminating knowledge and technology by involving the students in publications sponsored projects and consultancy.
PEO 1	Ample technical knowledge and skills for a successful career in Mechanical Engineering and product development, design, development and implementation of engineering systems, services and processes.
PEO 2	Capability to develop competitive technologies and find solutions to industry, societal challenges and engineering problems with ethical and professional standards.
PEO 3	Ability to be entrepreneurial, innovative in the context of global scenarios of technological challenges and environmental issues.
PEO 4	To pursue life-long learning and to adapt to the changing industry requirements.
PEO 5	To be a team player, lead and engage diverse teams through effective communication, inter-personal and project management skills.
PSO 1	Apply their learning to design and develop basic mechanical systems and processes.
PSO 2	Select manufacturing processes and their appropriate parameters for the production of typical engineering components.
PSO 3	Apply the concepts of mechanical engineering in power generation, aerospace, environmental, bio-medical, automotive, sustainable energy systems and with suitable safety precautions.

Program Outcomes of BE (Mechanical) Program

1. Engineering Knowledge	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
2. Problem Analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).
3. Design/Development of Solutions	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).
4. Conduct Investigations of Complex Problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
5. Modern Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6).
6. The Engineer and Society	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
7. Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).
8. Individual and Teamwork	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences.
10. Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments..
11. Life-long Learning	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

BE (Mechanical Engineering)

SEMESTER – I

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MTC02	Matrix Theory and Advanced Calculus	3	1	-	3	40	60	4
2	26CYC07	Material Chemistry	3	-	-	3	40	60	3
3	26EEC01	Basic Electrical Engineering	3	-	-	3	40	60	3
4	26CSC01	Problem solving and Programming using C	3	-	-	3	40	60	3
5	26ADC01	Artificial Intelligence Foundations and Applications	2	-	-	3	40	60	2
PRACTICALS									
6	26CYC08	Material Chemistry Lab	-	-	3	3	50	50	1.5
7	26EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
8	26CSC02	Problem Solving and Programming using C Lab	-	-	3	3	50	50	1.5
9	26MEC01	Robotics and Drones Lab	-	1	2	3	50	50	2
10	26MEC04	Engineering Workshop & 3D Printing	-	-	3	3	50	50	1.5
Total			**14**	**02**	**13**	**-**	**450**	**550**	**22.5**
Clock Hours Per Week: 29									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

BE (Mechanical Engineering)

SEMESTER – II

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MTC05	Applied Vector Calculus and Ordinary Differential Equations	3	1	-	3	40	60	4
2	26PYC05	Engineering Physics	3	-	-	3	40	60	3
3	26CEC01	Engineering Mechanics	3	1	-	3	40	60	4
4	26EGC01	Communicative English	2	-	-	3	40	60	2
PRACTICALS									
5	26PYC06	Engineering Physics Lab	-	-	3	3	50	50	1.5
6	26CSC38	Python Programming Workshop	-	-	3	3	50	50	1.5
7	26MEC41	Engineering Graphics	-	1	3	3	50	50	2.5
8	26EGC02	Communication Skills Lab	-	-	2	3	50	50	1
9	26MBC02	Community Engagement	-	-	2	-	50	-	1
Total			**11**	**03**	**13**	**-**	**410**	**440**	**20.5**
Clock Hours Per Week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

BE (Mechanical Engineering)

SEMESTER – III

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MTC10	Partial Differential Equations and Statistics	3	-	-	3	40	60	3
2	26MEC05	Mechanics of Materials	3	1	-	3	40	60	4
3	26MEC06	Thermodynamics	3	-	-	3	40	60	3
4	26MEC07	Fluid Mechanics & Hydraulic Machines	3	1	-	3	40	60	4
5	26MEC08	Materials Science Engineering	3	-	-	3	40	60	3
6	26MBC01	Engineering Economics & Accountancy	3	-	-	3	40	60	3
PRACTICALS									
7	26MEC09	Mechanics of Materials Lab	-	-	2	3	50	50	1
8	26MEC10	Fluid Mechanics & Hydraulic Machines Lab	-	-	2	3	50	50	1
9	26MEC11	Materials Science Engineering Lab	-	-	2	3	50	50	1
Total			**18**	**02**	**06**	**-**	**410**	**510**	**23**
Clock Hours Per Week: 26									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

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BE (Mechanical Engineering)

SEMESTER – IV

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MEC12	Kinematics of Machines	3	-	-	3	40	60	3
2	26MEC13	Applied Thermodynamics	3	-	-	3	40	60	3
3	26MEC14	Manufacturing Processes	3	-	-	3	40	60	3
4	26MEC15	Design of Machine Elements	3	-	-	3	40	60	3
5	26MEC16	Fundamentals of Design Thinking	2	-	-	3	40	60	2
6		Professional Elective - I	3	-	-	3	40	60	3
7	26MTM01	Aptitude and Problem Solving Skills - I	-	1	-	-	50	-	Non Credit
PRACTICALS									
8	26MEC17	Computer Aided Machine Drawing Lab	-	-	2	3	50	50	1
9	26MEC18	Applied Thermodynamics Lab	-	-	2	3	50	50	1
10	26MEC19	Manufacturing Processes Lab	-	-	2	3	50	50	1
11	26MEN01	NPTEL Certification	With Minimum of 2 Credits Weightage				50	-	2
12	26MEU01	Upskill Certification – I	3-4 weeks/90 hours				25	-	0.5
Total			**17**	**01**	**06**	**-**	**490**	**510**	**22.5**
Clock Hours Per Week: 24									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

Professional Elective - I		
S.no	Course code	Title of the Course
1	26MEE01	Mechatronics and Automation
2	26MEE02	Power Plant Engineering
3	26MEE03	AI for Mechanical Engineering
4	26MEE04	Entrepreneurship

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BE (Mechanical Engineering)

SEMESTER – V

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MEC20	Machine Design	3	-	-	3	40	60	3
2	26MEC21	Dynamics of Machines	3	-	-	3	40	60	3
3	26MEC22	Computational Methods for Mechanical Systems	3	-	-	3	40	60	3
4	26MEC23	Heat Transfer	3	-	-	3	40	60	3
5		Professional Elective - II	3	-	-	3	40	60	3
6	26MTM02	Aptitude and Problem Solving Skills - II	-	1	-	-	50	-	Non Credit
PRACTICALS									
7	26MEC24	Dynamics & Vibrations Lab	-	-	2	3	50	50	1
8	26MEC25	Computational Methods for Mechanical Systems Lab	-	-	2	3	50	50	1
9	26MEC26	Heat Transfer Lab	-	-	2	3	50	50	1
10	26EGC03	Employability Skills	-	-	2	3	50	50	1
11	26MEI01	Internship – I / NPTEL (8 weeks) / Industry Certification	90 hours				50	-	2
12	26MEM01	Industrial visit					25	-	Non Credit
Total			**15**	**01**	**08**	**-**	**525**	**500**	**21**
Clock Hours Per Week: 24									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

Professional Elective - II		
S.no	Course code	Title of the Course
1	26MEE05	Robotic Engineering
2	26MEE06	Solar & Wind Energy Systems
3	26MEE07	Additive Manufacturing
4	26MEE08	Product Design and Process Planning

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SEMESTER – VI

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MEC27	CAD/CAM	3	-	-	3	40	60	3
2	26MEC28	Metal Cutting and Machine Tools Engineering	3	-	-	3	40	60	3
3	26MEC29	Refrigeration & Air Conditioning	3	-	-	3	40	60	3
4	26CSCXX	Data Structures using Python	3	-	-	3	40	60	3
5		Professional Elective – III	3	-	-	3	40	60	3
6		Professional Elective – IV	3	-	-	3	40	60	3
7	26EGM01	Indian Constitution	2	-	-	2	-	50	Non Credit
PRACTICALS									
6	26MEC30	CAD/CAM Lab	-	-	2	3	50	50	1
7	26MEC31	Metal Cutting and Machine Tools Lab	-	-	2	3	50	50	1
8	26CSCXX	Data Structures using Python Lab	-	-	2	3	50	50	1
9	26MEC32	Mini Project	-	-	2	-	50	-	1
10	26MEU02	Upskill Certification – II	3-4weeks/90 hours				25	-	0.5
Total			**20**	**00**	**08**	**-**	**465**	**560**	**22.5**
Clock Hours Per Week: 28									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

Professional Elective - III		
S.no	Course code	Title of the Course
1	26MEE09	Tribology
2	26MEE10	Hydrogen Energy & Fuel Cell Technology
3	26MEE11	AI for Quality and Reliability
4	26MEE12	Engineering Research Methodology

Professional Elective - IV		
S.no	Course code	Title of the Course
1	26MEE13	Condition Monitoring of Industrial Machinery
2	26MEE14	Hybrid Electric Vehicles
3	26MEE15	Smart Manufacturing
4	26MEE16	Digital Twins for Mechanical Engineering

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SEMESTER – VII

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MEC33	Metrology & Instrumentation	3	-	-	3	40	60	3
2	26MEC34	Thermal Turbo Machines	3	-	-	3	40	60	3
3	26MEC35	Industrial Management & Operations Management	3	-	-	3	40	60	3
4		Open Elective – I	-	-	-	-	40	60	2
5		Professional Elective – V	3	-	-	3	40	60	3
6	26CEM01	Environmental Science	1	-	-	2	-	50	Non Credit
PRACTICALS									
6	26MEC36	Metrology & Instrumentation Lab	-	-	2	3	50	50	1
7	26MEC37	Thermal Turbo Machines Lab	-	-	2	3	50	50	1
8	26MEC38	Project Part – I	-	-	4	-	50	-	2
9	26MEI02	Industrial Internship – II / Rural Internship / Academic Internship / Research Internship	120-135 hours				50	-	3
Total			**13**	**00**	**08**	**-**	**400**	**450**	**21**
Clock Hours Per Week: 21									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

Professional Elective - V		
S.no	Course code	Title of the Course
1	26MEE17	MEMS Devices Design and Fabrication
2	26MEE18	HVAC Systems
3	26MEE19	Modern Machining & Forming Methods
4	26MEE20	Supply Chain Management

Open Elective – I (through NPTEL)

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BE (Mechanical Engineering)

SEMESTER – VIII

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1		Open Elective – II	3	-	-	3	40	60	3
2		Open Elective - III	3	-	-	3	40	60	3
3	26EEM01	Universal Human Values: Understanding harmony	1	-	-	-	50	-	1
PRACTICALS									
9	26MEC39	Project Part – II	-	-	8	-	100	100	4
Total			**07**	**00**	**08**	**-**	**230**	**220**	**11**
Clock Hours Per Week: 15									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

Open Elective – II		
S.no	Course code	Title of the Course
1	26EGO01	Technical Writing Skills
2	26CIO01	Fundamentals of Internet of Things
3	26CSO05	Fundamentals of Cyber Security
4	26ECO08	Quantum Computing
5	26EGO02	Gender Sensitization

Open Elective - III		
S.no	Course code	Title of the Course
1	26EEO05	Digital Waste Management
2	26CSO06	Introduction to Cloud Computing
3	26CSO02	Introduction to Database Management Systems
4	26CIO03	Fundamentals of Block Chain Technology
5	26BTO02	Biomaterials for Engineers

Total credits:

Semester	1	2	3	4	5	6	7	8	**Total**
Credits	22.5	20.5	23	22.5	21	22.5	21	11	**164**

List of open electives offered by Mechanical Engineering Department

S. No.	Course Code	Name of the Course
1	26MEO01	Principles of Design Thinking
2	26MEO02	3D Printing
3	26MEO03	Corporate Organizational Behavior
4	26MEO04	Introduction to Operations Research
5	26MEO05	Research Methodologies and Innovation
6	26MEO06	Principles of Entrepreneurships and Startups
7	26MEO07	Futuristic Vehicular Technology
8	26MEO08	Advanced Robotics
9	26MEO09	Fundamentals of Wind & Solar Energy Systems
10	26MEO010	Principles of Digital Manufacturing & Industry 4.0

List of service courses offered by Mechanical Engineering Department

S. No.	Course Code	Name of the Course	Remarks
1	26MEC39	Fundamentals of Robotics Engineering	2 Credits
2	26MEC40	Fundamentals of Robotics Engineering Lab	1 Credit

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R26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

BE (Mechanical Engineering)

SEMESTER – I

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MTC02	Matrix Theory and Advanced Calculus	3	1	-	3	40	60	4
2	26CYC07	Material Chemistry	3	-	-	3	40	60	3
3	26EEC01	Basic Electrical Engineering	3	-	-	3	40	60	3
4	26CSC01	Problem solving and Programming using C	3	-	-	3	40	60	3
5	26ADC01	Artificial Intelligence Foundations and Applications	2	-	-	3	40	60	2
PRACTICALS									
6	26CYC08	Material Chemistry Lab	-	-	3	3	50	50	1.5
7	26EEC02	Basic Electrical Engineering Lab	-	-	2	3	50	50	1
8	26CSC02	Problem Solving and Programming using C Lab	-	-	3	3	50	50	1.5
9	26MEC01	Robotics and Drones Lab	-	1	2	3	50	50	2
10	26MEC04	Engineering Workshop & 3D Printing	-	-	3	3	50	50	1.5
Total			**14**	**02**	**13**	**-**	**450**	**550**	**22.5**
Clock Hours Per Week: 29									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

26MTC02

MATRIX THEORY AND ADVANCED CALCULUS
(for Mechanical Engg.)

Instruction	3L + 1T Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives: This course aims to

1. To develop proficiency in solving system of linear equations using matrix methods.
2. To provide a clear understanding of eigen values, eigenvectors and their applications.
3. To explain mean value theorems and their geometrical interpretations.
4. To develop the ability to use partial derivatives for analyzing functions of two variables and determining their extreme values.
5. To introduce and apply double and triple integral concepts.

Course Outcomes: Upon completion of this course, students will be able to

1. Apply matrix methods to solve system of linear equations.
2. Determine eigenvalues and eigenvectors and analyze the nature of quadratic forms.
3. Interpret and analyze mean value theorems and their geometrical significance, including curvature.
4. Determine extreme values of functions of two variables using partial derivatives.
5. Evaluate double and triple integrals and apply them in relevant problems.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	2	-	-	-	-	-	2	2	1	1
CO2	3	3	2	2	1	-	-	-	-	-	2	3	1	2
CO3	3	3	1	2	1	-	-	-	-	-	2	2	1	1
CO4	3	3	2	2	1	-	-	-	-	-	2	3	1	1
CO5	3	3	2	2	2	-	-	-	-	-	2	3	1	2

UNIT-I: Matrices-I

Linear system of equations**,** Echelon form, Rank of a matrix and consistency, solution of Non-homogeneous system of equations, solution of homogeneous system of equations, Linear dependence and independence of vectors. Solution of system of linear equations by Factorization method (Doolittle's method).

UNIT-II: Matrices-II

Eigenvalues, Eigenvectors, Properties of Eigenvalues and Eigenvectors, Cayley Hamilton theorem, Quadratic form, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

UNIT-III: Differential Calculus

Rolle's Theorem, Lagrange's Mean value theorem, Cauchy's Mean value theorem (without proofs) and their geometrical interpretations. Curvature, Radius of curvature, Centre of curvature, Evolute and Involute (Cartesian curves).

UNIT-IV: Multivariable calculus

Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobian, Taylor's expansion of functions of two variables, Maxima and Minima of functions of two variables.

UNIT-V: Multiple Integrals

Introduction of double integral, Evaluation of double integral, Evaluation of double integral in polar coordinates, Change of order of integration, Triple integral, Change of variables, Area by double integration, Volume as a triple

integral.

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. N.P.Bali and Dr. Manish Goyal, "A text book of Engineering Mathematics", 9th edition, Laxmi Publications, 2017.

Suggested Reading:

1. B.V.Ramana., "Higher Engineering Mathematics", 11th Reprint, Tata McGraw-Hill, New Delhi, 2010.
2. R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th edition, Narosa Publications, 2016
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2016.

Online Resources:

Course Code	Course Name	Resource Link
26MTC02	Matrix Theory and Advanced Calculus	1.https://nptel.ac.in/courses/111107112 [(Unit-I&II: Week-1&3)] 2.https://nptel.ac.in/courses/111105160 [(Unit-III,IV&V: Week-2,3,4,5,9&10)]

26CYC07

MATERIAL CHEMISTRY

(for Mechanical Engg.)

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

Course Objectives: This course aims to

1. Impart the knowledge of industrial materials in engineering applications.
2. Develop concepts of electrochemical principles and corrosion mechanisms for industrial applications.
3. Explore the fundamental concepts, synthesis and engineering applications of polymers.
4. Create awareness about wastewater treatment and environmental protection.
5. Discuss the applications of quantum dots and nanomaterials in engineering field.

Course Outcomes: Upon completion of this course, students will be able to

1. Evaluate the quality and efficiency of industrial materials based on the standards & requirements.
2. Apply electrochemical principles to calculate cell potentials and predict corrosion behavior
3. Illustrate the synthesis, properties, and applications of advanced engineering polymers
4. Analyze water quality parameters and select appropriate domestic and industrial treatment techniques
5. Apply fundamental concepts of quantum confinement effect and nanomaterials in modern technology.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	-	-	3	-	-	-	-	2	1	2	1
CO2	3	2	2	-	-	3	-	-	-	-	2	1	2	2
CO3	3	2	2	-	-	2	-	-	-	-	2	2	2	2
CO4	3	2	3	-	-	3	-	-	-	-	2	1	1	2
CO5	3	2	2	-	-	2	-	-	-	-	2	1	2	2

Unit I: Industrial Materials: Cement and Lubricants

Cement: Classification of cement, chemical composition and manufacturing of portland cement (raw materials, mixing raw materials for dry and wet process, burning, grinding and packing), setting and hardening of Portland cement. Reactions involved during setting of cement.

Refractories: Classification, criteria of good refractory materials. Conditions for failure of a refractory materials.

Lubricants: Definition and characteristics of a good lubricant- classification of lubricants with examples. Mechanism of lubrication- thick film, thin film and extreme pressure lubrication. Additives and selection of lubricants. Properties- viscosity, cloud point, pour point, flash and fire point. Saponification number-definition and significance.

Unit II: Electrochemistry and Corrosion

Electrochemistry: Electrode potentials, Cell potentials and Cell emf. Electrochemical series and its applications. Reference electrodes: construction and working of the standard hydrogen electrode (SHE) and the saturated calomel electrode (SCE). Nernst equation and its applications - numericals. Potentiometric acid base and redox titrations (principle and graphs).

Corrosion: Introduction to corrosion, types of corrosion – chemical and electrochemical corrosion, mechanism of electrochemical corrosion by absorption of oxygen and evolution of hydrogen. Differential aeration corrosion, galvanic 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.

Unit III: Materials in Engineering and Technology

Polymers: Monomer, polymer, polymerization, degree of polymerization. Synthesis, properties and applications of thermoplastic polymers (PVC and PTFE) and thermosetting polymers (Bakelite, Kevlar). Elastomers- natural rubber, vulcanization of rubber, process and applications.

Conducting polymers: Definition, classification and mechanism of conduction in (p-doped and n-doped) polyacetylene and their engineering applications.

Bio-degradable polymers: Preparation and applications of poly lactic acid and poly vinyl alcohol.

UNIT-IV: Water Chemistry

Hardness of water: Types, units of hardness and disadvantages of hard water. Alkalinity of water and its estimation. Numerical problems on hardness of water and alkalinity. Boiler troubles – scales and sludge formation, causes, effects and prevention. Softening of water by ion exchange method. Desalination of water by reverse osmosis and electro dialysis method. Specifications of potable and industrial water. Disinfection of water by chlorination method, breakpoint chlorination. BOD and COD- definition, estimation (only brief procedure) and significance. Industrial wastewater treatment by using Zero Liquid Discharge (ZLD) method.

UNIT-V: Quantum dots and Nanomaterials

Nanomaterials: Introduction to nanomaterials and their classification as 0D, 1D, 2D and 3D materials. General applications of nanomaterials. Basic chemical method of preparation: sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (principles only).

Quantum dots: Definition and classification of quantum dots. Concept of quantum confinement. Size dependent optical properties (absorption and photoluminescence). Core and core shell quantum dots-surface capping and functionalization with emphasis on stability. Applications in LEDs, solar cells, bio-imaging and sensing. Raman Spectroscopy (Principle only).

Composite materials: Definition and classification of composites- Particle reinforced, fibre reinforced - glass fibre reinforced and carbon fibre reinforced composites and their applications.

Text Books:

1. P.C. Jain and M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company Ltd., New Delhi, 17th edition (2025).
2. A Textbook of Polymer Science and Technology, Shashi Chawla, Dhanpat Rai & Co. (2014).
3. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, “Drugs”, Universities Press (India) Limited, Hyderabad (2016).

Suggested Reading:

1. B. S. Bahl, G.D. Tuli, Arun Bahl (Author), “Essentials of Physical Chemistry”, S.Chand & Co.Ltd, 28th edition (2022).
2. R B.R. Puri, L.R. Sharma and M.S. Pathania, “Principles of Physical Chemistry”, S. Nagin Chand & Company Ltd., 47th edition (2019).
3. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2018.

Online Resources:

Course Code	Course Name	Resource Link
26CYC07	Material Chemistry	1. https://nptel.ac.in/courses/105104157 (week 1, Lecture 4 & 5) 2. http://digimat.in/nptel/courses/video/113104082/L01.html (Unit-II) 3. https://www.youtube.com/watch?v=nSAvyQajVzE&t=678s (Unit-III) 4. https://nptel.ac.in/courses/105107207 (Unit-IV) 5. https://nptel.ac.in/courses/113104102 (Unit-V)

26EEC01

BASIC ELECTRICAL ENGINEERING

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

Course Objectives: This course aims to

1. Understand the behavior of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis.
2. Comprehend the basic principle of operation of AC and DC machines.
3. Infer about different types of safety rules and methods of Earthing.

Course Outcomes: Upon completion of this course, students will be able to

1. Understand the concepts of Kirchhoff's laws and their application various theorems to get solution of simple dc circuits.
2. Predict the steady state response of RLC circuits with AC single phase/three phase supply.
3. Infer the basics of single phase transformer.
4. Describe the construction, working principle of DC machine and 3-phase Induction motor
5. Acquire the knowledge of electrical wires, cables, earthing, Electrical safety precautions to be followed in electrical installations and electric shock and its safety and energy calculations.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	-	-	1	2	-	3	2	1	2
CO2	3	3	2	-	-	-	-	1	2	-	3	2	1	3
CO3	3	3	2	1	-	-	-	1	2	-	3	2	1	3
CO4	2	1	-	-	-	-	-	1	2	-	3	3	2	3
CO5	2	-	2	-	-	-	-	1	2	-	3	2	2	3

Unit I: DC Circuits

Electrical Circuit Elements: R, L and C, voltage and current sources, Kirchhoff current **(KCL)** and voltage laws (**KVL**), Analysis of simple circuits with DC excitation: Nodal Analysis, Mesh Analysis, Superposition, Thevenin's and Norton's Theorems.

Unit II: AC Circuits

Single Phase AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, series RL and RC.

Three phase balanced circuits: Introduction, Comparison of Single phase and Three Phase System, voltage and current relations in star and delta connections (Elementary treatment only).

Unit III: Single Phase Transformer

Construction, Working Principle, EMF Equation, Comparison of Ideal and Practical Transformer, Equivalent circuit of Transformer, Losses, OC and SC tests and Efficiency.

UNIT-IV: DC and AC Machines

DC Generators: Construction, Principle of operation, EMF equation, Classification, Applications.

DC Motors: Principle of operation, Classification, Torque Equation, Characteristics & Speed control of DC Shunt Motor, Applications.

Three Phase Induction Motors: Principle of operation, Applications.

UNIT-V:

Electrical Installations and Sensors:

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

Components of LT Switchgear: Fuse, MCB and Earthing (Elementary Treatment only), Elementary calculations for energy consumption.

Sensors: Introduction, Working Principle, Types-Voltage, Current, Temperature, Humidity, and Motion (Elementary treatment only).

Text Books:

1. B. L. Theraja & A. K. Theraja, Electrical Technology in S.I units (Volume-1 and Volume-2), S. Chand Publishing, 2021.
2. D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2nd edition, 2019.
3. Wadhwa, C L, "Basic Electrical Engineering", New Age International Publishers, 5th edition, 2023.
4. Jacob Fraden," Handbook of Modern Sensors (Physics, Designs, and Applications)" Fifth Edition, 2016.

Suggested Reading:

1. D. P. Kothari & I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill,4th edition, 2019.
2. S. K. Sahdev, "Basic Electrical Engineering",Pearson Education, 2015.
3. P.V. Prasad, S. S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2012.

ONLINE RESOURCES:

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Basic Electrical Circuits	Prof. Nagendra Krishnapura	IIT Madras
2	Electrical Machines	Prof. Anirban Sengupta	IIT Kanpur
3	Electric Circuits	Prof. S. C. Dutta Roy	IIT Delhi
4	Basic Electrical Technology	Prof. D. P. Kothari	IIT Delhi
5	Introduction to Electrical Engineering	Prof. S. K. Sharma	IIT Kanpur

26CSC01

PROBLEM SOLVING AND PROGRAMMING USING C

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

PREREQUISITES: Basic high school mathematics.

Course Objectives: This course aims to

1. Understanding the steps in problem solving and formulation of algorithms to problems.
2. Develop programming skills as a means of implementing an algorithmic solution with appropriate control and data structures.
3. Develop intuition to enable students to come up with creative approaches to problems.

Course Outcomes: Upon completion of this course, students will be able to

1. List and outline the steps to develop algorithmic solutions and identify flowchart symbols.
2. Illustrate programming concepts such as variables, data types, conditionals, loops, print statements, and functions.
3. Develop algorithms using recursion and iteration techniques.
4. Analyze the use of arrays, pointers, initialization, and dynamic memory allocation.
5. Evaluate and develop large-scale programs using multiple files, header files, and make utilities.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	1	1	-	1	-	-	-	-	-	1	2	1	1
CO2	3	1	1	-	1	-	-	-	-	-	1	2	1	1
CO3	3	1	1	-	1	-	-	-	-	-	1	2	2	1
CO4	3	1	1	-	1	-	-	-	-	-	1	3	2	2
CO5	3	1	1	-	1	-	-	-	-	-	1	2	3	2

Unit I:

Introduction: Introduction to Programming, Idea of Algorithm, Representation of Algorithm, Flowchart, from algorithms to programs, source code.

Basics of C: Background, Structure of a C Program, Datatypes, Tokens, Operators and Expressions- Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions, Input and Output Functions.

Unit II:

Control Statements: Conditional Execution -Selection Statements, Conditional Operator, Switch statement. Iteration Execution - While Construct, For Construct, do-while Construct Goto Statement, Special Control Statements, Nested Loops.

Arrays: One-Dimensional Arrays-Declaration, Initialization, internal representation. Multidimensional Arrays.

Unit III:

Strings: Strings: One-dimensional Character Arrays, Arrays of Strings: Two-dimensional Character Array.

Search and Sorting: Searching algorithms-linear, binary searching. Sorting algorithms- bubble sort, selection sort.

Functions: Concept, Uses, Prototype, Declaration, Parameter passing techniques, Passing Arrays to Functions, Storage Classes, Recursion.

Unit-IV:

Pointers:

Declaring a Pointer, Initializing Pointers, Indirection Operator and Dereferencing, Arrays and Pointers, Pointers and Strings, Pointers to Pointers, Array of Pointers, Pointers to an Array, Two-dimensional Arrays and Pointers, Pointers to Functions and Dynamic Memory Allocation.

Unit-V:

User-defined Datatypes: Structures- Declaring Structures and Structure Variables, Accessing the Members of a Structure, Initialization of Structures, Typedef, Nesting of Structures, Arrays and Structures. Union, Enumeration Types.

Files: Using Files in C, Declaration of File Pointer, Working with Text Files, Character Input and Output, Working with Binary Files, Sequential Versus Random File Access, File Record.

C Preprocessor Directives.

Text Books:

1. Pradip Dey and Manas Ghosh "Programming in C 2/e", 2nd Edition, Oxford University Press, 2012.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language", 2nd Edition (Paperback), Prentice Hall India, 2018.

Suggested Reading:

1. B.A.Forouzan and Hassan Afyouni "A Structured Programming Approach in C", 4th Edition, Cengage Learning, 2024.
2. E. Balaguruswamy, "Programming in ANSI C", 9th Edition, Tata McGraw-Hill, 2024.
3. Paul Deitel and Harvey Deitel, "C: How to Program", 9th Edition, Pearson, 2022.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
2. https://archive.nptel.ac.in/courses/106/105/106105171/

26ADC01

ARTIFICIAL INTELLIGENCE FOUNDATIONS AND APPLICATIONS

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

Course Objectives: This course aims to

1. Provide a foundational understanding of Artificial Intelligence and its evolution.
2. Introduce key AI subfields and their real-world applications across industries.
3. Explain the impact of AI on society, including ethical and fairness considerations.
4. Study emerging trends such as Generative AI and future directions.

Course Outcomes: Upon completion of this course, students will be able to

1. Understand the basic concepts and evolution of Artificial Intelligence.
2. Illustrate major AI subfields and their functionalities.
3. Develop and describe applications of AI in various domains.
4. Elaborate ethical issues, bias, and societal impacts of AI systems.
5. Demonstrate emerging trends such as Generative AI and their future implications.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	2	-	-	-	-	-
CO4	2	2	-	-	-	2	2	3	-	-	-
CO5	2	2	-	-	-	2	2	2	-	-	-

Unit I: Introduction to Artificial Intelligence

Evolution of Artificial Intelligence: early developments and growth of AI. Definition and scope of AI. Core components of AI: Machine Learning, Pattern Recognition, Natural Language Processing, and Computer Vision. Concept of Artificial General Intelligence (AGI).

Unit II: AI Subfields and Technologies

Introduction to AI subfields: **Computer Vision** - object detection, facial recognition, medical imaging, **Natural Language Processing** - text classification, translation, summarization, **Machine Learning** - classification, regression, clustering, recommendation systems, **Robotics**- types and components, and **Knowledge Engineering** - representation and reasoning.

Unit III: Applications of Artificial Intelligence

Applications of AI in various domains: **Healthcare** - diagnosis, drug discovery, **Finance** - risk management, trading, **Retail** - personalization, customer support, **Agriculture** -precision farming, **Education** - personalized learning, and **Transportation** -traffic management. Challenges in applying AI in real-world scenarios.

UNIT-IV: Ethics, Bias and Fairness in AI

Ethics in AI systems. Types of bias and fairness issues. Transparency and explain ability. Accountability of AI systems. Privacy and data protection concerns. Security risks in AI systems.
Inclusivity, sustainability, robustness, and reliability.

UNIT-V: Generative AI and Future Directions

AI in research and interdisciplinary domains. Introduction to Generative AI and its evolution. Emerging trends and future directions of Artificial Intelligence. Social implications and impact of AI.

Text Books:

1. AI for Everyone: A Beginner’s Handbook for Artificial Intelligence, First Edition, Pearson India, 2023.

Suggested Reading:

1. Stuart Russell, Peter Norvig, 'Artificial Intelligence: A Modern Approach', Fourth Edition, Pearson, 2021.
2. Melanie Mitchell, 'Artificial Intelligence: A Guide for Thinking Humans', First Edition, Farrar, Straus and Giroux, 2019.

ONLINE RESOURCES:

1. Government of India, Press Information Bureau (PIB), YUVA AI for ALL Initiative Available: https://www.pib.gov.in/PressReleseDetailm.aspx?PRID=2191334.
2. FutureSkills Prime (MeitY & NASSCOM), AI Learning Platform. Available: https://futureskillsprime.in
3. India AI Mission (Government of India AI Initiative). Available: https://indiaai.gov.in

26CYC08

MATERIAL CHEMISTRY LAB

(for Mechanical Engg.)

Instruction	3L Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: This course aims to

1. Impart fundamental knowledge in handling the equipment/glassware and chemicals in chemistry laboratory.
2. Provide the knowledge in both qualitative and quantitative chemical analysis.
3. Get familiarized with the principles of various determination techniques.
4. Understand and apply the various instrumental methods to analyse the chemical compounds.
5. Interpret the theoretical concepts in the preparation of new materials like drugs and polymers.

Course Outcomes: Upon completion of this course, students will be able to

1. Identify the basic chemical methods to analyze the substances quantitatively & qualitatively.
2. Develop analytical thinking and problem-solving skills in identifying unknown samples.
3. Estimate the amount of chemical substances by volumetric analysis..
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	-	2	-	-	-	-	2	-	1	1
CO2	3	3	2	2	-	2	-	-	-	-	2	-	2	1
CO3	3	2	3	2	-	2	-	-	-	-	2	-	1	2
CO4	3	2	2	2	-	2	-	-	-	-	2	2	2	1
CO5	3	2	3	2	-	2	-	-	-	-	2	1	2	1

List of Lab Exercises:

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Determination of viscosity of sample oil by Ostwald's Viscometer.
3. Estimation of temporary, permanent and total hardness of water using EDTA solution.
4. Determination of Alkalinity in the given water sample.
5. Determination of concentration of given $KMnO_4$ solution by colorimetric Method.
6. Determination of concentration of given $K_2Cr_2O_7$ solution by colorimetric Method.
7. Estimation of amount of HCl conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids conductometrically using NaOH solution.
9. Estimation of amount of HCl potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} potentiometrically using $KMnO_4$ solution.
11. Preparation of Zinc Oxide Nanoparticles.
12. Determination of chemical oxygen demand (COD) of industrial waste water sample.
13. Determination of strength of cement (Chemical aspect).

Text Books:

1. J. Mendham and Thomas, "Vogel's text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi, 6th edition. 2017.
2. Senior practical physical chemistry by B. D. Khosla, V. C. Garg & A.Gulati, R. Chand & Co., New Delhi (2011).

Suggested Reading:

1. Dr. Subdharani, “Laboratory Manual on Engineering Chemistry”, Dhanpat Rai Publishing, 2020.
2. S.S. Dara, “A Textbook on experiment and calculation in engineering chemistry”, S. Chand and Company, 9th revised edition, 2015.

Online Resources:

Course Code	Course Name	Resource Link
26CYC08	Material Chemistry Lab	https://www.vlab.co.in/ba-nptel-labs-chemical-sciences

26EEC02

BASIC ELECTRICAL ENGINEERING LAB

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

Course Objectives: This course aims to

1. To acquire to verify the basic electrical circuit laws and theorems.
2. Explore the concept of single phase AC and Three phase AC concepts.
3. To find the characteristics of Transformers, DC, AC Machines and switch gear components.

Course Outcomes: Upon completion of this course, students will be able to

1. Comprehend the circuit analysis techniques using various circuital laws and theorems.
2. Determine the different parameters related Single Phase AC and 3 Phase AC Circuits.
3. Determine the turns ration/performance parameters of single-phase transformer.
4. Infer the characteristics of the DC shunt motor subjected to different tests.
5. Illustrate different parts of Machines, Protection equipment and Sensors.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	-	1	1	-	-	-	-	-	-	2	1	2
CO2	3	2	-	1	1	-	-	-	-	-	-	3	1	3
CO3	3	2	1	2	1	-	-	-	-	-	-	2	1	3
CO4	3	2	1	2	1	-	-	-	-	-	1	3	2	3
CO5	2	1	1	-	1	1	-	-	-	-	1	3	2	3

List of Lab Exercises:

1. Verification of KCL and KVL.
2. Verification of Thevenin's Theorem.
3. Verification of Superposition Theorem.
4. Verification of Norton's Theorem.
5. Determination of parameters of a choke or coil by Wattmeter Method.
6. Active and Reactive Power measurement of a single-phase system using 3-Ammeter method.
7. Active and Reactive Power measurement of a single-phase system using 3-Voltmeter method.
8. Measurement of 3-Phase Power in a balanced system.
9. Measurement of Energy Using a Single-Phase Energy Meter.
10. Verification of Turns/voltage ratio of single-phase Transformer.
11. Open Circuit and Short Circuit tests on a single phase Transformer.
12. Brake Test on DC Shunt Motor.
13. Speed Control of DC Shunt Motor.
14. Demonstration of Fuse & MCB.
15. Demonstration of Sensors.
16. Study of cut - out section of Electrical Machines.

Note:

At least 10 experiments need to be conducted.

26CSC02

PROBLEM SOLVING AND PROGRAMMING USING C LAB

Instruction	3P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Prerequisite: Basic high school mathematics

Course Objectives: This course aims to
1. Setting up programming environment.
2. Develop Programming skills to solve problems.
3. Use of appropriate C programming constructs to implement algorithms.

Course Outcomes: Upon completion of this course, students will be able to
1. Identify and setup program development environment
2. Implement the algorithms using C programming language constructs
3. Analyze programs using arrays, structures and pointers
4. Evaluate problems in a modular approach using functions.
5. Develop file operations with simple text data

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	-	1	1	1	-	-	-	-	-	1	-	2	1	1
CO2	3	2	1	2	-	-	-	-	-	-	-	3	2	2
CO3	3	2	1	2	-	-	-	-	-	-	-	3	2	2
CO4	3	2	1	2	-	-	-	-	-	-	-	2	3	1
CO5	3	1	-	1	-	-	-	-	-	-	-	2	2	1

List of Lab Exercises:

1. Introducing to IDE Eg: Visual Editor, TurboC, DevC++, Visual Studio etc..
2. Implement programs using arithmetic, relational, bitwise, conditional, logical, and ternary operators.
3. Implement programs using control statements (sequential, selection and iteration).
4. Implement programs using user defined functions and Recursion.
5. Implement Programs using one dimensional arrays.
6. Implement programs on two dimensional arrays with and without using functions.
7. Implement programs on String manipulation (with and without using string library functions).
8. Implement programs on sorting and searching using iteration and recursion. (Bubble Sort, Selection Sort, Linear Search, Binary Search).
9. Implement programs using pointers and dynamic memory allocation.
10. Implement programs using Structures.
11. Implement file handling programs (Modes, Operations, Access).

Text Books:

1. Pradip Dey and Manas Ghosh “Programming in C 2/e”, 2nd Edition Oxford University Press, 2012.
2. B. W. Kernighan and D.M. Ritchie, "The 'C' Programming Language”, 2nd Edition (Paperback), Prentice Hall India, 2018.

Suggested Reading:

1. B.A.Forouzan and Hassan Afyouni “A Structured Programming Approach in C”, 4th Edition, Cengage Learning, 2024.
2. E. Balaguruswamy, “Programming in ANSI C”, 9th Edition, Tata McGraw-Hill, 2024.
3. Paul Deitel and Harvey Deitel, “C: How to Program”, 9th Edition, Pearson. 2022.

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
2. https://archive.nptel.ac.in/courses/106/105/106105171/

26MEC01

ROBOTICS AND DRONES LAB
(Common to Mechanical, Civil, ECE, EVL, EEE, Chemical & Bio Tech)

Instruction	3 (1T + 2P) Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	2

Prerequisite: Nil

Course Objectives: This course aims to
1. Develop a fundamental understanding of robotics, Arduino programming, and electronic circuit interfacing used in autonomous systems.
2. Gain practical knowledge of interfacing various sensors such as ultrasonic sensors, IR sensors, and LiDAR sensors with microcontrollers for data acquisition in robotic and drone applications.
3. Acquire proficiency in controlling different types of actuators including servo motors, stepper motors, DC motors, and BLDC motors for robotic and drone movement.
4. Understand the structure, components, and working principles of drones, and develop the ability to assemble basic quadcopter system.
5. Apply basic computer vision techniques using Python and OpenCV for image processing tasks relevant to drone-based applications.

Course Outcomes: Upon completion of this course, students will be able to
1. Understand the fundamentals of robotics, Arduino programming, and electronic interfacing required for autonomous systems.
2. Interface and utilize sensors such as ultrasonic, IR, and LiDAR sensors to collect and process environmental data for robotic and drone applications.
3. Demonstrate the ability to control various actuators including servo motors, stepper motors, DC motors, and BLDC motors for implementing robotic movements.
4. Assemble and understand the operation of drone systems including mechanical, electrical, and control components required for drone flight.
5. Apply Python and OpenCV techniques for basic image processing tasks such as RGB extraction, shape creation, and region of interest (ROI) extraction (or) to develop simple autonomous systems.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	2	1	–	2	2	1	2	2	1	2
CO2	2	3	2	3	2	1	–	1	1	1	2	2	1	2
CO3	2	2	3	2	2	1	–	2	1	1	2	3	2	3
CO4	2	2	3	2	2	1	1	3	2	2	2	3	2	2
CO5	2	2	2	2	3	1	–	1	2	1	3	1	–	2

List of Lab Exercises:

1. a. Interface Arduino with LEDs to do traffic light simulation.
   b. Design and implement a system to interface an Arduino board with a seven-segment LED display to show decimal digits from 0 to 9. The Arduino should be programmed to sequentially display each number with a fixed time delay between transitions.
2. a. Interface Arduino with Electronic Devices such as Push Button to control piezo buzzer.
   b. Interface Arduino with Electronic Devices such as Potentiometer to control blinking time of LED.
3. Interfacing Arduino with Ultrasonic Distance Sensor and Displaying Sensor Data on Serial Monitor.
4. Interfacing Arduino with IR Sensor and Reading Sensor Data on Serial Monitor.
5. Implement a system using Arduino to control the precise movement of a Servo Motor.
6. Control and operate a Stepper Motor using Arduino for precise and sequential motion.

7. Construct a two-wheel robot using DC motors controlled by Arduino. Program the robot to: (i) Move forward with controlled acceleration (ii) Move backward with controlled deceleration.
8. Controlling a BLDC motor of a drone using a Servo Tester.
9. Attach a propeller to a BLDC motor and measure the wind speed using an Anemometer.
10. Measure the distance between an obstacle and the drone using a TF-Mini LiDAR Range Sensor.
11. Assemble the mechanical and electrical subsystems of a quadcopter drone by integrating frame arms, BLDC motors, ESCs, power distribution system, and connectors. Verify electrical continuity and correct motor-ESC connections.
12. Integrate drone control components including flight controller, radio receiver, GPS module, battery, and propellers. Study of Drone Take-off, Flight, and Landing Basics.
13. Open CV for Image Processing in Drones: (i) Extraction of RGB values of a pixel (ii) Creation of coloured shapes and saving images (iii) Extraction of Region of Interest (ROI).
14. Open-Ended Autonomous System Project.

Note:

Students shall complete any 10 out of the 14 experiments. The Experiment No. 14 (Open-Ended Project) is mandatory and carries 10 marks in CIE.

Text Books:

1. J. M. Hughes, Arduino: A Technical Reference
2. A Handbook for Technicians, Engineers, and Makers. Sebastopol, CA: O'Reilly Media, 2016.
3. S. Monk, Programming Arduino: Getting Started with Sketches. New York, NY: McGraw-Hill, 2022.
4. D. McGriffy, Make: Drones: Teach an Arduino to Fly. San Francisco, CA: Maker Media, 2016.

Suggested Reading:

1. https://www.geeksforgeeks.org/robotics-introduction/
2. https://dronebotworkshop.com/

26MEC04

ENGINEERING WORKSHOP & 3D PRINTING

Instruction	3P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Prerequisite: Nil

Course Objectives: This course aims to

1. Give a feel of engineering practices and develop holistic understanding of various engineering materials and manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization, positive and team work attitude to get things right the first time.
3. Provide basic knowledge of steel, plastic, composite, and other materials for suitable applications.
4. Study of principle and hands on practice on techniques of fabrication, manufacturing, and allied skills.
5. Advance important, hard and pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

Course Outcomes: Upon completion of this course, students will be able to

1. Fabricate a square tray and perform a lap joint on mild steel using proper marking, and finishing techniques.
2. Apply house-wiring techniques to construct and verify single-point, series, parallel, and staircase circuits.
3. Apply pipe fitting techniques to thread, assemble, and verify GI pipe systems as per given diagrams.
4. Perform 3D modelling using solid works software and pre-processing operations on STL files for 3D printing, also understand reverse engineering process.
5. Conceptualize and produce simple device/mechanism of their choice.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	1	2	1	1	-	-	1	-	-	-	1	-	-	1
CO2	1	-	1	-	-	-	-	-	-	-	1	-	2	1
CO3	1	-	1	-	-	1	-	-	-	-	1	2	2	1
CO4	1	-	1	-	-	1	-	-	-	-	1	2	2	1
CO5	2	2	2	1	3	1	1	1	2	-	2	3	3	3

Lab Experiments

Group 1: Workshop Practice

1. To make a square tray from the given sheet metal.
2. Fabricate a funnel from the given sheet metal and join it using soldering.
3. Wiring of single light point and socket with switches, and series–parallel connection of two light points with verification.
4. Stair case wiring of one light point controlled from two different places independently using two 2-way switches.
5. To make external threads for GI/uPVC pipes using die and connect the GI/uPVC pipes as per the given diagram using taps, couplings, and bends.
6. Assemble GI/uPVC pipes as per the diagram using fittings, install a shower, tap, and valves, and demonstrate operation with a water connection.

Group 2: 3D Printing

1. Introduction to Additive manufacturing and modelling software.
2. To create a 3D CAD model (Door Bracket and Door handle) using modelling software.
3. To perform pre-processing operations and print a door bracket model using an extruder type 3D printer.
4. To create 3D CAD model using Reverse engineering.
5. To demonstrate engraving, drilling and cutting operations on printed circuit boards using CNC PCB Mate.
6. To design an innovative component using the CAD software/print the selected innovative component using a 3D printer.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Sabrie Soloman , "3D Printing & Design ", 1st edition, Khanna Publishing House, 2020.

Suggested Reading:

1. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology. I", Pearson Education, 2008.
2. Oliver Bothmann, 3D Printers: A Beginner's Guide, January 1, 2015.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY

R26 (In line with AICTE Model Curriculum) with effect from AY 2026-27

BE (Mechanical Engineering)

SEMESTER – II

S.no	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours Per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	26MTC05	Applied Vector Calculus and Ordinary Differential Equations	3	1	-	3	40	60	4
2	26PYC05	Engineering Physics	3	-	-	3	40	60	3
3	26CEC01	Engineering Mechanics	3	1	-	3	40	60	4
4	26EGC01	Communicative English	2	-	-	3	40	60	2
PRACTICALS									
5	26PYC06	Engineering Physics Lab	-	-	3	3	50	50	1.5
6	26CSC38	Python Programming Workshop	-	-	3	3	50	50	1.5
7	26MEC41	Engineering Graphics	-	1	3	3	50	50	2.5
8	26EGC02	Communication Skills Lab	-	-	2	3	50	50	1
9	26MBC02	Community Engagement	-	-	2	-	50	-	1
Total			**11**	**03**	**13**	**-**	**410**	**440**	**20.5**
Clock Hours Per Week: 27									

L: Lecture **D: Drawing** **CIE: Continuous Internal Evaluation**

T: Tutorial **P: Practical/Project Seminar/Dissertation** **SEE: Semester End Examination**

26MTC05

APPLIED VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS

(for Mechanical Engg.)

Instruction	3L + 1T Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives: This course aims to

1. To develop skills in solving first-order differential equations using appropriate methods.
2. To extend the understanding of higher-order differential equations and their solution techniques.
3. To introduce Laplace transform techniques and their applications in solving differential equations.
4. To develop understanding of scalar and vector functions along with their physical interpretations.
5. To introduce and apply vector calculus concepts including line, surface and volume integrals.

Course Outcomes: Upon completion of this course, students will be able to

1. Solve first-order linear differential equations using appropriate methods.
2. Solve higher-order linear differential equations using standard techniques.
3. Apply Laplace transforms to solve differential equations effectively.
4. Apply vector differential operators to scalar and vector functions.
5. Evaluate line, surface and volume integrals using Green's, Gauss and Stoke's theorems.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	1	-	-	-	-	-	2	2	1	1
CO2	3	2	1	1	1	-	-	-	-	-	2	3	1	2
CO3	3	3	2	2	2	-	-	-	-	-	2	3	1	2
CO4	3	3	2	2	1	-	-	-	-	-	2	3	1	2
CO5	3	3	2	2	2	-	-	-	-	-	2	3	1	2

Unit I: First Order Ordinary Differential Equations

Exact differential equations, Differential Equations reducible to exact equations, Linear equation, Bernoulli's equation, Clairaut's equation, Orthogonal trajectories (Cartesian and polar curves) and LR circuits.

Unit II: Higher Order Linear Differential Equations.

Higher order linear differential equations with constant coefficients, rules for finding the Complementary function, Particular Integral and General solution. Method of variation of parameters, Solution of Cauchy's homogeneous linear equation and LCR circuits.

Unit III: Laplace Transforms

Laplace Transform of Elementary functions, Linearity property, First Shifting property, Change of scale property. Laplace Transform of Periodic functions, Transforms of derivatives, integral's, Multiplication by t^n and division by t. Evaluation of Integrals by Laplace Transforms. Inverse Laplace transform of elementary functions, Inverse Laplace Transform by Method of partial fractions, Convolution theorem (Without proof) and related problems, Solution of Ordinary Differential Equations by Laplace Transform method.

UNIT-IV: Vector Differential Calculus

Scalar and Vector point functions, operator Del, Del applied to scalar point function-Gradient, Directional derivative, Del applied to vector point function-Divergence, Curl, Solenoidal vectors and Irrotational vectors, Del applied twice to point functions.

UNIT-V: Vector Integral Calculus

Line integral, circulation, work done by force, Surface integral and Volume integral. Verification of Green's theorem in a plane (without proof), verification of Stoke's theorem (without proof) and verification Gauss divergence theorem (without proof).

Text Books:

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

Suggested Reading:

1. N.P.Bali and Dr. Manish Goyal, "A text book of Engineering Mathematics", 9th edition, Laxmi Publications, 2017.
2. R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th edition, Narosa Publications, 2016.

Online Resources:

Course Code	Course Name	Resource Link
26MTC05	Applied Vector Calculus and Differential Equations	1. https://nptel.ac.in/courses/111105160 [(Unit-I,II,IV&V: Week-6,7, 9, 10,11&12)] 2.https://nptel.ac.in/courses/111106139 [(Unit-III: Week-2,3,4,&5)]

26PYC05

ENGINEERING PHYSICS

(For Civil & Mechanical Engg.)

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

Course Objectives: This course aims to

1. Acquire knowledge about physics of oscillations and rotational motion.
2. Understand the physical properties of crystalline and magnetic materials.
3. Aware of characteristic properties of dielectric and thermoelectric materials.
4. Familiarize with non-destructive testing techniques.

Course Outcomes: Upon completion of this course, students will be able to

1. Analyse oscillatory systems using damping and resonance principles.
2. Understand and apply the concepts of rigid body dynamics.
3. Analyse crystal structures, defects, and characterization techniques.
4. Apply dielectric and magnetic material behaviour for engineering applications.
5. Recognize various non-destructive testing techniques and thermoelectric materials in engineering applications.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	2	2	2	1	1	1	2	2	3	2
CO2	3	3	2	2	2	2	2	1	1	1	2	3	3	3
CO3	3	3	2	3	2	2	2	1	1	1	2	2	2	2
CO4	3	3	2	2	2	2	2	1	1	1	2	2	2	3
CO5	3	3	2	2	3	2	3	1	1	1	2	3	3	3

Unit I:

Oscillations: Harmonic oscillator – Damped harmonic motion – over damped, critically damped and under damped oscillators – Logarithmic decrement, Relaxation time, Quality factor – Forced oscillations and resonance.

Unit II:

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

Unit III:

Crystallography & Characterization Techniques: Crystal systems – Bravais lattices – Lattice planes – Miller indices – Bragg's law – Experimental determination of lattice constant of a cubic crystal by powder X-ray diffraction method – Structure of NaCl – Characterization Techniques : AFM, SEM, TEM.

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

UNIT-IV:

Dielectric Materials: Introduction – Dielectric polarization – Types of dielectric polarization (qualitative): electronic, ionic polarizations, orientation and space-charge polarizations – Frequency and temperature dependence of dielectric polarization – Ferroelectricity – Barium titanate – Applications of ferroelectrics.

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.

UNIT-V:

Thermoelectricity: Introduction – Seebeck effect – Thermocouple – Thermoelectric series – Peltier effect – Thomson effect – Thermoelectric power and generation – Figure of merit – Applications of thermoelectric materials –Thermoelectric cooling.

Non-Destructive Testing: Introduction to non-destructive testing (NDT) – Importance of NDT techniques – Destructive versus Non-Destructive techniques – Types of NDT techniques – Visual testing (direct and remote visual inspection) – Ultrasonic testing (UT) – Principle of UT – UT probes (normal beam probe, angle beam probe, transmitter-receiver probe) – UT inspection methods (pulse echo, transmission and angle beam pulse echo techniques) – Ultrasonic pulse echo testing – NDT advantages, limitations and applications.

Text Books:

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

Suggested Reading:

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

26CEC01

ENGINEERING MECHANICS

Instruction	3L + 1T Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

Course Objectives: This course aims to

1. Understand the resolution of forces and to obtain resultant of all force systems.
2. Understand equilibrium conditions of static loads for smooth surfaces.
3. Understand the principles of friction and applications, and Analysis of simple trusses.
4. Obtain centroid, centre of gravity for various regular and composite areas and bodies.
5. Obtain Moment of inertia for various regular and composite areas.

Course Outcomes: Upon completion of this course, students will be able to

1. Calculate the components and resultant of coplanar forces system.
2. Draw free body diagrams to analyze the forces in the given structure.
3. Understand the mechanism of friction and can solve friction problems and Analyse simple trusses.
4. Determine the centroid of lines, plane areas, composite areas and centres of gravity of bodies.
5. Determine moments of inertia of plane and composite areas.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	2	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	2	-	-

Unit I:

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

Unit II:

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems, Lami's theorem - applications. Problems on general case of coplanar force systems.

Unit III:

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

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

UNIT-IV:

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, composite areas, theorems of Pappu's and its applications. Centroids of Volumes, Center of gravity of elementary and composite bodies.

UNIT-V:

Moment of Inertia: Definition of Moment of Inertia, Area Moment of Inertia, Polar Moment of Inertia, Radius of gyration, Transfer theorem, Moment of Inertia of elementary & composite areas.

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. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
2. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
3. A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010.

Online Resources:

1. https://archive.nptel.ac.in/courses/112/106/112106286/
2. https://archive.nptel.ac.in/courses/112/106/112106180/

26EGC01

COMMUNICATIVE ENGLISH
(B.E./B.Tech. - Common to all Branches)

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

Prerequisite: Basic knowledge of English grammar and vocabulary and communicative abilities.

Course Objectives: The course is taught with the objectives of enabling the students to

1. Improve their understanding of communication skills to apply in real life situations.
2. Equip themselves with Reading Comprehension strategies and texts and textuality.
3. Enhance their writing skills through paragraphs, précis and essays by using cohesive devices for structural coherence.
4. Build tone and tonality for professional use through meaningful sentences.
5. Demonstrate knowledge of drafting formal reports to define, describe and classify the processes by following a proper structure.

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

1. Create the awareness of communication skills in life and and usefulness of proficiency.
2. Apply effective reading techniques through critical reading exercises to reading comprehension and to support lifelong learning.
3. Develop their ability to write paragraphs independently on any context with cohesion, edit essays coherently while realizing brevity through précis writing.
4. Construct sentences clearly and comprehensively to write effective business letters and draft emails for a better professional communication.
5. Advance efficiency in writing, distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	1	1	1	1	1	1	1	2	3	3	2	-	1	-
CO2	1	1	1	1	1	1	1	1	1	2	1	-	1	-
CO3	1	2	1	1	-	1	1	1	1	3	1	-	1	1
CO4	1	2	1	1	-	1	1	2	2	2	2	-	1	3
CO5	1	2	1	2	1	2	2	2	3	3	2	-	3	3

Unit I: Discourses on Communication:

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

Vocabulary & Grammar: The concept of Word Formation - Root words, Use of prefixes and suffixes to form derivatives, Standard abbreviations. Tenses. Diagnostic writing task.

Reading Task I: Rene Descartes' "*I think therefore, I am*

Unit II: Introduction to Reading Skills: Text and Textuality

The Reading process, purpose, Analysis of different kinds of texts; Reading Comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions. Practice with Critical Reading passages.

Vocabulary and Grammar: Use of Synonyms and Antonyms, Construction of Sentences with cohesion.

Reading Task II: Bertrand Russell's"*Knowledge and Wisdom*" (Essay)

Unit III: Introduction to Writing Skills

Paragraph Writing. – Structure and features of a paragraph; Essay writing, Précis writing.

Vocabulary & Grammar: Use of Discourse Markers, Coherence in writing.
Reading Task III: Rudyard Kipling's "*If"*

UNIT-IV: Professional Writing Skills: Tone and Tonality

Professional Communication:Letter Writing – Structure, format of a formal letter; Letter of Request and Response, Drafting Emails.
Vocabulary and Grammar: Phrasal verbs, Subject-verb agreement in sentences.
Reading Task IV: Chetan Bhagath's "*The Cut-off*"

UNIT-V: Professional Writing Skills: Engineering Specific Input.

Report writing – Importance, structure, elements & styles of formal reports; Writing a formal report.
Vocabulary and Grammar: Words often Confused, idioms, Summative writing task.
Reading Task IV: *Nightfall in the City of Hyderabad* by Sarojini Naidu.

Text Books:

1. Sanjay Kumar & PushpLata, "English Language and Communication Skills for Engineers", Oxford University Press, 2018.
2. "Language and Life: A Skills Approach", Board of Editors, 2018th Edition, Orient Black Swan, 2018.

Suggested Reading:

1. Ashraf, M Rizvi, "Effective Technical Communication", Tata McGraw-Hill, 2006.
2. Michael Swan,"Practical English Usage", Oxford University Press, 4th Edition,2016.
3. Meenakshi Raman and Sangeetha Sharma, "Technical Communication: Principles and Practice" 3rd Edition, Oxford University Press, 2015.

26PYC06

ENGINEERING PHYSICS LAB
(for Civil & Mechanical Engg.)

Instruction	3P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Course Objectives: The objectives of the course is to make the student

1. Apply the concepts of physics while conducting the experiments.
2. Learn the functioning of thermoelectric materials.
3. Understand the properties of magnetic and dielectric materials.
4. Capable of measuring mechanical properties of solids and liquids.
5. Understand the motion electrons in electric and magnetic fields.

Course Outcomes: Upon completion of this course, students will be able to

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

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	3	–	3	–	2	–	1	1	2	1	2	3	2
CO2	2	2	3	2	2	2	3	2	2	2	2	2	2	3
CO3	3	2	–	3	2	2	–	1	1	2	1	2	2	2
CO4	3	3	–	3	2	2	–	1	2	2	2	2	2	2
CO5	3	3	–	3	3	2	–	2	2	2	2	3	3	3

Lab Experiments

List of Exercises

1.	Error Analysis :	Estimation of errors in the determination of time period of a torsional pendulum
2.	Flywheel :	Determination of moment of inertia of given flywheel
3.	Compound Pendulum :	Determination of acceleration due to gravity
4.	Young's Modulus :	Determination of Young's modulus of the given steel bar/wooden scale by non-uniform bending method
5.	Helmholtz's Resonator :	Determination of resonating volume of air and neck correction
6.	Melde's Experiment :	Determination of frequency of the electrically maintained vibrating bar/fork
7.	Viscosity of Liquid :	Determination of viscosity of a given liquid by oscillating disc method
8.	Dielectric Constant :	Determination of dielectric constant of given PZT sample
9.	M & H Values :	Determination of magnetic moment M of a bar magnet and absolute value H of horizontal component of earth's magnetic field
10.	B-H Curve :	Determination of hysteresis loss of given specimen

11.	Thermoelectric Power :	Determination of thermoelectric power of given sample
12.	e/m of an electron :	Determination of specific charge of an electron by J.J. Thomson method
13.	Ultrasonic Interferometer :	Determination of velocity of ultrasonic waves in water using Ultrasonic Interferometer

NOTE: A minimum of 12 experiments should be done

26CSC38

PYTHON PROGRAMMING WORKSHOP
(Common to Mechanical, Civil, ECE, EVL, EEE, Chemical & Bio Tech)

Instruction	3P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

Prerequisite: Basic Computer Skills, Interest in Problem Solving, Basic Mathematical Skills.

Course Objectives: This course aims to
1. Master the fundamentals of writing Python scripts.
2. Learn Python elements such as variables, flow controls structures, functions and modules.
3. Discover how to work with lists and sequence data, and files.

Course Outcomes: Upon completion of this course, students will be able to
1. Inspect and identify suitable programming environment to work with Python.
2. Choose appropriate control constructs, data structures to design and build the solutions.
3. Develop the solutions with modular approach using functions to enhance the code efficiency.
4. Analyze and debug the programs to verify and validate code.
5. Demonstrate use of Standard Template Libraries and modules to build file handling / Searching / sorting applications.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	2	-	-	1	1	-	-	-	-	-	2	1	1	1
CO2	3	3	3	1	1	1	-	-	-	-	2	2	2	2
CO3	3	3	3	1	2	1	-	-	-	-	2	2	2	2
CO4	3	3	3	1	1	1	-	-	-	-	2	3	3	1
CO5	3	3	3	1	2	1	-	-	-	-	2	2	2	2

Lab Experiments

List of Exercises

1. Explore various Python Program Development Environments. eg: Vscode, IDLE, PyCharm, anaconda etc.,
2. Design Flowcharts using raptor / draw.io tools.
3. Simple scripts to demonstrate the use of various data types and operators.
4. Demonstrate the use of control structures.
5. Experiments using Comprehensions with List, Dictionary, Set.
6. Implementation using Functions, Lambda functions and parameter passing.
7. Experimentation with Arrays using array and numpy modules.
8. Experiments using Searching and Sorting techniques.
9. Simple scripts to demonstrate the use of built-in modules.(Ex: math, random).
10. Demonstration of File Handling.

Text Books:

1. Jeeva Jose, "Taming Python by Programming", 2nd Edition, 2019, Khanna Book Publications.
2. Reema Thareja, "Python Programming", 1st Edition, 2017, Oxford Press.

Suggested Reading:

1. Zed A. Shaw, “Learn Python3 the Hard Way”, 1st Edition, 2018, Pearson Education Inc.
2. R.S. Salaria, “Programming in Python”, 1st Edition, 2024, Khanna Publishing House.
3. Yashavant Kanetkar and Aditya Kanetkar, “Let Us Python”, 1st Edition, 2019, Edition, BPB Publications.

Online Resources:

1. https://onlinecourses.swayam2.ac.in/cec24_cs01/preview.
2. https://www.coursera.org/specializations/python.
3. https://www.python.org.
4. https://www.visual-paradigm.com/tutorials/decision-table-in-action.jsp.

26MEC41

ENGINEERING DRAWING
(Common to Mechanical & Civil Engineering)

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

Prerequisite: Nil

Course Objectives: This course aims to

1. Understand engineering drawing principles, standards, and conventions and develop proficiency in constructing conic sections for engineering applications.
2. Develop the ability to visualize and represent points and straight lines in different positions using the principles of orthographic projection.
3. Develop the ability to visualize and draw orthographic projections of plane surfaces and Solids in different orientations with respect to the reference planes.
4. Develop the ability to visualize, project, section, and develop engineering solids in different orientations with respect to the reference planes.
5. Develop the ability to visualize three-dimensional objects and represent them using isometric projection techniques.

Course Outcomes: Upon completion of this course, students will be able to

1. Apply engineering drawing principles and standards to construct conic sections accurately for engineering applications.
2. Understand orthographic projections of points and straight lines.
3. Construct and interpret orthographic projections of plane surfaces and Solids.
4. Draw projections of sectional solids and true shapes of sections, and develop the surfaces of common engineering solids accurately.
5. Create an isometric projections and views.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	1	2	1	2	1	1	1	2	1	1	2	1	1
CO2	3	2	1	1	2	1	1	1	2	1	1	2	1	1
CO3	3	2	2	1	2	1	1	1	2	1	1	2	1	1
CO4	3	2	3	1	2	1	1	1	2	1	1	3	1	1
CO5	2	1	3	1	3	1	1	1	2	1	1	3	1	1

List of Exercises

1. Practice engineering drawing standards, drawing instruments, lettering techniques, and dimensioning conventions.
2. Construction of Conic Sections by General method.
3. Orthographic projection: Principles, conventions, Projection of points.
4. Projection of straight lines in simple position, inclined to one plane & both the reference planes (without traces and mid-point).
5. Projection of perpendicular planes.
6. Projection of solids in simple position.
7. Projection of solids with axis Inclined to one plane.
8. Sections of Prisms and Pyramids in simple position.
9. Development of the surfaces of a right regular prism and a cone in simple positions.
10. Isometric projections of regular solids.

11. Conversion of isometric views to orthographic views and vice-versa

Text Books:

1. N.D.Bhatt, "Elementary Engineering Drawing", Charotar Publishing House Pvt. Ltd., 55th Edition, 2025.
2. K.Venugopal and V. Prabhu Raja, "Engineering Drawing and Graphics + AutoCAD", New Age International Pvt.Ltd, Revised edition, 2015.
3. Basanth Agrawal and C.M. Agrawal, "Engineering Drawing", McGraw-Hill Education (India) Pvt. Ltd**,** 2021.

Suggested Reading:

1. Shaw M.B and Rana B.C., "Engineering Drawing", 2/e, Pearson Education, 2020.
2. K.L. Narayana and P.K. Kannaiah, "Text Book of Engineering Drawing", Scitech Publications (India) Pvt. Ltd., 2021.

26EGC02

COMMUNICATION SKILLS LAB
(Common to Mechanical, Civil, ECE, EVL, EEE, Chemical & Bio Tech)

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

Prerequisite: Basic Knowledge of English Communication.

Course Objectives: This course will introduce the students
1. To nuances of Phonetics and give them sufficient practice in correct pronunciation through computer-aided multi-media instruction.
2. To the significance and application of word stress and intonation.
3. To sufficient practice in listening to English spoken by educated English speakers in different socio-cultural and professional settings.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behaviour while developing their ability to use language appropriately, to discuss in groups and make presentations.

Course Outcomes: After successful completion of the course the students will be able to
1. Define the speech sounds in English and understand the nuances of pronunciation in English.
2. Produce speech with clarity and confidence using correct word stress, and intonation.
3. Achieve improved ability to listen, understand, analyse, and respond to English spoken in various settings.
4. Determine the context and speak appropriately in various situations.
5. Design effective posters collaboratively through creative decisions, give presentations, and efficiently participate in Group discussions.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	-	-	-	-	-	-	-	1	1	-	1	-	1	-
CO2	-	-	-	-	-	1	-	1	2	-	1	-	1	-
CO3	-	-	-	-	-	1	1	1	2	-	1	-	1	1
CO4	1	1	1	1	1	1	2	2	3	-	1	-	1	3
CO5	-	1	1	1	1	2	2	2	3	1	2	-	3	3

Lab Experiments

List of Exercises

Computer-Aided Language Learning Lab

1. **Introduction to English Phonetics**: Introduction to English Phonetics and organs of speech.
2. **Sound System of English**: Speech sounds- Vowels and Consonants - Basic phonetic transcription practice.
3. **Syllable Division and Word stress**: Introduction to syllables- structure of syllables - Rules of word stress.
4. **Intonation**: Types of Intonation, Practice in Articulation – MTI – Common Errors in pronunciation.
5. **Listening Skills**: understanding Listening- types of listening- Practice in Listening comprehension texts.

Interactive Communication Skills Lab

6. **Role Play -** Practicing the nuances of situational language, simulating the real-world conversations in a designed environment.
7. **Group Discussions -** Understanding the Dynamics and techniques of a Group Discussion, and Non-Verbal Communication.
8. **Debate -** Learning speaking dynamics in a formal discourse, discussion and oral addresses**.**
9. **Poster Presentation –** Working on a Theme, Poster preparation and presentation.

10. **Public Speaking –** Speaking with confidence and clarity in different contexts on various issues.

Text Books:

1. T Balasubramanian. 2017. *A Textbook of English Phonetics for Indian Students*. Macmillan, 2nd Edition.
2. J Sethi et al., 2005. *A Practical Course in English Pronunciation* (with CD). Prentice Hall India.
3. Priyadarshi Patnaik. 2023. *Group Discussions and Interview Skills*. Cambridge University Press Pvt. Ltd., 2nd Edition.
4. Aruna Koneru. 2018. *Professional Speaking Skills*. Oxford University Press.

Suggested Reading:

1. Kumar Rajesh. 2013. *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd.
2. KN Shoba& J. Lourdes Javani Rayen. 2019.*Communicative English – A workbook.* Cambridge University Press.
3. Sanjay Kumar& Pushp. Lata. 2019. *Communication Skills: A Workbook*. Oxford University Press.
4. Veerendra Mishra et al. 2020. *English Language Skills: A Practical Approach.* Cambridge University Press.

Suggested Software:

1. K-VAN Multi-Media Language Lab.
2. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)..
3. Digital All.
4. Orell Digital Language Lab (Licensed Version).

26MBC02

COMMUNITY ENGAGEMENT

Instruction	2P Hours per Week
Duration of SEE	--
SEE	NIL
CIE	50 Marks
Credits	1

Course Objectives: The main objectives of this course are to

1. Develop an understanding of rural life, culture, and socio-economic conditions.
2. Expose students to rural livelihoods, local economic systems, and entrepreneurship opportunities.
3. Familiarize students with rural institutions, governance mechanisms, and development programmes in India.
4. Promote community engagement, social responsibility, and experiential learning through field-based activities.
5. Enable students to analyse community issues and contribute to sustainable rural development solutions.

Course Outcomes: Upon completion of this course, students will be able to

1. Understand rural society, culture, and development issues.
2. Demonstrate empathy and social responsibility towards communities.
3. Analyse rural livelihood systems and economic activities.
4. Evaluate the role of rural institutions and government programmes.
5. Participate in community-based activities and suggest improvements.

CO-PO/PSO Articulation Matrix

PO/PSO/ CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO1	1	2	2	2	-	3	1	2	-	-	2
CO2	-	1	2	2	-	2	-	2	1	-	1
CO3	-	1	1	2	-	3	1	3	1	2	1
CO4	2	2	3	2	-	2	1	2	2	1	-
CO5	1	2	2	1	-	2	-	1	-	1	1

Module I Appreciation of Rural Society

Rural lifestyle and social structure, Caste and gender relations, Rural values and traditions, Rural infrastructure.

Module II Understanding Rural Economy and Livelihood

Agriculture and allied activities, Rural entrepreneurship, Non-farm livelihoods and artisans, Rural markets and credit systems, Farmer Producer Organizations (FPOs).

Module III Rural Institutions

Panchayati Raj system (Gram Sabha, Gram Panchayat), Self-Help Groups (SHGs), Role of NGOs in rural development.

Module IV Rural Development Programmes

Overview of rural development in India, Key government schemes, Mahatma Gandhi National Rural Employment Guarantee (MGNREGA) Scheme, National Rural Livelihood Mission (NRLM), Pradhan Mantri Awas Yojana (PMAY), Swachh Bharat, Skill India, Ayushman Bharat.

Text Books:

1. Singh, Katar, “Rural Development: Principles, Policies and Management”, 3rd Edition, Sage Publications, New Delhi, 2016.
2. Desai, Vasant, “Rural Development in India”, 2nd Edition, Himalaya Publishing House, 2020.

3. Chambers, R., “Rural Development: Putting the last first”, 1st Edition, Routledge, 2014.
4. Helen Sheil, “Growing and Learning in Rural Communities” 2nd Edition, 2024.

Suggested Reading & Journals:

1. Seth Appiah-Opoku , Usha Iyer-Raniga, “Contemporary Rural Development Programs”, 1st Edition, 2025.
2. Journal of Rural development, National Institute of Rural Development and Panchayati Raj (NIRDPR), Hyderabad.
3. Indian Journal of Social Work, Tata Institute of Social Sciences (TISS), Mumbai.
4. Manjeet Singh Nain. (2026). Editorial. Indian Journal of Extension Education, 62(2).
5. Kurukshetra Journal, Ministry of Rural Development, Government of India.

ONLINE RESOURCES:

1. https://www.rural.gov.in/
2. https://nirdpr.org.in/
3. https://sdgs.un.org/goals
4. https://onlinecourses.nptel.ac.in/e-learning
5. https://idronline.org/