Scheme of Instruction, Evaluation

and

Syllabi of

B.E. CIVIL ENGINEERING

With effect from Academic Year 2026-27

Estd. 1917

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING

(Autonomous)

Osmania University

Hyderabad – 500 007, TS, INDIA

Estd. 1929

INSTITUTION

The University College of Engineering is established in the prestigious Osmania University, Hyderabad in the year 1929 having the distinction of being the 6th oldest Engineering College in the then British India.The college become autonomous in the year 1994. Over the decades, the UCE(A), OU has produced several illustrious alumni who brought laurels to the nation at world forums. The college is offering BE in eight branches viz., AI&ML, BME, CE, CSE, EEE, ECE, ME and Mining Engineering; ME in 22 specializations with majority of them receiving NBA Accreditation. The college offers Ph.D. in all ME specializations. The college has well established laboratories and research facilities and well placed in NIRF Rankings. The faculty members are well qualified and several of them received Best Teacher Award from Government of Telangana state. They are serving as expert members on several professional bodies. The faculty members authored several research publications, text/reference books and extend consultancy services.

Vision

The Vision of the institute is to generate and disseminate knowledge through harmonious blending of science, engineering and technology. To serve the society by developing a modern technology in students heightened intellectual, cultural, ethical and humane sensitivities, fostered a scientific temper and promoting professional and technological expertise.

Mission

- To achieve excellence in Teaching and Research
- To generate, disseminate and preserve knowledge
- To enable empowerment through knowledge and information
- Advancement of knowledge in Engineering, Science and Technology
- Promote learning in free thinking and innovative environment
- Cultivate skills, attitudes to promote knowledge creation
- Rendering socially relevant technical services to the community
- To impart new skills of technology development
- To inculcate entrepreneurial talents and technology appreciation Programs
- Technology transfer and incubation

DEPARTMENT

The Department of Civil Engineering was established in the year 1929 and was the first Department to commence the undergraduate program at university college of Engineering, Osmania University. Over the years, the Department grew from strength to strength in terms of its academic achievements and infrastructure development. Currently, the Department offers BE in Civil Engineering; ME in Structural Engineering, Geotechnical Engineering, Water Resources Engineering and Transportation Engineeringspecializations and PhD programs. The Department also has the distinction of enrolling large number of foreign students both at UG and PG levels.

The Department provides research and consultancy services to various organizations. Several faculty members have received prestigious awards, including the Best Teacher awards of the State Government and the Best Publication awards, reflecting their teaching abilities and the research contribution. Many of the faculty members are listed in several national and international biographical directories. The faculty has published over 1500 papers in various international and national journals and conferences besides text books and professional books.

Vision

To be as a leading academic department on pace with global standards and contribute to the development of economic, technically viable and useful to societal problems and challenges of civil engineering profession and also contribute to the regional and country's developmental activities.

Mission

- To produce highly competent and capable professionals to face the challenges and provide viable solutions to Civil Engineering problems
- Integration of their knowledge and skills to excel in the profession through continuous learning and contribute to the well-being of the society.
- To enhance the technical knowledge, research aptitude to serve the society in highly competent manner.

Program Educational Objectives (PEO):

PEO1: Impart basic knowledge in the field of Civil Engineering.
PEO2: Develop skills to analyze and provide viable solutions to various Civil Engineering problems.
PEO3: Enhance communication skills and encourage team work.
PEO4: Prepare Civil Engineering professionals with zeal for research, life-long learning, and work for sustainable development of society with ethics.

PROGRAM OUTCOMES (POs)

POs	Engineering Graduates will be able to:
PO1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineeringproblems.
PO2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics,natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis ofthe information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities withan understanding of the limitations.
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant tothe professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and needfor sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse

	teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member andleader in a team, to manage projects and in multidisciplinary environments.
PO12	**Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.
PROGRAM SPECIFIC OUTCOMES (PSOs)	
PSO1	**Analytical Skill:** Ability to plan, execute, manage and rehabilitate Civil Engineering systems and processes
PSO2	**Entrepreneurial Skill :** Ability to become independent practitioners, consultant and entrepreneurs in the field of Civil Engineering

MAPPING OF PEO'S WITH PO'S

S.No.	PEO Statement	M1	M2	M3
PEO 1	Impart basic knowledge in the field of Civil Engineering	3	2	2
PEO 2	Develop skills to analyze and provide viable solutions to various Civil Engineering problems.	3	3	2
PEO 3	Enhance communication skills and encourage team work.	2	2	1
PEO 4	Prepare Civil Engineering professionals with zeal for research, life-long learning, and work for sustainable development of society with ethics.	3	3	3

Rubrix

1 : Weakly mapped
2 : Moderately mapped
3 : Strongly mapped

PEO	Justification and rationale of the mapping
PEO 1	Mainly focuses on imparting basic knowledge in Civil Engineering to produce highly competent and capable professionals. Accordingly, the correlations are assigned.
PEO 2	Emphasis is on training to inculcate analytical skills to design various Civil Engineering problems. Hence, the correlations are allotted.
PEO 3	Focuses on personality development, character building and to work with peers. Therefore, the correlations are justified.
PEO 4	Equip with required skills to effectively tackle the real life problems of Civil Engineering in sustainable manner. Therefore, M1 to M3 are in good agreement.

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (CIVIL ENGINEERING) w.e.f. 2026-27

I – Semester

S. No.	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	MC 100 HS	Induction Program	3 weeks							
2	BS 101 MT	Matrices and Calculus	3	0	-	3	3	40	60	3
3	BS 101 CH	Engineering Chemistry	3	0	-	3	3	40	60	3
4	HS 101 EG	Communicative English	3	0	-	3	3	40	60	3
5	ES 101 CE	Engineering Mechanics-I	3	0	-	3	3	40	60	3
Practical										
6	BS 151 CH	Engineering Chemistry Lab	-	-	3	3	3	25	50	1.5
7	HS 151 EG	Communicative English Lab	-	-	2	2	3	25	50	1.5
8	ES 151 CE	Engineering Graphics	2	-	4	6	3	25	50	4
9	ES 152 ME	Workshop Practice	-	-	6	6	3	25	50	3
		Total	**14**	**0**	**15**	**29**		**260**	**440**	**22**

Service Courses offered to other Departments:

S. No.	Course Code	Course Title	Scheme of Instruction				Contact hr/week	Scheme of Evaluation		Credits
			L	**T**	**Dr**	**P**		**CIE**	**SEE**	
1	ES 151 CE	Engineering Graphics for EEE	2	-	4	-	6	25	50	4
2	ES 151 CE	Engineering Graphics for MN	2	-	4	-	6	25	50	4
3	ES 102 CE	Engineering Mechanics for MN	3	-	3	-	3	40	60	3

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (CIVIL ENGINEERING) w.e.f. 2026-27

II – Semester

S No	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	BS 201 MT	Differential Equations and Fourier Series	3	0	-	3	3	40	60	3
2	BS 201 PH	Engineering Physics	3	0	-	3	3	40	60	3
3	ES 201 CS	Programming for Problem Solving	3	0	-	3	3	40	60	3
4	ES 201 CE	Engineering Mechanics II	3	0	-	3	3	40	60	3
5	PC 201 CE	Building Materials & Construction	3	0	-	3	3	40	60	3
6	ES 202 EE	Electrical Technology and Mechanical Technology	3	0	-	3	3	40	60	3
Practicals										
7	BS 251 PH	Engineering Physics Lab	-	-	3	3	3	25	50	1.5
8	ES 251 CS	Programming for Problem Solving Lab	-	-	2	2	3	25	50	1.5
9	ES 251 CE	Computer Aided Civil Engineering Drawing	2	-	4	6	3	25	50	4
10	ES 252 CE	Engineering Mechanics Laboratory	-		2	2	3	25	50	1.5
		Total	**20**	**0**	**11**	**31**		**340**	**560**	**26.5**

Service Courses : CSE / AIML / ECE

S No	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
1	ES 253 CE	Engineering Graphics	2		4	6	3	25	50	4

Service Course: B.M.E.

S No	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	

1	ES 211 CE	Applied Mechanics	3			3	3	40	60	3

B.E. CIVIL ENGINEERING

I SEMESTER

SYLLABUS

BS 101 MT	MATRICES AND CALCULUS						Course Type Core/PF/FE
Pre-requisite: Mathematical Knowledge of 12th	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

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

- To study Matrices as vector spaces, subspaces, linear transformation and its use in solving system of linear equations.
- To study Eigenvalue problems, Diagonalizable Matrices and Quadratic Forms.
- To introduce the concepts of Functions of Several Variables and its Applications.
- To introduce the concepts of Multiple Integrals and its Applications.
- To study Vector Differential and Integral Calculus

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

1. Find vector spaces and subspaces and solutions of system of linear equations.
2. Solve Eigenvalue problems, Similar & Diagonalizable Matrices and Canonical Form of Quadratic Forms
3. Find the maximum and minimum values of multiple variable functions.
4. Use the knowledge of Multiple Integrals in finding the area and volume of any region bounded by given curves
5. Apply the knowledge of Vector Calculus to find line, surface and volume integrals.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	-	-	1	-	-	2	2	1
CO2	3	2	1	2	2	2	-	-	1	-	-	2	2	1
CO3	3	2	2	3	2	2	-	-	1	-	-	2	3	1
CO4	3	2	1	1	1	2	-	-	1	-	-	2	2	1
CO5	3	2	2	3	1	2	-	-	1	-	-	2	3	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT - I

Matrices and Vector Spaces: Vector Spaces, Subspaces, Linear Independence of Vectors, Dimension and Basis, Linear Transformation, Solution of General linear System of Equations, Elementary row and Column Operations, Echelon form of a Matrix, Gauss Elimination Method for Non – Homogeneous Systems, Homogeneous System of Linear Equations.

UNIT - II

Eigenvalue Problems: Eigenvalues and Eigenvectors, Cayley - Hamilton theorem (without Proof), Similar and Diagonalizable Matrices, Special Matrices, Quadratic Forms, Canonical Form of a Quadratic Form.

UNIT - III

Functions of Several Real Variables: Introduction, Functions of Two Variables, Limits, Continuity, Partial Derivatives, Total Differential and Differentiability, Derivatives of Composite and Implicit Functions, Higher Order Partial Derivatives, Homogeneous

functions, Taylor's Theorem (without Proof), Maximum and Minimum Values of Function, Lagrange's Method of Multipliers.

UNIT - IV

Multiple Integrals: Double Integrals, Evaluation of double integrals by two successive integrations, Application of double integrals, Triple Integrals, Application of triple integrals, Evaluation of triple integrals Change of Variables in Integrals.

UNIT - V

Vector Differential and Integral Calculus: Gradient of a Scalar Field and Directional Derivative, Divergence and Curl of a Vector Field, Line Integrals, Line Integrals Independent of the Path and Green's Theorem (without Proof), Surface Integral, Divergence Theorem of Gauss and Stoke's Theorem (without Proof).

Suggested Reading:

1. R. K. Jain & S. R. K. Iyengar, Advance Engineering Mathematics, Narosa Publications, 5th Edition 2016, (Fifteenth Reprint 2026).
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley publications, 11th Edition, 2025.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 45th Edition, 2024(Reprint 2025).
4. N.P. Bali and M. Goyal, A textbook of Engineering Mathematics, Laxmi Publications, 11th Edition, 2025.
5. H. K. Dass and Er. Rajnish Varma, Higher Engineering Mathematics, S. Chand Publications 3rd Revised Edition 2014(Reprint 2025).

e-resources: https://onlinecourses.nptel.ac.in/e-learning/noc26_ma133

BS 201 PH	ENGINEERING PHYSICS						Course Type Core/PF/FE
Pre-requisite:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

Course Objectives:

- To understand the fundamental laws of electromagnetism and how they lead static and time-varying electric and magnetic fields and to apply wave theory to optical phenomena, such as interference, diffraction, and polarization
- To appraise significance of stimulated emission and laser light production. Subsequently propagation of light through optical fibers.
- To make student understand the formation of energy bands and classification of the solids based on the band theory and to sensitize the students towards nanomaterials.
- To understand the different types Magnetic materials and Dielectric materials with their origin of evolution.
- To understand Schrodinger's wave equation and its applications and to understand the concept of superconductors.

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

1. Know how electric and magnetic fields lead the behavior of electromagnetic wave. It bridges classical physics and modern optics, empowering learners to analyze complex electromagnetic systems and waves optics.
2. Understand the construction and working of different laser systems and apply them to propagate light through optical fiber cable as cutting edge application.
3. Understand the semiconducting materials and their properties, operating electronic devices, and applying them in circuits and also equips students with the fundamental principles, how materials behave at the nanoscale and how these unique physical, chemical, and biological properties differ from bulk materials.
4. Understand the fundamental physics behind how materials interact with electric and magnetic fields.
5. Unrich and understand the implications of matter waves in quantum mechanics evolution and to equip students with the theoretical skills to analyze, and apply materials that conduct electricity with zero resistance and expel magnetic fields.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	3	-	-	-	-	-	3	2	1
CO2	3	2	3	2	3	3	-	-	-	-	-	3	3	1
CO3	3	2	3	2	3	3	-	-	-	-	-	3	3	1
CO4	3	2	1	2	1	3	-	-	-	-	-	3	2	1
CO5	3	2	3	2	3	3	-	-	-	-	-	3	2	2

UNIT-I

Modern Optics: Interference – Newton's Rings by reflected light – Experimental arrangement – Types of diffraction – Diffraction due to single slit - Diffraction due to double slit (qualitative)- diffraction grating (Conditions of maxima and minima) – Polarization – Malus law – Double refraction – Nicol's Prism. – Optical activity and polarimeter.

Electro Magnetic Theory: Basic laws of electricity and magnetism – Derivation of Maxwell's equations in integral and differential forms - Conduction and displacement current – modification of Ampere's law - Equation of plane wave in free space – Poynting theorem.

UNIT-II

Lasers: Characteristics of lasers – Absorption of radiation, spontaneous and stimulated emission of radiation - Einstein's coefficients and their relation - Population inversion– Types of lasers - Ruby laser, Helium-Neon laser and semiconductor laser – state of art applications of lasers.

Fiber Optics: Construction of an optical fiber – Propagation of light through an optical fiber - Acceptance angle - Numerical aperture – Types of optical fibers (Based on number of modes and refractive index profile) – Fiber drawing process (double crucible method) - Applications of optical fibers

UNIT-III

Quantum Mechanics: Schrödinger's time independent and time dependent wave equation – Physical significance of wave function – Particle in 1-D box – Wave function, Probability function – Quantum states – Introduction to quantum technology and applications.

Semiconductor Physics: Classification of materials based on band theory - Kronig-Penney model (qualitative treatment) - Energy band formation in solids - Intrinsic and Extrinsic semiconductors - Concept of a hole - Carrier concentration and conductivity in intrinsic semiconductors – Formation of P-N junction diode, Light Emitting Diode and their I-V characteristics – Thermistor and its characteristics - Hall effect and its applications.

UNIT-IV

Dielectric Materials: Dielectrics - Types of polarizations – Electronic, Ionic, Orientational and Space charge polarizations – Expression for Electronic polarizability - Frequency and temperature dependence of dielectric polarizations - Determination of dielectric constant by capacitance Bridge method - Ferro electricity - Barium Titanate – Piezo electricity – Super capacitor.

Nanomaterials: Introduction - Properties of materials at reduced size - Surface to volume ratio – Quantum confinement effect – Classification of nanomaterials - Preparation of nanomaterials: bottom–up methods (e.g., Sol Gel method and Chemical Vapor Deposition method), Top-down methods (e.g., Ball milling method) - Basic ideas of carbon nanotubes – Applications of nanomaterials and their health hazards.

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UNIT-V

Magnetic Materials: Origin of magnetism (Orbital and Spin magnetic moments) - Classification of magnetic materials: dia, para, ferro, antiferro and ferrimagnetic materials –

Weiss molecular field theory of ferromagnetism - Magnetic domains - Hysteresis curve - Soft and hard magnetic materials – Ferrites: Applications of ferrites.

Superconductivity: Introduction - General properties of super conductors - Meissner effect - Type I and Type II superconductors - BCS theory (qualitative) – Introduction to High T_c superconductors - Applications of superconductors

Suggested Reading:

1. M.S. Avadhanulu and P.G. Kshirasagar - Engg. Physics, S.Chand & Co.
2. C.M. Srivastava and C. Srinivasan - Science of Engg. Materials, New Age International.
3. R.K. Gour and S.L. Gupta – Engg. Physics, Dhanpat Rai Publications
4. B.K. Pandey and S.Chaturvedi – Engineering Physics, Cengage Learning.
5. A.K Bhandhopadhya - Nano Materials, New Age International.

BS 101 CH	ENGINEERING CHEMISTRY FOR MINING, CIVIL & MECHANICAL Branches						CourseType Core/PF/FE
Prerequisite if any: Mathematical Knowledge of 12th/ Intermediate level	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40 Marks	60Marks	3

Course Objectives:

- To understand the fundamentals and principles of water chemistry relevant to Engineering chemistry.
- To acquire the knowledge of polymers used for industrial purposes with various applications.
- Interpret spectroscopic data for structural elucidation of molecules.
- Analyze the spontaneity and equilibrium of chemical reactions.
- Apply knowledge of batteries and nanomataerials to aid in engineering and technical applications.

Course Outcomes:

1. Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also teaches the techniques of softening of hard water and treatment of water for drinking purpose. Gains knowledge in causes of corrosion and its prevention.

2. Analyze the basic methods of reaction of organic molecules and study their properties.

3. Distinguishes the ranges of electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

4. Rationalize bulk properties and processes using thermodynamic considerations.

5. Apply the knowledge of basic fundamentals of nanoparticles to design nanosystems in every field.

Course Articulation Matrix:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	2	2	-
CO3	3	3	1	-	-	-	-	-	-	-	-	2	3	-
CO4	3	2	2	-	-	-	-	-	-	-	-	2	3	-
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	-

UNIT-I

Water Chemistry and Corrosion:

Water chemistry: Hardness of water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Water softening by Ion exchange and Reverse Osmosis methods. Boiler troubles-scales and sludges formation-causes, effects and prevention. Numerical problems.

Specifications of potable water. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization by Chlorination.

Corrosion-causes and its effects. Types of corrosion-Dry or Chemical corrosion and Wet or

Electrochemical corrosion and their mechanism. Electrochemical corrosion and its types. Factors influencing rate of corrosion.
Corrosion control methods: Cathodic protection methods- Sacrificial anodic and impressed current cathodic protection methods. Surface coating methods: Hot dipping-Galvanizing and Tinning.

UNIT-II
Reaction Mechanism and Polymers:
Reaction Mechanism: Introduction - Addition, Substitution and Elimination reactions. Addition to C=C and C=O, Nucleophilic substitution in aliphatic system: SN^1 and SN^2 mechanism, Elimination reactions: E^1 and E^2 mechanism
Polymers: Introduction, Classification of polymers -Plastics, Fibres and Elastomers.
Preparation, properties and engineering applications of the following polymers:
Plastics: PVC and Bakelite
Fibers: Nylon 6:6, and Dacron.
Elastomers: Buna-S and Butyl Rubber.
Conducting polymers: Introduction. Mechanism of conduction in polymers. Intrinsic conducting polymers: Poly-acetylene and poly-aniline. Applications of conducting polymers. Biodegradable polymers, Applications of polymers in concrete materials – Epoxy resins.

UNIT-III
Molecular Structures and Spectroscopy:
Molecular Orbital Theory. Linear Combination of Atomic Orbital's (LCAO). Molecular Orbital energy level diagrams of diatomic molecules-O_2, N_2 and NO.
Description of Electromagnetic spectrum.
Principles of UV-Visible Spectroscopy: Statement of Beer-Lambert Law. Chromophores and Auxochromes. Absorption and intensity shifts: Bathochromic, Hypsochromic, Hyper chromic and Hypo chromic shifts with one example each. Principle and applications of UV Sensors.
IR Spectroscopy: Principle of IR Spectroscopy.IR active and IR inactive molecules (two examples each). Types of vibrational bands, Degrees of Freedom for linear and non linear molecule, Principle and applications of IR Sensors.

NMR Spectroscopy: Principle of ^{1}H-NMR Spectroscopy. Multiplicity, Chemical Shift. Example-Ethyl chloride, Principle and Applications of MRI.

UNIT-IV
Thermodynamics and Electro Chemistry:
Thermodynamics: Terminology of Thermodynamics, thermodynamic processes, Work done in Reversible isothermal and adiabatic processes, efficiency of heat engine by Carnot cycle, concept of entropy, physical significance of entropy, Work function, Gibbs free energy and their significance, variation of free energy with temperature and pressure, criteria of spontaneity in terms of entropy and free energy-Numericals.
Electrochemistry: Electrochemical cells- Electrolytic and Galvanic cells, cell-notation, cell reaction and cell potentials. Types of electrodes-Calomel, and Glass electrode. Determination of P^H of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells-Nernst equation and its derivation. Application of Nernst equation & Numericals.
Principles and applications of Conductometric titrations.

UNIT-V
Energy Sources and Nanomaterials:
Batteries: Primary batteries-Zn carbon battery. Secondary batteries-Pb- Acid battery and Ni-Cd battery. Lithium-ion batteries- advantages and applications.

Fuel cells: Concept of fuel cells and their advantages. Construction and working of H_2-O_2 and methanol-Oxygen fuel cells.
Solar cells: Concept of solar energy conversion, photovoltaic cells.
Nanomaterials: Introduction. Properties of nanomaterials. Synthesis of nanomaterials-Top down, Bottom up approach and Sol-gel method. Applications of nanomaterials.

Suggested Readings:

1. Jain & Jain, *Engineering chemistry*, Dhanpat Rai publishing Co., 17 th Edition.
2. Shashi Chawla, Text book of Engineering chemistry. Danpat rai & Co.
3. Arun Bahl and BS Bahl, *A text book of Organic Chemistry*, S. Chand Co. Ltd., S. Chand Publishing, 2017.
4. Robert Silverstein spectrometric identifications of organic compounds, Journal of Chemical Education, ACS Publications.
5. L.D.S. Yadav, Organic Spectroscopy. Springer nature-2005.
6. Y.R. Sharma Elementary organic spectroscopy, S. Chand Publications.

HS 101 EG	COMMUNICATIVE ENGLISH						Course Type Core/PF/FE
Prerequisite: English proficiency above B1 level as per the CEFR for languages.	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**		**Credits**
	L	**T**	**P**		**CIE**	**SEE**	
	3	**-**	**-**		**40**	**60**	**3**

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

- To develop students' listening, speaking, reading. and writing (LSRW) skills for academic and professional co1nmunjcation.
- To enhance vocabulary, grammar, and language accuracy for effective expression.
- To improve comprehension and critical thinking through prose, poetry, biographies, and professional ethics.
- To equip students with technical and professional writing skills such as report writing. email writing. presentations, and resume writing.
- To enable students to communicate confidently and ethically in professional and social environments.

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

1. Demonstrate effective listening, speaking, reading, and writing skills in academic and professional contexts.
2. Apply appropriate vocabulary, grammar. and language structures to communicate accurately and fluently.
3. Analyze literary and non-literary texts lo develop comprehension. critical thinking, and interpretation skills.
4. Prepare professional documents such as reports. emails, letters, resumes, and presentations using appropriate formats and conventions.
5. Demonstrate ethical communication practices and interpersonal skills required for teamwork and professional success.

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	-	-	-	-	-	-	3	3	-	2	1	1
CO2	3	2	-	-	-	-	-	-	2	3	-	2	1	2
CO3	2	3	-	-	-	-	-	2	2	2	-	3	2	1
CO4	2	2	-	-	1	-	-	-	2	3	-	2	2	3
CO5	-	2	-	-	-	2	-	3	3	3	-	2	1	2

Unit - I
Prose: Silent Crisis: *Martha C Nussbaum*
Listening: What is Listening; Process of Listening; Importance of Listening
Speaking: Importance of Communication. Types of Communication (Non-verbal and Verbal)

Reading: Importance of Reading
Writing: Features of Writing Composition: Cohesions. Coherence. Precision and Clarity)
Vocabulary and Grammar: Homonyms: Homophones; Homographs: Punctuation; Sentence Structure (Simple, Compound, Complex)

Unit - II
Poem: Where the mind is without fear: *Rabindranath Tagore*
Listening: Types of listening, Non-verbal and verbal signs of active listening
Speaking: Types of communication II (oral, written, visual)
Reading: Reading skills–skimming, scanning
Writing: Discourse markers and linking words, Paragraph writing and Precis writing
Vocabulary and Grammar: Root words: prefix and suffix, Synonyms, Antonyms, Idioms & Phrasal Verbs; Concord.

Unit - III
Biography: Homi J. Bhabha: *Enakhi Chatterji*
Listening: Effective listening: Principles and techniques
Speaking: Styles of communication (formal, informal, semiformal), Channels of communication (Vertical, Horizontal, Interpersonal, Grapevine)
Reading: Intensive and extensive reading
Writing: Essay writing, Report Writing
Vocabulary and Grammar: Words often confused; Tenses

Unit - IV
Poem: A world made by Atoms: *Margaret Cavendish*
Listening: Barriers to effective listening
Speaking: Barriers to Communication, Johari Window
Reading: SQ3R method
Writing: Letter writing, Resume Writing, Email Etiquette, Etiquette for WhatsApp/other messaging services
Vocabulary and Grammar: One-word substitutes; Active and Passive voice; Reported Speech.

Unit - V
Prose: Professional Ethics
Listening: Note-taking; Critical Listening Exercises
Speaking: Speaking to communicate effectively; Proverb expansion through JAM
Reading: Critical and Inferential reading passages
Writing: Creative Writing
Vocabulary and Grammar: Technical Vocabulary, Common errors: correct use of prepositions and articles, avoiding ambiguity, misplaced modifiers, avoiding redundancy

Suggested Reading:

1. Ashraf, M. Rizvi. *Effective Technical Communication*. Tata McGraw-Hill, 2006.
2. *Language and Life: A Skills Approach*. Orient Blackswan, 2018.
3. Raman, Meenakshi, and Sangeetha Sharma. *Technical Communication: Principles and Practice*. 2nd ed., Oxford University Press, 2011.
4. Swan, Michael. *Practical English Usage*. Oxford University Press, 1995.

5. Vijaya, B. *Communicative English and Employability Skills*. Orient Blackswan, 2026.

ES 101 CE	ENGINEERING MECHANICS – I						Course Type Core/PF/FE
Pre-requisite:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

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

- Analyze planar and spatial force systems, including resultants, moments, and couples.
- Apply equilibrium principles and free-body diagrams to analyze force systems in static equilibrium.
- Evaluate internal forces in trusses and frames using classical analysis methods.
- Apply friction laws to solve engineering problems involving rough surfaces, wedges, and belts.
- Determine centroids, moments of inertia, and related geometric properties of engineering sections.

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

1. Determine resultants, moments, and equivalent force-couple systems for planar and spatial force systems.
2. Construct free-body diagrams and apply equilibrium equations to solve static force system problems.
3. Analyze trusses and frames and determine member forces using standard analytical methods.
4. Solve engineering problems involving friction in simple systems, wedges, and belt drives.
5. Compute centroids, moments of inertia, and radius of gyration of simple and composite sections.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO2	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO3	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO4	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO5	3	3	2	-	-	-	-	2	-	-	-	-	1	1

Unit – I

Force Systems: Classification of force systems; resolution and composition of planar and spatial forces; resultants of coplanar and non-coplanar force systems; moment of a force, Varignon's theorem, couples and their characteristics, and equivalent force-couple systems.

Unit – II

Equilibrium of Force Systems: Concept and significance of free-body diagrams; conditions and equations of equilibrium for particles and rigid bodies; equilibrium analysis of planar and spatial force systems; engineering applications of force systems.

Unit – III

Analysis of Trusses & Frames: Classification of trusses and frames; analysis of plane trusses using the method of joints and method of sections; analysis of frames using the method of members; identification of tension and compression members.

Unit – IV

Friction: Nature and laws of friction; coefficient of friction, angle of friction and angle of repose; analysis of bodies on rough surfaces; friction in simple and connected systems; application of friction principles to ladders; wedge friction and belt friction.

UNIT – V

Centroid and Moment of Inertia: Centroid of lines, areas and composite sections; Pappus theorems and applications; moment of inertia of simple and composite areas; parallel-axis and perpendicular-axis theorems; radius of gyration and engineering applications.

Suggested Readings

1. Timoshenko S et al. (2017). *Engineering Mechanics*, 5th Edition, McGraw-Hill.
2. Bhavikatti S S. (2019). *Engineering Mechanics*, 7th Edition, New Age International.
3. Hibbeler R C. (2017). *Engineering Mechanics Statics and Dynamics*, Pearson.
4. Khurmi R S and Khurmi N. (2018). *A Textbook of Engineering Mechanics*, 22nd Edition, S Chand, New Delhi.
5. Singer F L. (1975). *Engineering Mechanics Statics and Dynamics*, 3rd Edition, Harper Collins International Edition.
6. Timoshenko S et al. (2017). *Engineering Mechanics*, 5th Edition, McGraw-Hill.

e-Resources:

1. http://nptel.ac.in/
2. http://mhrd.gov.in/e-contents
3. http://spoken-tutorial.org/

BS 151 CH	ENGINEERING CHEMISTRY LABORATORY FOR MINING, CIVIL & MECHANICAL Branches					Course Type Core/PF/FE
Prerequisite if any: Mathematical Knowledge of 12th/Intermediate level	**Contact hours per week**			**Duration of SEE (Hours)**	**Scheme of Evaluation**	**Credits**
	L	**T**	**P**		**CIE** / **SEE**	
	3	-	-	**3**	**25Marks** / **50 Marks**	**1.5**

Course Objectives:

- To know the quality standards of potable water for health-based limits.
- To perform the routine synthesis of commonly used drug in the laboratory.
- Apply electrochemical principles in conductivity, Electrode potentials and verification of Beer' s law.
- To Evaluate Iron content from Iron ores.
- To Synthesize an extensively used polymer in industry.

Course Outcomes

The chemistry laboratory course use consists of experiments illustrating the principle of chemistry relevant to the study of science and engineering. The students will learn to:

1. Estimate hardness of Water in various water samples.
2. Synthesize a small molecule drug.
3. Measure of conductance of solutions and electrode potentials .
4. Analysis of Iron content in Iron ore.
5. Understand the principles and mechanism of polymerization reaction.

Course Articulation Matrix:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	-	-	-	-	-	1	1	1
CO2	2	3	1	1	-	-	1	-	-	-	-	2	1	1
CO3	2	2	2	2	-	1	-	-	-	-	-	2	1	1
CO4	2	2	1	-	-	-	1	1	-	-	-	2	1	1
CO5	3	2	1	1	-	1	1	1	-	-	-	1	1	1

6.

List of Experiments:-

I) Water analysis.

1) Determination of Total hardness of water by EDTA method.
2) Determination of Permanent hardness of water by EDTA method.

II) Synthesis of a drug molecule:

3) Synthesis of Aspirin.

III) Colorimetry:

4) Verification of Beers law and Estimation of the given permanganate.
5) Verification of Beers law and Estimation of the given $CuSO_4$.

IV) Conductance measurements:

6) Determination of cell constant.

7) Estimation of HCl and CH_3COOH by conductometric titration.

V) Potentiometric Measurements:

8) Estimation of HCl by potentiometric titration.

9) Estimation of ferrous iron by potentiometric titration.

VI) Extraction of Iron From Hematite:

10) Determination of Iron in Hematite.

VII) Synthesis of Polymer:

11) Preparation of phenol-Formaldehyde Resin.

References:

1. Senior Practical Physical Chemistry, B.D.Khosla, A.Gulati and V.Garg (R.Chand&Co., Delhi)
2. An Introduction to Practical Chemistry,K.K.Sharma and D.S.Sharma (Vikaspublishing, N.Delhi)

HS 151 EG	COMMUNICATIVE ENGLISH LABORATORY						Course Type Core/PF/FE
Prerequisite: English proficiency above B1 level asper the CEFR for languages.	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	2		25	50	1.5

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

- To develop learners' pronunciation skills through an understanding of the English sound system, stress, and intonation.
- To enhance contextual and collaborative communication skills for academic, social, and workplace settings.
- To improve fluency, confidence, and interpersonal communication through interactive language activities.
- To develop employability skills required for interviews, group discussions, presentations, and professional interactions.
- To foster effective communication, teamwork, and lifelong learning skills necessary for career growth

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

1. Demonstrate correct pronunciation using the English sound system, stress patterns, and intonation in spoken communication
2. Communicate effectively in various contexts using appropriate verbal and non-verbal communication skills.
3. Participate actively in collaborative communication activities, demonstrating teamwork and interpersonal skills.
4. Apply employability communication skills in interviews, group discussions, presentations, and workplace interactions.
5. Exhibit confidence, professionalism, and ethical communication practices for lifelong learning and career development.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	2	3	-	2	1	1
CO2	-	1	-	-	-	-	-	1	2	3	-	2	1	2
CO3	-	-	-	-	-	-	-	1	3	3	-	2	1	2
CO4	-	1	-	-	-	1	-	2	2	3	-	2	2	2
CO5	-	-	-	-	-	2	-	3	3	3	-	3	2	2

Unit I English Sound System

a. Sounds of English
b. Vowels
c. Consonants
d. Using Dictionary to decode Phonetic Transcription
e. Transcription exercise with the help of CALL (Computer Aided Language Lab)

Unit II Stress and Intonation

a. Syllable
b. Word-Stress and its importance
c. Intonation-Falling and Rising tone

d. Listening comprehension: Listening to various accents & Listening practice and exercises

Unit III Contextual Conversation Skills

a. JAM
b. Picture Perception
c. Public Speaking
d. Role plays: Use of dialogues in various situations like Social, Formal, Academic and Professional contexts.

Unit IV Collaborative Communication

a. Group discussion forms and techniques
b. Mock GDs
c. Factual GDs and Controversial GDs
d. Abstract GDs and Case Studies
e. Debate: Form, techniques, topics for mock debates in class

Unit V Employability Communication

a. Presentation Skills
b. Presentations with emphasis on visual aids and body language,
c. Interview Skills: Techniques
d. Frequently asked Interview Questions
e. Mock interviews, Simulator Technique

Prescribed Textbook

Vijaya, B. *Communicative English and Employability Skills*. Orient Blackswan, 2026.

Suggested Readings

1. Kumar, E. Suresh, and P. Sreehari. *A Handbook for English Language Laboratories*. Cambridge University Press, 2014.
2. Balasubramanian, T. *A Textbook of English Phonetics for Indian Students*. Macmillan, 2008.
3. Sethi, J., et al. *A Practical Course in English Pronunciation*. Prentice Hall of India, 2005.
4. Prasad, Hari Mohan. *How to Prepare for Group Discussions and Interviews*. Tata McGraw-Hill, 2006.
5. *English for Engineers and Technologists*. Combined ed., vols. 1–2, Orient Blackswan, 2010.

Software:

1. Sky Pronunciation Suite
2. K-van Software
3. Study Skills
4. English Pronunciation Dictionary –CALD

ES 151 CE	ENGINEERING GRAPHICS						Course Type Core/PF/FE
Pre-requisite:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	2	-	4		25	50	4

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

- Introduce the fundamentals of engineering drawing standards, geometrical constructions, conic sections, and engineering curves.
- Knowledge about AutoCAD software, coordinate systems, drawing tools, and basic drafting techniques for engineering graphics
- Develop proficiency in the use of AutoCAD commands for creating, modifying, dimensioning, annotating, and printing engineering drawings.
- Impart knowledge of engineering scales and orthographic projections of points, lines, planes, and solids.
- Enhance visualization skills for drawing sectional views and surface developments of engineering solids and for effective graphical communication of engineering concepts.

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

1. Apply the principles of engineering drawing to construct basic geometrical figures and curves using standard drawing practices.
2. Perform drafting operations using AutoCAD 2D commands to create, edit, dimension, and print engineering drawings.
3. Draw engineering scales and apply projection principles to points, straight lines, and various views of 2D and 3D objects.
4. Develop projections, sectional views, and surface developments of planes and regular solids, including prisms, pyramids, cylinders, and cones, in various orientations.
5. Demonstrate visualization and graphical communication skills using engineering drawing and CAD tools.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	2	-	2	1	1	-	2	2	2
CO2	1	1	-	-	-	2	-	2	1	1	-	2	2	2
CO3	1	1	-	-	-	2	-	2	1	1	-	2	2	2
CO4	1	1	-	-	-	2	-	2	1	1	-	2	2	2
CO5	1	1	-	-	-	2	-	2	1	1	-	2	2	2

Unit - I

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering.

Geometrical Constructions (General method only), Conic sections (General and special method); Cycloid, Epicycloid, Hypocycloid and Involute (line, triangle, square, circle, Regular Polygons), Construction of Tangent and Normal to all General methods of Conic sections, Cycloid, Epicycloid, Hypocycloid and Involutes.

Unit - II

Overview of Computer Graphics: Listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning, Snap to objects manually and

automatically; Drawings straight lines using various coordinate input entry methods, Applying various ways of drawing circles.

Unit - III

Commands, initial settings, drawing basic entities, modify commands, Text and Dimensioning, Blocks Applying dimensions to objects, applying annotations to drawings.

Setting up and use of Layers, Create, edit and use customized layers; Changing line lengths through modifying existing lines (Extend/Lengthen); Printing Options.

Unit - IV

Scales – Reduced and Enlarged scales, Representative Fraction, Problems - Plain, Diagonal and Vernier Scales,

Projections of Points – projection when placed in different quadrants

Projection of Straight lines – Projections when parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes.

Unit - V

Projections of Planes – Projections when parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes.

Projections of Regular Solids – Projections covering those parallel to one plane, perpendicular to one plane, inclined to one plane and inclined to both planes.

Sections of Solids - sectional Views of Right regular solids covering Prism, Cylinder, Pyramid, and Cone.

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

Suggested Reading:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, SciTech Publishers
5. S.N. Lal., Engineering Drawing (2018), M/s. Cengage Learning India Pvt. Ltd., Pratap Gunj, Delhi
6. CAD Software Theory and User Manuals.

ES 152 ME	WORKSHOP PRACTICE						Course Type Core/PF/FE
Prerequisite:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	6		25	50	3

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

- To train students for identifying, selecting, and use proper tools
- To impart practical, hands-on skills in basic manufacturing processes and fabrication across multiple trades.
- To instill a safety-first mindset regarding shop floor operations in an industrial environment
- To learn the fundamentals of house wiring which is used in daily life
- To measure mechanical dimensions accurately using standard instruments like Vernier calipers and understand the working of modern manufacturing equipment.

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

1. Identify and select tools appropriate for specific manufacturing, assembly, and fabrication tasks across various engineering trades.
2. Fabricate physical products by applying hands-on skills in basic manufacturing and fabrication processes like carpentry, fitting, welding, foundry and other trades
3. Practice industrial safety by adhering to shop floor regulations, recognizing potential hazards, and using personal protective equipment.
4. Understand how individual trades work together to manufacture and assemble a complete engineering product and visualize the working of modern manufacturing equipment
5. Perform precise measurements on machined or fabricated components using standard metrology instruments like Vernier calipers and gauges

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	2	-	-	-	2	1	-	2	1	1
CO2	2	-	2	-	2	-	-	-	3	1	-	2	1	1
CO3	1	-	-	-	-	3	2	2	2	1	-	2	1	1
CO4	2	1	2	-	2	-	1	-	3	2	1	2	1	2
CO5	2	1	-	2	3	-	-	-	2	1	-	1	1	1

LIST OF EXPERIMENTS

1. Carpentry shop:

a) Making of a cross-lap joint with Wood
b) Making of End Lap / Tee Lap Joint with wood

2. Fitting shop

a) Making of a step cut with a mild steel flat
b) Making of semicircular and V-cut with a mild steel flat

3. Sheet metal shop

a) Making of Funnel with GI Sheet
b) Making of a rectangular box with GI Sheet

4. House wiring

a) Making of Cleat wiring
b) Making of casing wiring

5. Welding shop

a) Making of Butt joint using Arc Welding

b) Making of a Lap Joint using Arc Welding

6. Machine shop

a) Making of Step turning on MS cylindrical rod

b) Making of Taper turning on MS cylindrical rod

7. Foundry shop

a) Preparation of casting using a single-piece pattern

b) Preparation of casting using a core pattern.

8. Smithy shop

a) Forging of a square-shaped peg from a cylindrical workpiece

b) Forging of square shape L- bend peg from a cylindrical workpiece

9. Demo of advanced manufacturing equipment

CNC Machine / Injection Molding / FDM 3D Printer

Note: Minimum six trades should be conducted.

Suggested Reading:

Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., *Elements of Workshop Technology*, Vol. I (2008) and Vol. II (2010), Media Promoters and Publishers Pvt. Ltd., Mumbai

B.E. CIVIL ENGINEERING

II SEMESTER

SYLLABUS

BS 201 MT	DIFFERENTIAL EQUATIONS AND FOURIER SERIES						Course Type Core/PF/FE
Prerequisite: Mathematical Knowledge of 12th/ Intermediate level	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

Course Objectives:

- To study the ordinary differential equations of first order.
- To study the linear ordinary differential equations of second and higher order with variable and constant coefficients.
- To apply general methodology to solve linear first order and second order partial differential equations.
- To learn about expansion of functions by Fourier series.
- To study the classification of second order partial differential equations and solve them by using separation of variables methods.

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

1. Find the solutions of ordinary differential equations of first order.
2. Find the solutions of linear ordinary differential equations of second and higher order with variable and constant coefficients.
3. Find the solutions of first and second order PDE.
4. Obtain the Fourier series for a given function.
5. Find solutions of the heat equation, wave equation, and the Laplace equation subject to boundary conditions.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	-	-	1	-	-	2	3	1
CO2	3	2	1	2	2	2	-	-	1	-	-	2	3	1
CO3	3	2	2	3	2	2	-	-	1	-	-	2	3	1
CO4	3	2	1	1	1	2	-	-	1	-	-	2	3	1
CO5	3	2	2	3	1	2	-	-	1	-	-	2	3	2

UNIT - I

Ordinary Differential Equations of First Order: Exact First Order Differential Equations, Integrating Factors, Linear First Order Equations, Bernoulli Equation, Application of Differential quations of First Order –Newton's Law of Cooling, Rate of Decay of Radioactive Materials.

UNIT - II

Linear Differential Equations: Introduction, Solutions of Linear Differential Equations, Linear Independence and Dependence, Methods for Solution of Linear Equations, Differential Operator $\boldsymbol{D}$, Solutions of Second and Higher Order Linear Homogeneous Equations with Constants Coefficients, Method of Reduction of Order for Variable Coefficient Linear Homogeneous Second Order Equations, Solutions of Non- Homogeneous Linear Equations, Method of Variation of Parameters, Solution of Euler – Cauchy Equation, Operator Methods for Finding Particular Integrals Case $\boldsymbol{r(x) = e^{\alpha x}}$, Case $\boldsymbol{r(x) = \cos(\alpha x)\ or\ \sin(\alpha x)}$, Case $\boldsymbol{r(x) = x^{\alpha}, \alpha > 0}$ and integer.

UNIT - III

Partial Differential Equations: Introduction, Formation of First and Second Order Equations, Solution of First Order Equations, Lagrange's Equation, Higher Order Linear Equations with Constant Coefficients.

UNIT - IV

Fourier series: Introduction, Fourier series, Fourier series Expansions of Even and Odd functions, Convergence of Fourier series, Fourier Half - Range Series.

UNIT - V

Application of Fourier series: Classification of Linear Second Order Partial Differential Equations, Separation of Variables Method (Fourier Method) Fourier series Solution of the Heat Equation, Fourier series Solution of the Wave Equation, Fourier series solution of the Laplace Equation.

Suggested Reading:

1. R. K. Jain & S. R. K. Iyengar, Advance Engineering Mathematics, Narosa Publications, 5th Edition 2016 (Fifteenth Reprint 2026).
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley publications, 11thEdition, 2025.
3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 45th Edition, 2024(Reprint 2025).
4. N.P. Bali and M. Goyal, A text book of Engineering Mathematics, Laxmi Publications, 11th Edition, 2025.
5. H. K. Dass and Er. Rajnish Varma, Higher Engineering Mathematics, S. Chand Publications 3rd Revised Edition 2014(Reprint 2025).

e-resources: https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ma98

ES 201 CS	PROGRAMMING FOR PROBLEM SOLVING						Course Type Core/PF/FE
Pre-requisite:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

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

- To introduce the basic concepts of Computing environment, number systems and flowcharts
- To familiarize the basic constructs of C language – data types, operators and expressions
- To understand modular and structured programming constructs in C
- To learn the usage of structured data types and memory management using pointers
- To learn the concepts of data handling using files

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

1. Explain various functional components in computing environment
2. Develop algorithmic solutions to problems and draw the flow charts
3. Explain and use basic constructs of C in writing simple programs
4. Use standard library functions in C and develop modular programs using user defined functions and structured data types
5. Use files and file handling for applications.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	1	-	-	-	1	-	1	-	2	1
CO2	3	3	2	-	1	-	-	-	1	-	1	-	3	1
CO3	3	2	2	-	2	-	-	-	-	-	1	-	3	1
CO4	3	3	3	1	2	-	-	-	1	-	1	-	3	2
CO5	2	2	3	1	3	-	-	-	1	-	1	-	3	2

Unit - I

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts.

Number Systems: Binary, Octal, Decimal, And Hexadecimal.

Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements

Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.

Unit - II

Conditional Control Statements: Bitwise Operators, Relational and Logical Operators, If, If-Else, Switch-Statement and Examples. Loop Control Statements: For, While, Do-While and Examples. Continue, Break and Go to statements

Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing.

Recursion- Recursive Functions.

Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers

Unit - III

Preprocessors: Preprocessor Commands

Arrays - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two-Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.

Unit - IV

Pointers - Introduction, Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, L -value and R-value, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command-line Arguments.

Strings - Concepts, C Strings, String Input/Output Functions, Arrays of Strings, String Manipulation Functions

Unit - V

Structures: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, Unions, Type Definition (typedef), Enumerated Types.

Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/Output Functions, Character Input/Output Functions.

Suggested Reading:

1. B.A. Forouzan and R.F. Gilberg, "*A Structured Programming Approach in C"* , Cengage Learning, 2007.
2. Kernighan BW and Ritchie DM, "*The C Programming Language"*, 2nd Edition, Prentice Hall of India, 2006.
3. Rajaraman V, "*The Fundamentals of Computer"*, 4th Edition, Prentice-Hall of India, 2006.
4. Dromey "*How to Solve it By Computer*, Pearson education, 2006.

ES 201 CE	ENGINEERING MECHANICS – II					Course Type Core/PF/FE
Prerequisite:	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

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

- Analyze the center of gravity, mass moment of inertia, and radius of gyration of engineering solids.
- Apply kinematic principles to describe the motion of particles and rigid bodies.
- Analyze the kinetics of rigid bodies subjected to forces and moments.
- Apply work–energy principles to solve problems involving rigid body motion.
- Apply impulse–momentum principles to analyze motion and impact phenomena.

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

1. Determine the centre of gravity, mass moment of inertia, and radius of gyration of simple and composite solids.
2. Analyze the displacement, velocity, and acceleration of particles and rigid bodies in translational and rotational motion.
3. Solve kinetics problems involving rigid body motion under the action of forces and torques
4. Apply the work–energy principle to determine the motion characteristics of rigid body systems.
5. Analyze engineering problems involving impulse, momentum, conservation of momentum, and impact.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO2	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO3	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO4	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO5	3	3	2	-	-	-	-	2	-	-	-	-	1	1

Unit - I

Centre of Gravity and Mass Moment of Inertia: Centre of gravity of solids and composite solids; determination of centre of gravity of standard engineering bodies; mass moment of inertia of simple and composite solids, radius of gyration and its significance.

Unit - II

Kinematics: Types of rigid body motion including translation, rotation, and general plane motion; kinematic analysis of particles and rigid bodies in rectilinear and curvilinear translation; analysis of rigid body rotation about a fixed axis.

Unit - III

Kinetics: Fundamentals of kinetics and Newton's second law for rigid body motion; analysis of rigid body motion in translation; kinetic analysis of rigid bodies undergoing fixed-axis rotation involving force, torque, and angular acceleration.

Unit - IV

Work-Energy: Concept of work and energy and their relationship in mechanical systems; principle

of work–energy for particles and rigid bodies in motion; applications of work–energy principles to simple and connected rigid body systems.

Unit - V

Impulse-Momentum: Linear impulse and momentum principles for particles and rigid bodies; conservation of linear momentum and its applications to engineering problems; direct central impact, coefficient of restitution, and analysis of elastic collisions.

Suggested Reading:

1. Timoshenko S et al. (2017). *Engineering Mechanics*, 5th Edition, McGraw-Hill.
2. Bhavikatti S S. (2019). *Engineering Mechanics*, 7th Edition, New Age International.
3. Hibbeler R C. (2017). *Engineering Mechanics Statics and Dynamics*, Pearson.
4. Khurmi R S and Khurmi N. (2018). *A Textbook of Engineering Mechanics*, 22nd Edition, S Chand, New Delhi.
5. Singer F L. (1975). *Engineering Mechanics Statics and Dynamics*, 3rd Edition, Harper Collins International Edition.

PC 201 CE	BUILDING MATERIALS AND CONSTRUCTION					Course Type Core/PF/FE
Prerequisite :	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation	Credits
	L	T	P		CIE SEE	
	3	-	-		40 60	3

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

- Study about the basic building materials.
- Know the smart building materials.
- Understand the construction of form work.

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

1. Differentiate between various building materials i.e. both conventional and smart building materials.
2. Describe the role of aggregates in concrete preparation and have knowledge of mix design methods of concrete.
3. Demonstrate the importance of energy conservation, damp proof course and fire protection and crack propagation in buildings.
4. Analyze different type of plasters, paints, varnish and distempers and their constituents.
5. Describe different materials used and construction of various form works and scaffoldings.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	2	-	-	1	3	1	-	-	-	2	2	-
CO2	2	-	2	-	-	1	3	1	-	-	-	2	2	-
CO3	2	-	2	-	-	1	3	1	-	-	-	2	2	-
CO4	2	-	2	-	-	1	3	1	-	-	-	2	2	-
CO5	2	-	2	-	-	1	3	1	-	-	-	2	2	-

Unit - I

Introduction: Uses of stones as building materials, classification, characteristics, dressing and polishing of stones, methods of quarrying and construction.

Bricks: Methods of manufacturing bricks. Classification and methods of construction. Timber: Timber as a building material and its uses. Methods of seasoning and preservation laminates and their uses, defects in Timber.

Cement: Introduction to cement, different grades, IS specifications and OPC and PPC Cements (blended cements).

Mortar and Sand: Characteristics of good mortar making sand, availability of sand ant its classification, bulking of sand, manufacturing methods of mortar. Different types of mortars-preparation, setting andcuring.

Unit - II

Coarse and fine Aggregate: Characteristics of good coarse and fine aggregates for manufacture of concrete, Significance and application of course and fine aggregate for the production of good quality concrete. Concrete: Introduction to Nominal mix and Design mix, Stages involved in preparation of concrete

Unit - III

Type of joints in Concrete - Construction, expansion, contraction, and isolation joints. Cracks in Buildings- Type of cracks in buildings, principal causes-moisture movement, thermal variations, elastic deformation, creep, chemical reaction.

Smart building Materials: Energy conservation in buildings- use of recycled materials, regional materials and industrial waste products as means of sustainable development. Green Building Materials

Unit - IV

Plastering and Pointing: Different types of plasters and plastering process, defects in plastering. **Paints, Varnish and Distemper:** Constituents, characteristics of good paints, bases, vehicles, thinners and coloring pigments. Painting of different types of surfaces varnish and its types, application. Distemper, dry and oil bound, and application of distemper

Unit - V

Form work- Types of Form work, types of materials used in form work. Scaffoldings- Types of Scaffoldings, Scaffolding Erection & dismantling, Scaffolding Inspection. Fire protection in structures- Classification of fire, general causes of fire, detection of fire, method for fire control, Analysis for structural components for fire resistance (wood, steel, concrete and masonry). Damp Proof Course-Causes of dampness, effects of dampness, methods of damp proofing.

Suggested Reading:

1. VN. Vazirani, and S.P. Chandola (1993), *Engineering Materials*, Khanna Publishers.
2. Sushil Kumar (1992), Building Construction, Standard Publishers.
3. S.P. Arora and S.P. Bindra (1999), *Textbook on Building Construction*, Dhanpath Raj Publications.
4. M. S. Shetty (2012), *Concrete Technology*, S. Chand Publishers.
5. Gurucharan Singh (2019), *Building materials and construction*, 17th Edition, Standard book house.

ES 202 EE	ELECTRICAL TECHNOLOGY AND MECHANICAL TECHNOLOGY						Course Type Core/PF/FE
Prerequisite :	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

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

- Understand the basic principles of electrical engineering, electrical installations, and safety practices relevant to Civil Engineering buildings and infrastructure projects.
- Acquire knowledge of electrical machines, pumps, motors, transformers, and their applications in water supply, irrigation, buildings, and construction engineering.
- Understand illumination systems, energy-efficient electrical services, renewable energy systems, and their applications in sustainable Civil Engineering projects.
- Gain knowledge of construction machinery and mechanical equipment used in earthwork, concreting, transportation, and infrastructure construction.
- Develop the ability to select, operate, and appreciate modern construction equipment, automation technologies, and safety practices used in Civil Engineering projects.

Course Outcomes:

After completion of the course the student will be able to:

1. Understand the basic electrical systems, electrical installations, wiring practices, and electrical safety applicable to buildings and Civil Engineering infrastructure.
2. Identify and select suitable electrical machines, pumps, transformers, and building service systems for Civil Engineering applications.
3. Apply the concepts of illumination, renewable energy systems, and energy-efficient technologies in buildings and infrastructure projects.
4. Identify, select, and explain the operation of construction machinery and mechanical equipment used in Civil Engineering works.
5. Demonstrate an understanding of modern construction technologies, equipment management, maintenance practices, and automation used in Civil Engineering projects.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	2	1	1	1	–	–	–	1	2	1
CO2	3	3	2	1	2	1	1	–	–	–	–	1	3	1
CO3	3	2	2	1	2	2	3	1	–	–	–	2	2	1
CO4	3	3	2	1	2	1	–	1	–	–	1	1	3	2
CO5	3	2	2	2	3	2	2	1	1	1	2	2	3	2

UNIT – I

Electrical Technology for Buildings and Infrastructure

Introduction to electrical engineering, basic electrical quantities (R, L and C), voltage and current sources, Ohm`s Law; single-phase and three-phase power supply; electrical wiring systems, Types of Wires and Cables, wiring accessories, switches, sockets and protective devices, Miniature Circuit Breakers (MCB), Residual Current Circuit Breakers (RCCB), Earth Leakage Circuit Breakers (ELCB), and surge protection devices; earthing and electrical safety practices.

UNIT – II

Electrical Machines and Building Services

Principles, construction, operation, of transformers, single-phase and three-phase induction motors, DC motors (basic concepts), motor starters, and electric drives, Variable Frequency Drives (VFDs), Applications. pumps and pumping systems; submersible and booster pumps, firefighting pumps.

UNIT – III

Illumination, Renewable Energy and Sustainable Building Services

Principles of illumination, lighting requirements for residential buildings, highways, bridges, tunnels, industrial buildings, and public spaces, LED lighting systems, street lighting, high-mast lighting and emergency lighting. Solar photovoltaic systems; solar water pumping; battery storage systems; electric vehicle charging infrastructure.

UNIT – IV

Power Transmission Elements: Gears terminology of spur, helical and bevel gears, gear trains. Belt drives (types). Chain drives.

Material Handling equipment: Introduction to Belt conveyors, cranes, industrial trucks, bull dozers

Refrigeration: Mechanical Refrigeration and types – units of refrigeration – Air Refrigeration system, details and principle of operation –calculation of COP, Building Refrigeration.

UNIT – V

Manufacturing Process

Welding: Introduction to Arc Welding, Gas Welding, Brazing & Soldering, Applications.

Machine Tools: Introduction to lathe, drilling machine, milling machine, grinding, 3D Printing, machine-Operations performed

Construction Machinery and Automation

General Description, Operation and Selection of the following: Earth moving and Excavation Equipment -Shovels, Dragline, Clam shell, Cable Excavator, Bucket Wheel Excavator, Tractor, Scraper, Earth compactors. Introduction to automated construction equipment, intelligent machine control, GPS-enabled construction equipment.

Suggested Reading:

1. Peurifoy, R.L., Schexnayder, C.J., Shapira, A. and Schmitt, R. (2021). *Construction Planning, Equipment and Methods*, 9th Edition, McGraw-Hill.
2. Mahesh Varma (2022). *Construction Equipment and Its Management*, Metropolitan Book Co.
3. V.N.Mittle,Aravind Mittal "Basic Electrical Engineering" *Tata Mc.Graw Hill Publicationss* second edition2007
4. J.B.Gupta, "Fundamentals of Electrical Engineering and Electronics" S.K.Kataria & Son publications,2002.
5. Rangwala, S.C. (2020). *Construction Technology*, Charotar Publishing House.
6. Bird, J. (2021). *Electrical and Electronic Principles and Technology*, Routledge.
7. Theraja, B.L. and Theraja, A.K. (2022). *A Textbook of Electrical Technology*, S. Chand Publishing.
8. Duggal, S.K. (2021). *Building Services*, New Age International.
9. IS 732 (Latest Edition): *Code of Practice for Electrical Wiring Installations*, Bureau of Indian Standards.
10. National Building Code of India (2016), Part 8 – Building Services.
11. Kumar, T., Leenus Jesu Martin and Murali, G., Basic Mechanical Engineering, Suma Publications, Chennai, 2007

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BS 251 PH	ENGINEERING PHYSICS LABORATORY						Course Type Core/PF/FE
Prerequisite :	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	3		25	50	1.5

Course Objectives:

The course is taught with the objectives of enabling the student to:

- To provide practical, experimental verification of fundamental physics concepts learned in lectures.
- To familiarize students with the operation, calibration, and maintenance of modern laboratory equipment and electronic measuring devices such as Four probe setups, Hall effect setup, polarimeters, diodes, lasers, spectrometers, and multimeters.
- To develop analytical and critical thinking skills. Students learn how to accurately record observations, perform graphical data analysis, apply experimental statistics, and estimate % of error and measurement precision.
- To estimate and evaluate the physical properties of engineering materials and components (e.g., determining energy gap in semiconductors, magnetic hysteresis or dielectric constants).
- To train students in the proper execution and documentation of scientific inquiry. This involves constructing proper experimental setups, drawing valid conclusions from collected data, and accurately maintaining laboratory records.

Course Outcomes:

On completion of this course, the student will be able to:

1. Students learn to correlate theoretical physics concepts with real-world observations.
2. Students able to design experimental setups, conduct measurements, and compare your practical findings with theoretical models or calculations.
3. Students will gain expertise in handling advanced lab instruments (e.g., spectrometers, four-probe setups, and lasers etc.). This includes an understanding of instrument sensitivity, targeted accuracy, and error analysis.
4. This course trains the students in meticulous data recording, graphical representation, and logical deduction.
5. Students learn to identify discrepancies between expected and measured values and draw evidence-based conclusions.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	1
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	1
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	1
CO4	3	3	2	1	3	1	-	-	-	-	-	-	3	2
CO5	3	1	-	-	-	-	-	-	-	-	-	-	3	2

List of Experiments:

1. To Estimate Radius of curvature of given lens by forming Newton's rings.
2. To determine specific rotatory power of a given solution by using Laurent's Half shade polarimeter.
3. To determine the wavelength of prominent spectral lines of mercury vapour lamp by plane diffraction grating with the help of spectrometer by using Normal Incidence Method.

4. To determine the Dielectric constant and Phase transition temperature of Lead Zirconium Titanate (PZT)/Barium Titanate ($BaTiO_3$).
5. To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron), and find out (a) Coercivity, (b) Retentivity and (c) Hysteresis loss.
6. To draw the I-V Characteristics of P-N Junction diode and to evaluate the value of potential barrier of the diode.
7. To find the values of Electrical conductivity and energy gap of Ge crystal by Four probe method.
8. To study V-I characteristics of Light Emitting Diode.
9. Determination of carrier concentration, Mobility and Hall Coefficient of Ge Crystal using Hall Effect Experiment.
10. To calculate the Numerical aperture (NA), acceptance angle of a given optical fibre.
11. Determination of wavelength of LASER using diffraction grating.
12. To determine the constants of A, B and α of given Thermistor.

Suggested Reading:

1. M.S. Avadhanulu and P.G. Kshirasagar - Engg. Physics, S.Chand & Co.
2. C.M. Srivastava and C. Srinivasan - Science of Engg. Materials, New Age International.
3. R.K. Gour and S.L. Gupta Engg. Physics, Dhanpat Rai Publications.
4. B.K. Pandey and S.Chaturvedi Engineering Physics, Cengage Learning.
5. A.K Bhandhopadhya - Nano Materials, New Age International.
6. S.K. Sharma, et al., Hand book of Material Characterization Springer.

ES 251 CS	PROGRAMMING FOR PROBLEM SOLVING LAB						Course Type Core/PF/FE
Prerequisite :	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	3		25	50	1.5

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

- To use tools available under LINUX for C programming
- To gain hands-on experience on basic constructs of C programming
- To formulate problems and implement algorithmic solutions in C
- To write modular programs in C using structure programming techniques and data
- files.
- To gain hands-on experience in using Python Programming constructs

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

1. Write, compile and debug C programs in Linux environment
2. Write simple programs using control structures, user defined functions and data
3. manipulation using arrays
4. Use standard C library functions to develop modular programs in C
5. Write basic Python Programs, using conceptual understanding of Programming.
6. Create Programs, solutions for any problem statements with Programmatic, logic based approach.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2		3						1	1	2	1
CO2	3	3	2		2						1	1	2	1
CO3	3	2	3		2	1					1	2	3	1
CO4	3	3	3	2	2						1	1	3	2
CO5	3	3	3	2	2						1	2	3	2

List of Programs:

1. Introducing to programming Environment(Linux commands, editing tools such as vi editor, sample program entry, compilation and execution)
2. Write programs using arithmetic, logical, bitwise and ternary operators.
3. Write programs simple control statements : Roots of a Quadratic Equation, extracting digits of integers, reversing digits ,finding sum of digit ,printing multiplication tables, Armstrong numbers, checking for prime, magic number,
4. Sin x and Cos x values using series expansion
5. Conversion of Binary to Decimal, Octal, Hexa and Vice versa
6. Generating a Pascal triangle and Pyramid of numbers
7. Recursion: Factorial, Fibonacci, GCD
8. Finding the maximum, minimum, average and standard deviation of given set of numbers using arrays
9. Reversing an array ,removal of duplicates from array
10. Matrix addition , multiplication and transpose of a square matrix .using functions
11. Bubble Sort, Selection Sort ,

12. Programs on Linear Search and Binary Search using recursion and iteration
13. Functions of string manipulation**:** inputting and outputting string , using string functions such as strlen( ),strcat( ),strcpy( )……etc
14. Writing simple programs for strings without using string functions.
15. Finding the No. of characters, words and lines of given text file
16. File handling programs : student memo printing
17. Create linked list, traverse a linked list, insert a node, delete a node, reversing list.
18. Python Basics and Input/Output
    a) Print "Hello, Engineering Students!"
    b) Read two integers and display their sum, difference, product, quotient, and remainder.
    c) Calculate the area and circumference of a circle.
    d) Swap two numbers (with and without a temporary variable).
    e) Convert temperature from Celsius to Fahrenheit.
    f) Calculate simple and compound interest.
19. Develop programs using conditional statements.
    a) Find the largest of three numbers.
    b) Check whether a year is a leap year.
    c) Determine whether a number is positive, negative, or zero.
    d) Check whether a number is even or odd.
    e) Display grades based on marks using if-elif ladder.
    f) Develop a menu-driven calculator using if-elif.
20. Develop programs using loops
    a) Print multiplication table of a given number.
    b) Generate first N Fibonacci numbers.
    c) Find factorial of a number.
    d) Check whether a number is prime.
    e) Reverse a given integer.
    f) Display Armstrong numbers between 1 and 1000.
21. Develop modular Python programs using functions.
    a) Write a function to find the maximum of two numbers.
    b) Write a function to calculate factorial using recursion.
    c) Write a function to check palindrome.
    d) Write a function to compute GCD of two numbers.
    e) Write a function to determine whether a number is prime.
    f) Create a menu-driven mathematical calculator using functions
22. Lists & Tuples - Perform operations on Python collections.
    a) Read N numbers into a list and find the largest and smallest.
    b) Compute average and median of list elements.
    c) Remove duplicate elements from a list.
    d) Sort a list in ascending and descending order.
    e) Search an element using linear search.
    f) Count frequency of each element in a list.

23. Develop programs using dictionaries.
    a) Create a student dictionary containing Roll Number, Name, Branch, and CGPA.
    b) Count frequency of characters in a string.
    c) Count frequency of words in a paragraph.
    d) Create a telephone directory using a dictionary.
    e) Implement a simple student record management system using dictionaries.
    f) Find the student with the highest marks from a dictionary of student names and marks.

Suggested Reading:

1 B.A. Forouzan and R.F. Gilberg, "A Structured Programming Approach in C" , Cengage Learning, 2007
2 Kernighan BW and Ritchie DM, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2006.
3 Rajaraman V, "The Fundamentals of Computer", 4th Edition, Prentice-Hall of India, 2006.
4 Dromey "How to Solve it By Computer , Pearson education, 2006

ES 251 CE	COMPUTER-AIDED CIVIL ENGINEERING DRAWING						Course Type Core/PF/FE
Prerequisite :	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	2	-	4		25	50	4

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

- To prepare you to design a system, component, or process
- To meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health, and safety.
- To prepare you to design a system for its manufacturability and sustainability.

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

1. Understand isometric basics and principles, and create drawings in AutoCAD.
2. Able to understand symbols and sign conventions.
3. Detailing of Masonry bonds.
4. Understand terms, elements, and methods of building drawing.
5. Establish fundamentals of Isometrics, building Information Modeling (BIM).

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	2	-	-	-	-	-	-	-	2	1
CO2	2	2	-	-	-	-	2	2	-	2	-	2	2	1
CO3	2	2	1	-	-	-	2	2	-	2	-	2	3	2
CO4	2	2	1	-	-	-	2	2	-	2	-	2	3	2
CO5	2	2	2	-	-	-	2	2	-	2	-	2	3	3

Unit - I

ISOMETRIC PROJECTIONS covering, Principles of Isometric projection, Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids, Draw the sectional orthographic views of geometrical solids.
AutoCAD: Setting up and use of Layers, layers to create drawings.

Unit - II

SYMBOLS AND SIGN CONVENTIONS: Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards.

Unit - III

MASONRY BONDS: English Bond and Flemish Bond Corner wall and Cross walls - One brickwall and one and half brick wall.

Unit - IV

BUILDING DRAWING: Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing, Site plan, floor plans, elevation and section drawing of small residential buildings, Foundation plan, Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity

Unit - V

PICTORIAL VIEW: Principles of isometrics and perspective drawing, Perspective view ofbuilding, Fundamentals of Building Information Modeling (BIM)

Suggested Reading:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. N. Kumara Swamy (Author), A. Kameswara Rao (Author), Building Planning andDrawing, Charotar Publishing House Pvt. Ltd. - Anand
4. S. S. Bhavikatti (Author), M. V. Chitawadagi (Author), Building Planning and Drawing(2014). I K International Publishing House Pvt. Ltd

ES 252 CE	ENGINEERING MECHANICS LAB						Course Type Core/PF/FE
Pre-requisite: Engineering Mechanics – I & II	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	-	-	3		25	50	1.5

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

- Understand and verify the fundamental laws of force systems through experimental investigations.
- Apply the principles of equilibrium and moments using engineering mechanics apparatus.
- Analyze the behavior of parallel force systems and their effects on structural elements.
- Evaluate frictional characteristics between contacting surfaces through experimentation.
- Determine the centroid and moment of inertia of engineering bodies using laboratory methods.

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

1. Verify the triangle, polygon, and parallelogram laws of forces experimentally.
2. Demonstrate the principles of moments and equilibrium using laboratory apparatus.
3. Verify the principle of parallel forces in beam systems.
4. Determine the coefficient of friction between contacting surfaces through experiments.
5. Determine the centroid and moment of inertia of engineering bodies using experimental techniques.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	3	2	-	-	-	2	2	-	-	1	1
CO2	3	-	-	3	2	-	-	-	2	2	-	-	1	1
CO3	3	-	-	3	2	-	-	-	2	2	-	-	1	1
CO4	3	-	-	3	2	-	-	-	2	2	-	-	1	1
CO5	3	-	-	3	2	-	-	-	2	2	-	-	1	1

List of Experiments: To verify

Cycle-I

1. Triangle Law of Forces using Universal Force Table Apparatus
2. Polygon Law of Forces using Gravesand's Apparatus
3. Principle of Moments using Bell Crank Lever Apparatus
4. Principle of Parallel Forces using Simply Supported Beam Apparatus

Cycle-II

1. Parallelogram Law of Forces using Universal Force Table Apparatus
2. Friction between the Surfaces using Friction Slide Apparatus
3. Centroid of a Plane Area using Center of Gravity Apparatus
4. Moment of Inertia of a Bar Pendulum

Suggested Reading:

1. Timoshenko S et al. (2017). *Engineering Mechanics*, 5th Edition, McGraw-Hill.
2. Bhavikatti S S. (2019). *Engineering Mechanics*, 7th Edition, New Age International.
3. Hibbeler R C. (2017). *Engineering Mechanics Statics and Dynamics*, Pearson.
4. Khurmi R S and Khurmi N. (2018). *A Textbook of Engineering Mechanics*, 22nd Edition, S Chand, New Delhi.

5. Singer F L. (1975). *Engineering Mechanics Statics and Dynamics*, 3rd Edition, Harper Collins International Edition.

e-Resources:

1. http://nptel.ac.in/
2. http://mhrd.gov.in/e-contents
3. https://www.vlab.co.in/

ES 211 CE	APPLIED MECHANICS (For BME)						Course Type Core/PF/FE
Prerequisite :	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

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

- Learn the concept of center of gravity and mass moment of inertia
- Understand the concept of stress, strain and elastic behavior of materials
- Know the shear force, bending moment and the bending stress distribution also the concept of fluid flow in statics, Kinematic, dynamics conditions
- Understand the basic properties of fluid flow, description of measurement techniques
- Illustrate the application of basic principles of fluids

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

1. Determine the center of gravity and mass moment of inertia of a solid
2. Apply the fundamental concepts of stress and strain
3. Analyze the structural members subjected to tension, compression, bending
4. Ability to apply the continuity, Bernoulli Energy Equation and measure pressure
5. Understanding of turbulent flows, Frictional loss and Non-Newtonian Flows.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	3	1
CO2	3	3	1	-	-	-	-	-	-	-	-	1	3	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1	3	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1	2	1
CO5	3	3	2	2	1	-	-	-	-	-	-	2	2	1

PART A: SOLID MECHANICS

UNIT – I

Center of Gravity and Mass Moment of Inertia: Pappu's theorems and its applications, center of gravity and mass moment of inertia of solids and composite bodies, radius of gyration.

UNIT – II

Simple Stresses and Strains: Types of stresses and strains, stress-strain curve for ductile material, deformation of prismatic bars under axial loads. Poisson's ratio, volumetric strain, elastic constants, compound bars and temperature stresses.

UNIT – III

Shear force and Bending Moment: Concepts of shear force and bending moment, shear force and bending moment diagram for cantilever, simply supported and overhanging beams subjected to concentrated and uniformly distributed loads, simple bending theory, bending stresses.

PART B: FLUID MECHANICS

Unit – IV

Fluid properties: Density, Viscosity, Compressibility and Surface Tension, Pressure and Its

measurement – Fluid pressure at point, Pascal's Law, Pressure variation in a Fluid at rest, Absolute, Gauge, Atmospheric and Vacuum Pressures, Measurement of Pressure – Simple Manometers and Differential Manometers, Continuity Equation, Continuity equation in 3-Dimensional with Cartesian coordinates, Equation of Motion- Euler's Equation of Motion, Bernoulli's Equation for ideal and real fluids, Practical Applications of Bernoulli's Equation- Venturi meter, Orifice Meter, Pitot-tube. Momentum Equation- Force exerted by a flowing fluid on a pipe bend. Streamline, Path line, Streak line.

Unit – V

Flow Stability and related characteristics- Types of flows (steady, Unsteady, laminar and turbulent flows), Steady Laminar flow- flow of viscous fluid through a circular pipe, Velocity Distribution, Ratio of Maximum velocity to Average velocity, Drop of pressure for a given length of pipe. Turbulent Flow- Reynolds Experiment, Frictional loss in pipe flow, Expression for loss of head due to Friction in pipes, Expression for coefficient of friction in terms of shear stress, Shear stresses in turbulent flow – Reynolds Expression for turbulent shear stress, Prandtl mixing length Theory for turbulent shear stress, Velocity Distribution in Turbulent Flow in pipes, Boundary Layer separation. Methods of Determination of co-efficient of viscosity, Capillary Tube Method, Rotating cylinder Method. Pressure – flow relationship for non-Newtonian fluids, Power law Fluid, Bingham plastic, casino's fluid.

Suggested Reading:

1. D.S. Prakash Rao, *Strength of Materials - A Practical Approach*, UniversityPress, 1999.
2. S.B. Iunarker, and R.I. Shah, *Applied Mechanics*, Charaotar Publishers, 2001.
3. G.H. Ryder, *Strength of Materials*, Macmill India Limited, Third Edition,2002.
4. Pytel and F. I. Singer, *Strength of Materials*, Harper and RC, FourthEdition, 1987.
5. R. K. Bansal 'Fluid mechanics and Hydraulic Machines', Lakshmi Publications
6. Krishna B. Chandran, Ajit P. Yoganathan and Stanley E. Rittgers, (2007) 'Bio-fluid Mechanics: The Human Circulation', CRC Press, Taylor & Francis Group, New York, 2007

ES 102 CE	ENGINEERING MECHANICS (For MN)						Course Type Core/PF/FE
Pre-requisite: Basic Knowledge of Physics	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-		40	60	3

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

- Analyze planar and spatial force systems, including resultants, moments, and couples.
- Apply equilibrium principles and free-body diagrams to analyze force systems in static equilibrium.
- Evaluate internal forces in trusses and frames using classical analysis methods.
- Apply friction laws to solve engineering problems involving rough surfaces, wedges, and belts.
- Determine centroids, moments of inertia, and related geometric properties of engineering sections.

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

1. Determine resultants, moments, and equivalent force-couple systems for planar and spatial force systems.
2. Construct free-body diagrams and apply equilibrium equations to solve static force system problems.
3. Analyze trusses and frames and determine member forces using standard analytical methods.
4. Solve engineering problems involving friction in simple systems, wedges, and belt drives.
5. Compute centroids, moments of inertia, and radius of gyration of simple and composite sections.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO2	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO3	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO4	3	3	2	-	-	-	-	2	-	-	-	-	1	1
CO5	3	3	2	-	-	-	-	2	-	-	-	-	1	1

Unit – I

Force Systems: Classification of force systems; resolution and composition of planar and spatial forces; resultants of coplanar and non-coplanar force systems; moment of a force, Varignon's theorem, couples and their characteristics, and equivalent force-couple systems.

Unit – II

Equilibrium of Force Systems: Concept and significance of free-body diagrams; conditions and equations of equilibrium for particles and rigid bodies; equilibrium analysis of planar and spatial force systems; engineering applications of force systems.

Unit – III

Analysis of Trusses & Frames: Classification of trusses and frames; analysis of plane trusses using the method of joints and method of sections; analysis of frames using the method of members; identification of tension and compression members.

Unit – IV

Friction: Nature and laws of friction; coefficient of friction, angle of friction and angle of repose; analysis of bodies on rough surfaces; friction in simple and connected systems; application of friction principles to ladders; wedge friction and belt friction.

UNIT – V

Centroid and Moment of Inertia: Centroid of lines, areas and composite sections; Pappus theorems and applications; moment of inertia of simple and composite areas; parallel-axis and perpendicular-axis theorems; radius of gyration and engineering applications.

Suggested Readings

1. Timoshenko S et al. (2017). *Engineering Mechanics*, 5th Edition, McGraw-Hill.
2. Bhavikatti S S. (2019). *Engineering Mechanics*, 7th Edition, New Age International.
3. Hibbeler R C. (2017). *Engineering Mechanics Statics and Dynamics*, Pearson.
4. Khurmi R S and Khurmi N. (2018). *A Textbook of Engineering Mechanics*, 22nd Edition, S Chand, New Delhi.
5. Singer F L. (1975). *Engineering Mechanics Statics and Dynamics*, 3rd Edition, Harper Collins International Edition.
6. Timoshenko S et al. (2017). *Engineering Mechanics*, 5th Edition, McGraw-Hill.

e-Resources:

4. http://nptel.ac.in/
5. http://mhrd.gov.in/e-contents
6. http://spoken-tutorial.org/