1ST & 2ND YEAR SYLLABUS

B.TECH. PROGRAMMES

in

CIVIL ENGINEERING

COMPUTER SCIENCE & ENGINEERING

ELECTRICAL ENGINEERING

ELECTRONICS & COMMUNICATION ENGINEERING

ELECTRONICS & INSTRUMENTATION ENGINEERING

MECHANICAL ENGINEERING

Effective from AY: 2025-26

National Institute of Technology Silchar

Silchar, Assam

DEPT. OF CIVIL ENGINEERING

Algebra and Calculus

B. Tech (For ALL Branches) **L-T-P-C**

MA11001 **First Semester (Professional Core)** **3- 0-0- 3**

Pre-requisites: *Matrix and determinants, Limit, Continuity, Differentiability, Basic idea of integration*.

	Course Content	Hours
Unit-1	**Linear Algebra:** R^n as a vector space, Linear dependence and independence of vectors in R^n, Basis & Dimension; Rank and nullity of a matrix, Elementary transformations, Consistency of a System of linear equations & their solutions by Direct Methods: Gaussian Elimination method, Gauss-Jordan method; Eigenvalues & Eigenvectors, Hermitian, Skew-Hermitian & Unitary matrices, Cayley-Hamilton's theorem & its applications.	**8**
Unit-2	**Infinite Series:** Definition of Sequence & Infinite Series, Convergence & Divergence of real Sequence & Infinite Series, Tests of Convergence of positive term infinite series: Comparison Test, D' Alembert's Ratio Test, Raabe's Test, Cauchy's root Test, Integral Test, Alternating Series, Leibnitz's Test (all tests without proofs).	**8**
Unit-3	**Differential Calculus:** Successive Differentiation, Leibnitz's Theorem, Rolle's theorem, Lagrange's & Cauchy's Mean value theorems, Curvature, Radius & centre of curvature, Partial differentiation, Euler's theorem, Jacobian, Taylor's & Maclaurin's Theorems with Lagrange's form of remainder for functions of one and two variables, Expansions of functions of one and two variables, Extreme values for functions of two or more variables, Lagrange's method of undetermined multipliers.	**14**
Unit-4	**Integral Calculus:** Reduction Formulae. Application of integrals in Quadrature, Rectification, Volume and surface area of solids of revolution.	**6**
		Total: 36

Course Outcomes:

On completion of this Course,

1. The students will be able to apply the consistency concepts, eigenvalues, and eigenvectors concepts in engineering problems.

2. The students will be able to apply the concept of convergence of infinite series in mathematical & engineering problems.

3. The students will be capable of applying the knowledge of differentiation in the expansion of functions and optimizing functions appearing in engineering and daily life problems.

4. The students will be able to apply knowledge of integration in finding area, length of arc of curves, volume, and surface area appearing in engineering and real-life problems.

PH11001	Wave Mechanics and Optics	L-T-P-C
	B.Tech (CE, CSE and ME)	3-0-0-3
	First Semester (Common)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Waves and Oscillation:** Introduction to Vibrations and Oscillations, Review on Free Oscillations, Damped motions -under damping -Logarithmic decrement, relaxation time and Q-Factor, overdamping and critical damping, Forced oscillations with damping - Steady state solution and its frequency response, Power absorbed and dissipation in forced oscillator, Resonance- amplitude, velocity and power- sharpness of resonance.	**7**
	Coupled oscillations, introduction of normal modes and normal coordinate and their physical significance- general solutions, wave equation in one dimension, Characteristics and solution, superposition, travelling and standing waves, phase and group velocity.	**5**
Unit-2	**Electromagnetic Waves:** Vector Calculus : Scalar and Vector Fields – Differential calculus, Del operator, Gradient, Divergence and Curl, Product rules, Second Derivative with Del operator, Laplacian operator –Line, Surface and Volume Integrals (definition), Fundamental theorem of Integral calculus qualitatively (Gradient, Divergence and Curl)	**4**
	Electromagnetic theory: Maxwell's equations, Displacement current, Maxwell's equation in matter, Electromagnetic waves: The wave equation, Sinusoidal waves, Polarization EM waves in vacuum, Monochromatic plane waves, Energy in electromagnetic waves, EM waves in conductors, Conservation laws: continuity equation, Poynting's theorem, boundary conditions, reflection and transmission at normal incidence.	**6**
Unit-3	**Wave Optics:** Wave fronts- Huygens Principle, Temporal and spatial coherence, Division of wave front and amplitude, intensity distribution in an interference pattern, Young's double slit experiment, diffraction - single slit, double slit, grating, polarization – polarisation by reflection, refraction and scattering.	**6**
Unit-4	**Modern Physics and Quantum Mechanics:** Failure of classical physics, qualitative review of relevant experiments such as blackbody radiation, photo- electric effect, Compton scattering, de Broglie matter waves and Davison-Germer experiment, Uncertainty principle, Wave packet.	**3**
	Basic postulates of quantum mechanics, Wavefunction, normalization of wave function, quantum mechanical operators, probability density, expectation value, Development of Schrödinger equation (time dependent & time independent), particle on a 1D infinite potential well, potential barrier and quantum tunnelling.	**5**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the fundamental concepts of **classical and quantum wave mechanics**.
2. Interpret fundamental physical laws and principles for relevant engineering applications.
3. Apply principles of physics to solve numerical problems in **classical and quantum wave mechanics**.
4. Analyze various physical phenomena using appropriate concepts such as superposition, wave-particle duality, polarization, and quantization.
5. Evaluate the validity and limitations of theories in waves, electromagnetism, and quantum physics through comparison with experimental observations.

Text Books/ Reference Books:

1. Vibration and waves, A. P. French, CBS Publishers
2. Introduction to Electrodynamics, D. J. Griffiths, *Pearson*
3. *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*, Resnick and Eisberg, John Wiley & Sons
4. Quantum Mechanics, D. J. Griffiths, Cambridge University Press
5. Principles of Optics, Max Born and Emil Wolf, Cambridge University Press
6. Optics, Ajoy Ghatak, ata Mcgraw-Hill Publishing Company

CS11001

Programming and Data Structure **L-T-P-C**

B.Tech (CE, CSE and ME) 2-0-2-3

First Semester (Professional Core)

Prerequisites: Nil

		Hours
Unit-1	**Introduction:** Basic operations of digital computers, basic concepts of integer and floating point number representation, algorithm and efficiency.	**4**
Unit-2	**(Elements of C Programming)**: Data types, variables, operators, expression and assignment statements, conditional and branch statements, Loops and iteration statements, 1-d arrays, functions and parameter passing, recursions, Strings, pointers and structures, dynamic memory allocations.	**12**
Unit-3	**(Linear Data Structures): 2-d arrays, linked lists, stacks, and queues.**	**10**
Unit-4	**(Searching and Sorting):** Linear and binary search, bubble sort, insertion sort, merge sort, quick sort.	**8**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Learn the syntax and semantics of C programming language.
2. Test and execute the programs and correct syntax and logical errors.
3. Implement conditional branching, iteration and recursion.
4. Use basic data-structures (arrays, link lists, stacks, and queues) to formulate algorithms and programs.
5. Understand and analyse different searching sorting techniques.

Text Books/ Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
6. R. G. Dromey, How to Solve it by Computer, Prentice-Hall of India.

HS11001/11002	**English for Technical Communication** Ist / IInd Semester (Professional Core)	L-T-P-C 2-0-2-3

	Course Content	**Hour**
Unit 1	**Organizational Communication:** Introduction to the Course Importance and Relevance of the Course Why Communicative English? What is Communication? Barrier to Communication Non-verbal/Oral/(In)Formal Communication	6
Unit II	**Reading Comprehension** **Ignited mind** (Two Chapters) by APJ Abdul Kalam Essay: **Religion of the forest** by Rabindranath Tagore Essay: **Is Google Making Us Stupid?** by Nicholas Carr **The Story of My Sanskrit** (A chapter) by Kumud Pawde	**8**
Unit III	**Written Communication:** Letter Writing Cover Letter CV/Resume Writing Précis writing Essay Writing Report Writing Email Etiquettes Idioms and Phrases One Word Substitution Technical Communication Documentation and Minutes of Meeting Debate	**12**
Unit IV	**Oral Communication:**	**6**

Job interviews (Process, stages in job interviews, types of interviews, preparation, use of verbal and non-verbal cues, mock interview sessions)

Group Discussion (Features, uses-recruitment, selection, stages, positive and negative roles, organizational GD's (Brain Storming, Normal Group techniques, Delphi Technique))

Pictorial Essays.

Course Outcomes:

1. Students will recall the content and make inferences on organizational communication setup
2. Students will be able to read faster and comprehend better
3. Students will be able to express their ideas and thoughts clearly and systematically in the form of essays and reports
4. Students will be able to conduct short meetings with the skill to draft simple and short minutes of the meeting.
5. Students will demonstrate the ability to face the employment selection and answer interview questions, and they will be able to participate in group discussions confidently and assertively

Reference Books:

1. Barun K. Mitra & Basundhara Mitra, *Personality Development and Soft Skills.* Oxford University Press, 2024.

2. Meenakshi Raman & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press, 2015. https://d.docs.live.net/0af95281db477321/Desktop/question%20papers%20NITS/Technical%20Communication.pdf

3. Michael Swan. *Practical English Usage*. Oxford University Press, 2016.

4. Nilanjana Gupta. *English for All*. Macmillan Publishers India Ltd, 2011.

5. S. Miglani & S. Goyal. *English for Professionals- A Practical Book of Communication Skills in English*. Vayu Education of India, 2010.

6. Sanjay Kumar & Pushp Lata. *Communication Skills*. Oxford University Press, 2015.

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CE11001	Building Materials and Construction	L-T-P-C
	B.Tech (Civil Engg.)	3-0-0-3
	First Semester (Professional Core)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Stones, Bricks, and Clay:** Classification, properties, and uses of stones and bricks; testing; IS codes; stabilized mud blocks, clay for bricks and tiles.	**5**
Unit-2	**Cement, Steel, and Concrete:** Types of cement; manufacturing and properties; tests on cement; concrete ingredients, W/C ratio, curing, Types of steel.	**5**
Unit-3	**Timber and Miscellaneous Materials:** Timber; engineered wood products; glass, aluminium, bitumen, AAC blocks, PVC; Advanced materials: waterproofing, termite proofing.	**5**
Unit-4	**Building Components – Substructure and Superstructure:** Overview of Building Components: Definitions and classification; Substructure: Functions and elements, Types of foundations: shallow (spread, mat, raft), deep (pile, caisson); Superstructure: Components: plinth, walls, columns, beams, slabs, Load bearing vs. framed construction, Introduction to lintels, sills, coping, weathering course, Staircases and ramps – types and components.	**8**
Unit-5	**Masonry and Walls:** Types of masonry: brick, stone, block, composite; brick bonds; cavity and partition walls.	**4**
Unit-6	**Floors and Roofs:** Types of floors; flat and pitched roofs; trussed roofs; green and reflective roofs.	**4**
Unit-7	**Doors, Windows, Finishes, and Modern Construction Techniques:** Doors/windows: types and fittings; plastering, pointing, painting; introduction to prefabrication, modular construction, 3D printing, BIM, IoT, drones.	**5**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Identify and describe the properties and applications of conventional and innovative building materials.
2. Interpret BIS standards and testing procedures for assessing the quality of building materials.
3. Explain construction practices for various building components as applicable in the Indian scenario.
4. Evaluate and recommend sustainable and modern materials and construction practices.

Text Books/Reference Books:

1. S.K. Duggal – Building Materials
2. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain – Building Construction
3. Sushil Kumar – Building Construction
4. M.S. Shetty – Concrete Technology
5. Relevant IS Codes: IS 383, IS 456, IS 2386, IS 269, IS 10262, IS 516, IS 1905
6. AICTE/NPTEL MOOCs on Emerging Trends in Civil Engineering Materials.

CE12001	Computer Aided Drawing and Graphics	L-T-P-C
	B.Tech (CE, CSE and ME)	1-0-2-2
	First Semester (Professional Core)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction to Engineering Drawing:** Importance and application in engineering, general instruction regarding instruments, dimensions and lettering, types of lines, concept of scales, geometrical constructions.	**9**
Unit-2	**Orthographic Projections:** Introduction to orthographic projections, elements and angles of projections, projection of points, projection of straight lines, projection of planes, conversion of pictorial views of objects into orthographic projections.	**6**
Unit-3	**Projections of Solids:** Orthographic projection of regular solids: Cubes, prisms, pyramids, cylinders, cones, tetrahedrons. Projections of frustum of solids.	**6**
Unit-4	**Isometric View:** Principles of isometric view, isometric view of simple objects, conversion of orthographic projections into isometric views.	**3**
Unit-5	**Introduction to CAD:** Introduction to CAD and advantage of CAD in engineering field, windows and system of AutoCAD, drawing area, command line, model space, layout space and work space. Drawing settings - Unit and limits, pan and zoom. Drafting settings - Grid, object snap, ortho on/off.	**3**
Unit-6	**Drafting Tools in CAD:** Tools and short commands for line, polyline, circle, polygon, arc, rectangle, ellipse, elliptical arc, hatch, spline, construction line, multiline, multiline style, point. Isometric drawing in AutoCAD.	**3**
Unit-7	**Modifying Tools in CAD:** Tools and short commands for move, rotate, trim, extend, copy, mirror, fillet, chamfer, erase, explode, offset, lengthen, edit polyline (fill on/off), edit hatch, edit array, edit multiline, align, break, point break and join. Object properties – Properties of windows, colour, linetype, linetype scale, line weight and match properties.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Produce geometric constructions with appropriate scale and dimension.
2. Apply the skill for preparing detail 2D drawing of engineering objects.
3. Visualize and develop the 3D view of engineering objects.
4. Create basic 2D drawings using AutoCAD software.

Text Books/Reference Books:

1. Bhatt, N. D., Engineering Drawing: Plane and Solid Geometry, 54th Edition, Charotar Publishing House Pvt. Limited, 2023.
2. Venugopal, K., and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, 6th Edition, New Age International, New Delhi, 2022.
3. Narayana, K. L., and Kannaiah, P., Text book on Engineering Drawing, 2nd Edition, Scitech Publishers, 2011.
4. Gopalakrishna, K. R., and Gopalakrishna, S., Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017.

PH12001	Physics Laboratory	L-T-P-C
	B.Tech (CE, CSE and ME)	0-0-2-1
	First Semester (Common)	

Prerequisites: None

List of Experiments

1. To calibrate an ammeter with the help of a potentiometer.
2. To study the twist in the thin rod by statical method using Barton's horizontal apparatus and thus to determine the modulus of rigidity of the material of the rod.
3. To study the bending of a beam supported at its ends and loaded at the middle and thus to determine the Young's modulus of the material of the beam.
4. To determine the refractive index of the material of a given prism using a spectrometer.
5. To determine frequency of a transverse waves and mass per unit length of given wire by using sonometer apparatus.
6. To study the charging and discharging of a capacitor and hence to determine it's time constant.
7. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
8. To determine the wavelength of sodium light using single slit diffraction.
9. Comparison of two low resistances by using Meter Bridge.

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply the various experimental procedures and techniques for physics related experiments.
2. Use the different measuring devices and setups to record the data with precision.
3. Apply the underlying physical concepts/theories to obtain quantitative results.
4. Evalute and analyze the error in the experiment with respect to the standard values of physical quanties.
5. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Text Books/ Reference Books:

1. University Practical Physics, D. C. Tayal, HPH Publisher
2. B.Sc. Practical Physics, Samir Kumar Ghosh, New Central Book Agency

Numerical and Mathematical Methods for Differential Equations

MA11002

B. Tech. (For CE, CSE and ME)

Second Semester (Professional Core)

L -T-P- C

3- 0 - 0 - 3

Pre-requisites*: Linear Algebra and Calculus.*

	Course Content	**Hours**
Unit-1	**Ordinary Differential Equation:** Exact differential equation of first order, integrating factors. Second & higher order linear differential equations with constant coefficients, Homogeneous (Cauchy's) linear differential equation, Method of variation of parameters.	**8**
Unit-2	**Partial Differential Equation:** Formation of partial differential equations (PDE), Solution of PDE by direct integration, Lagrange's linear equation & its solution, Non-linear PDE of first order, Charpit's method of solution, Homogeneous and Non-homogeneous linear equations with constant coefficients. Second-order PDE with constant coefficients, solution by the method of separation of variables.	**9**
Unit-3	**Laplace and Fourier Transform:** Basic idea of Integral Transform, Laplace and inverse Laplace transforms & their properties, Convolution Theorem, Solution of ODE by Laplace transform method. Periodic functions, Fourier series representation of a function, half-range series, and the Fourier integral formula. Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting, and time shifting properties. Convolution theorem.	**10**
Unit-4	**Numerical Analysis:** Finite difference, Interpolation: Newton's forward and backward interpolation formulae, Lagrange's formula. Solution of algebraic and transcendental equations: Fixed point Iteration method, Bisection, Secant, Newton-Raphson Method. Solution of a system of linear equations by Iterative Methods: Gauss-Jacobi's method & Gauss-Seidel method. Solution of ODE: Picard's method, Taylor series method, and Runge-Kutta method (Fourth order).	**9**
		Total: 36

Course Outcomes:

On completion of this course

1. The students will be able to apply ordinary differential equations in engineering and real-life problems.
2. The students will be capable of applying partial differential equations in engineering and real-life problems.
3. The students will be able to apply the Laplace/Fourier transform in engineering problems.

4. The students will be able to apply numerical techniques in engineering problems.

Course Objectives:

1. To enable the students to understand the basic ideas of ordinary differential equations and their solutions, and also the application of series in solving ordinary linear differential equations.
2. To enable the students to understand the basic ideas of partial differential equations and their solutions, and also the applications in IVP & BVP.
3. To enable the students to solve ODE/PDE by using Laplace and Fourier transforms.
4. To enable students to clear their basic concept of solutions of algebraic/transcendental equations and ODE by numerical techniques.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10^{th} Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44^{th} Edition, Khanna Publishers, 2017

Reference Books:

1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand & Company Ltd, 2020.
2. G.F. Simmons, Differential Equations, Tata McGraw-Hill, 2nd edition, 2017.
3. M. K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical Method for Scientific and Engineering Computation, 2022.
4. S. Sreenadh, Fourier Series and Integral Transforms, S. Chand Publication, 2014.

CY11002	Engineering Chemistry	L-T-P-C
	B.Tech (CE, CSE and ME)	3-0-0-3
	Second Semester	

Prerequisites: None

	Course Content	Hours
Unit-1	**Polymer & Composite materials:** Classification of polymers, methods of polymerization, thermosetting and thermoplastic polymers, conducting and biodegradable polymers, synthesis, properties and applications of polyethylene, chloropolyvinyl chloride (CPVC), Composite materials: Classification and basic requirement of composite materials, applications.	**6**
Unit-2	**Fuel & Petroleum:** Fuel: Introduction, classification of fuel, calorific value (HCV and LCV), determination of calorific value by bomb calorimetry, bio-fuels. Petroleum, knocking, octane number and cetane number, petrochemical.	**6**
Unit-3	**Nanomaterials & Green Chemistry:** Nanomaterials: Introduction; synthesis, characterization and applications of nanomaterials. Principles and application of Green Chemistry.	**6**
Unit-4	**Electrochemistry & Corrosion:** Electrode potentials and its relevance to oxidation and reduction, types of electrodes, galvanic cell, measurement of EMF and application of EMF, types of reference electrodes, determination of pH. Dry Cells, lead acid cell and Fuel Cells: Construction, reaction, advantages and applications. Corrosion: Types of corrosion, factors affecting corrosion and corrosion control.	**6**
Unit-5	**Water & its treatment:** Sources of impurities in water; hardness in water and its disadvantages; boiler scale and its prevention; caustic embrittlement; boiler corrosion: treatment of water at industrial and domestic level; biological oxygen demand (BOD) and chemical oxygen demand (COD) and their significance.	**6**
Unit-6	**Spectroscopy:** Basics of spectroscopy, electromagnetic spectrum, Basic principles of IR, UV-Visible and NMR spectroscopy, Application of IR, UV-Visible and NMR spectroscopy in structure elucidation and material characterization.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the properties and applications of polymers, composites, petroleum-based fuels for engineering and industrial use.
2. Apply the concepts of nanomaterials and green chemistry in the development of sustainable engineering solutions.
3. Analyze electrochemical processes and corrosion mechanisms to propose suitable mitigation techniques.
4. Assess water quality and treatment methods, and interpret spectroscopic data for material analysis.

Text Books/ Reference Books:

1. Jain, P.C., and Jain, M., Engineering Chemistry (2025), Dhanpat Rai Publishing Company
2. Chawla, S., Engineering Chemistry (2019), Dhanpat Rai Publishing Company
3. Glasstone, S., Physical Chemistry (1948), McMillan India
4. Dey, A. K., Environmental Chemistry (2003), New Age International
5. Rao, C. N. R., Müller A., Cheetham, A. K. (Editor), The Chemistry of Nanomaterials Synthesis, Properties and Applications, Chemistry of Nanomaterials (2004) (Wiley-VCH)

ME11002	Engineering Mechanics	L-T-P-C
	B.Tech (CE,CSE and ME)	2-1-0-3
	Second Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	Equivalent Force System, Equilibrium of Rigid Bodies, Law of Coulomb friction: Applications of dry friction in wedge and belt.	**9**
Unit-2	Equilibrium of simple plane trusses. Analysis of trusses by the method of joints and method of section. Principle of virtual work, Simple applications of Principle of virtual work for rigid bodies in static equilibrium.	**9**
Unit-3	Centroid of simple and composite plane figures. Pappus theorem and its applications. Area moment of inertia of simple and composite figures, Perpendicular axis theorem. Parallel axis theorem, Polar moment of inertia.	**6**
Unit-4	*Kinematics of particles:* Rectilinear motion of particles, plane curvilinear motion of particles in different coordinate systems, constrained motion of connected particles. *Plane kinematics of rigid bodies:* Translation of a rigid body in plane motion, rotation of rigid bodies about a fixed axis. *Kinetics of particles:* Applications of Newton's laws of motion, D'Alembert's principle, Principle of work-energy and Impulse-momentum in particle dynamics, Direct central impact and oblique central impact. *Plane kinetics of rigid bodies:* Equation of plane motion of a rigid body, Principle of work-energy in plane motion of a rigid body.	**12**
	Total	**36**

Course Outcomes (COs):

Upon the completion of this course, the students are expected

1. To build a fundamental understanding of static equilibrium in particles, rigid bodies, and friction, and apply it to solve related engineering problems.
2. To develop the ability to analyze simple plane trusses and apply the principle of virtual work to systems in static equilibrium.
3. To apply the theorem of Pappus. Parallel axis theorem and Perpendicular axis theorem.
4. To apply the concept of centroid and moment of inertia in analyzing the simple and composite figures.
5. To develop the ability to apply for solving the practical problems on kinematics and kinetics of motion of particles and rigid bodies.

Text Books:

1. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Statics, John Wiley & Sons, Inc; 3/e.
2. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Dynamics, John Wiley & Sons, Inc; 3/e.
3. F. P. Beer, Jr., E. R. Johnston, E. R. Eisenberg, P. J. Cornwell, D. Mazurek. Vector Mechanics for Engineers- Statics & Dynamics, McGraw-Hill Higher Education; 9/e.
4. 1. H. Shames, Engineering Mechanics - Statics and Dynamics, 4lh edition, Prentice-Hall of India.
5. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati. Engineering Mechanics, McGraw Hill Education; 5/e.

Reference Books:

1. S. Timoshenko, D.H. Young, Engineering Mechanics, 4th edition, McGraw- Hill.
2. R.C. Hibbeler. Engineering Mechanics - Statics & Dynamics, Pearson Education, 4/e.

EE11002	Electrical and Electronics Science	L-T-P-C
	B.Tech (CE, CSE and ME)	3-0-0-3
	Second Semester (Professional Core)	

Prerequisites: Nil

	Course Content	Hours
Unit-1	Electrical safety: Definition, precautions D.C. Circuit & Networks: KVL and KCL, Superposition Theorem, Thevenin's and Norton's Theorems, Maximum power transfer theorem	**4**
Unit-2	A.C. Circuit: A.C. Fundamentals, phasor representation and algebra, Series R-L, R-C and R-L-C circuits, power calculations in A.C. circuit, phasor diagrams. Balanced Star-Delta connections, phase and line currents and voltages and their relations	**6**
Unit-3	Measuring instruments: Ammeter, voltmeter, wattmeter, energy meter – types & connection, concepts of grounding and earthing	**3**
Unit-4	Electrical Machines: D.C machine fundamentals and Transformer (Brief construction, types, working principle, voltage equation and application), 3-phase induction motor (Brief construction, principle, types, applications).	**5**
Unit-5	Introduction to Electronic devices, **Diode:** Basic structure and operating principle, **Diode Applications:** rectifier circuits (half-wave and full-wave rectifier), voltage regulator using Zener diode, clipper circuits, clamper circuits	**5**
Unit-6	**BJT:** Basic structure, operation of transistor in active and saturation mode, DC analysis. **MOSFET:** Introduction to MOSFET Operation and characteristics.	**5**
Unit-7	**Operational Amplifier (Op-Amp):** Ideal op-amp, inverting amplifier, non-inverting configuration, transfer characteristics, op-amp applications like difference amplifier, summing amplifier, integrator, and differentiator.	**3**
Unit -8	**Basic Digital Electronics:** Logic gates, Boolean algebra, De-Morgan's theorem, K-Map, combinational circuits like adder, multiplexer, and demultiplexer.	**5**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the basic structure and operating principle of electronics devices and analyse DC and AC networks.
2. Measure different electrical quantities in simple 1-phase and 3-phase circuits.
3. Classify the electrical machines and the electronics devices; explain their working principles, characteristics and applications.
4. Design and implement simple analog and digital electronic circuits.

Text Books/ Reference Books:

1 Gupta, J. B., *Basic Electrical Engineering*, S. K. Kataria & Sons.
2 Husain, A., and Ashfaq, H., *Basic Electrical Engineering*, Dhanpat Rai & Co.
3 Nashelsky, L., and Boylestad, R., *Electronic Devices and Circuit Theory*, 10th Edition, Pearson India.
4 Kumar, A. Anand, *Fundamentals of Digital Circuits*, 4th Edition, PHI.

CE11002	Engineering Survey	L-T-P-C
	B.Tech (Civil Engg.)	3-0-0-3

Second Semester (Professional Core)

Prerequisites: None

	Course Content	Hours
Unit-1	**Linear and Angular Measurements:** Introduction, primary division, classification and principles of surveying. Instruments and procedure of linear measurement using chain survey. Instruments and procedure of angular measurement using compass survey. Chain and compass traversing. Accuracy, errors and corrections associated with chain and compass survey.	**8**
Unit-2	**Levelling and Contouring**: Levelling instruments and their adjustments. Methods and types of levelling. Effects of curvature and refraction. Reciprocal levelling. Errors in levelling. Characteristic, methods and uses of contours.	**6**
Unit-3	**Theodolite and Tacheometric Survey**: Theodolite - Instruments and measurement of horizontal and vertical angles. Tacheometer - Instruments and methods of measuring of horizontal and vertical distances.	**8**
Unit-4	**Curve setting:** Classification, setting out of circular curve and transition curve.	**6**
Unit-5	**Electronic Distance Measurement and Remote Sensing:** Principles and types of EDM instruments, total station, global positioning systems (GPS). Introduction to remote sensing, classification, components, principles and application**.**	**8**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand different aspects of surveying and able to apply concepts for linear and angular measurements using chain and compass.
2. Analyze levelling, contouring and curve setting.
3. Apply the principle of angular and distance measurement using theodolite and tacheometer.
4. Understand the theories of advanced instrumentation of surveying and basics of remote sensing.

Text Books/Reference Books:

1. B.C. Punmia, A.K. Jain and A.K. Jain, ***Surveying (Vol I & II),*** Laxmi Publication Pvt. New Delhi.
2. K.R. Arora, ***Surveying (Vol-I & II, Vol-III),*** Standard Book House.
3. T.P. Kanetkar and S.V. Kulkarni, ***Surveying & Levelling (Vol-I & Vol-II)***, Pune Vidyarthi Griha Prakashan.
4. W. Schofield and M. Breach, ***Engineering Surveying***, CRC Press.
5. R. Subramanian, ***Surveying and Levelling,*** Oxford University Press.
6. A. Reddy, ***Textbook of Remote Sensing and Geographical information system***, B.S. Publications.
7. Satheesh Gopi, R. Sathikumar and N. Madhu, ***Advanced Surveying: Total Station, GIS and Remote Sensing***, Pearson India.
8. J.V. Sickle, ***GPS for Land Surveyors***, CRC Press.

ME12002	Workshop Practice	L-T-P-C
	B.Tech. (CE, CSE and ME)	0-0-3-1
	Second Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	General safety precautions in workshop and introduction.	**3**
Unit-2	**Carpentry Shop:** Safety precaution, Kinds of wood and timber, Application of timber as per their classification, Carpentry hand tools and machines, Different types of carpentry joint, Demonstration of wood working machine like, band saw, circular saw, thickness planner, wood working lathe, surface planners, etc.	**6**
Unit-3	**Welding Shop:** Safety precaution in welding shop, Introduction to gas and arc welding, Soldering and brazing etc. Welding equipment and welding material.	**6**
Unit-4	**Fitting Shop:** Safety precaution, Introduction to fitting shop tools, equipment, Operation and their uses, Marking and measuring practice.	**6**
Unit-5	**Machine Shop:** Safety precautions, Demonstration and working principles of some of the general machines, like lathe, shaper, milling, drilling, grinding, slotting etc., General idea of cutting tools of the machines.	**6**
	Total	**27**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Know the importance of general safety precautions on different shop floors.
2. Identify the basics of tools and equipments used in fitting, carpentry, sheet metal, machine, welding and smithy.
3. Do fabrication of wooden joints and understand joining of metals.
4. Make metal joints and sheet metal work.
5. Understand the basics of removal of material from work piece surface to attain specific shape.
6. Familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.

Text Books/ Reference Books:

1. S K Hajra Choudhury, A K Hajra Choudhury, N. Roy. Workshop Technology Vol I & II, Media Promoters & Publishers Pvt. Ltd; 9/e.
2. H S Bawa. Workshop Practice, McGraw Hill Education; 2nd edition, 2/e.

EE12002	Electrical and Electronics Science Laboratory	L-T-P-C
	B.Tech (CE, CSE and ME)	0-0-2-1
	Second Semester (Professional Core)	

Prerequisites: Nil

Sl. No.	Experiments
1	Verification of Thevenin's and Norton's Theorems in a DC circuit.
2	Verification of Superposition Theorem in DC circuits.
3	Measurement of power in single phase AC circuit using three ammeter method
4	Measurement of three phase power in an AC circuit with star and delta connected variable loads.
5	Familiarization with the components and instruments.
6	Design of a clipper and clamper circuits (both positive and negative)
7	Plot the VI characteristics of a PN junction diode and Zener diode and compare their difference
8	Implement Boolean functions using logic gates.
9	Design of circuits using operational amplifier

Course Outcomes (COs):

After completion of the course, students will be able to

1. Develop practical skills using electrical and electronic components and measuring equipment.
2. Demonstrate and justify results of Network theorems in DC circuits.
3. Compute and verify power consumptions for single and three phase loads.
4. Understand the characteristics of various electronics devices.
5. Design and analyze simple analog and digital circuits.

CY12002	**Chemistry Laboratory**	**L-T-P-C**
	B.Tech (CE, CSE and ME)	0-0-2-1
	Second Semester	

Prerequisites: None

List of Experiments:

Experiment 1: To determine the total hardness of pond water/ supplied water using the standard EDTA solution
Experiment 2: Estimation of magnesium from the supplied solution using standard EDTA
Experiment 3: Estimation of calcium from the supplied solution using standard EDTA
Experiment 4: Determination of dissolved oxygen (DO) of lake water
Experiment 5: Determination of total alkalinity of supplied aqueous solution.
Experiment 6: To determine the strength of the $KMnO_4$ solution using a standard oxalic acid solution
Experiment 7: To determine the amount of Fe(II) present in the supplied solution using the standard $KMnO_4$ solution
Experiment 8: To determine the amount of Fe(III) present in the supplied solution using the standard $K_2Cr_2O_7$
Experiment 9: Quantitative determination of Copper (II) using standard HYPO ($Na_2S_2O_3$) solution
Experiment 10: Estimation of calcium in milk powder using standard EDTA solution
Experiment 11. Detection of special elements in supplied organic compounds.
Experiment 12: Determination of functional groups in the supplied organic compounds
Experiment 13: Preparation of Copper (II) glycinato complex
Experiment 14: Determination of the relative viscosity of the given organic compound by Ostwald Viscometer
Experiment 15: Determination of the surface tension of the given organic compound by the stalagmometer

Course Outcomes (COs): After completion of the course, students will be able to

1. Know about the methods for the determination of water quality parameters. They can assess the quality of water for drinking purposes, etc., by performing experiments such as determining total hardness, Ca^{2+}, Mg^{2+}, total alkalinity, and dissolved oxygen.
2. Determine presence of Fe^{3+}, Fe^{2+}, Cu^{2+} ions in water
3. Determine the physical properties of liquids by performing experiments, such as viscosity. They will also be able to determine the viscosity of the lubricating oil. The generated knowledge can be used for industrial product development, like detergent formulation.
4. Determine the surface tension of liquids
5. Synthesise coordination complexes of biologically important transition metal ions.
6. To perform the chemical reactions to find out different elements, functional groups or nonmetals present in the organic compounds. This will also help them to understand the role of different functional groups in chemical reactivity.

Text Books/ Reference Books:

1. Das, S. C., Advanced Practical Chemistry (2024), The World Press Private Limited
2. Laboratory Manual, Dept. of Chemistry, NIT Silchar

MA21001

Applied Mathematical Analysis and Statistics
B.Tech.(For CE,CSE,ME)
Third Semester (Professional Core)

L -T-P- C
3- 0 - 0 - 3

Prerequisites: Ordinary & Partial differentiation, Elementary integration, Vector operations.

	Course Content	Hours
Unit-1	**Vector Integral Calculus:** Line integral, Double integral, Surface integral, Triple integral, Green's theorem, Stokes' theorem and Gauss Divergence theorem and their applications.	**10**
Unit-2	**Complex Analysis:** Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integrals.	**10**
Unit-3	**Probability & Statistics:** Introduction to probability, Additive & multiplicative Laws of probability, Conditional probability, Independent events, Baye's theorem, Random variable, Probability mass function, Probability density function, Cumulative distribution function, Binomial, Poisson & Normal distributions. Curve fitting: Fitting of straight lines & parabolas by the method of least squares. Correlation & Regression analysis: Coefficient of correlation, Coefficient of regression, Lines of regression.	**12**
Unit-4	**Stochastic Process:** Definition of Stochastic process, Classification and properties of stochastic processes, Simple Markovian stochastic processes, Gaussian processes, Stationary processes.	**6**
	Total	**38**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply concepts of Vector Calculus to solve multivariable integration and field problems.
2. Analyze complex functions using methods of Complex Analysis.
3. Use techniques of Probability and Statistics for data analysis and uncertainty modelling.
4. Model random systems using Stochastic Processes and related probabilistic methods.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publisher, 2017.
3. J. Ravichandran, Probability and Statistics for Engineers. Wiley India Pvt. Ltd., New Delhi, 2010.
4. A. Papoulis, S. U. Pillai, Probability Random Variables and Stochastic Processes, CBS Publishers and Distributors Pvt. Ltd, 2025.

Reference Books:

1. M.D. Raisinghania, Vector Analysis, S.Chand & Company Ltd, 2020.
2. S. Lipschutz and J. J. Schiller, Complex Variables, Schaum's Outline series, 2009.
3. S. Lipschutz and J. J. Schiller. Introduction to Probability and Statistics. Schaum's Outline Series, 2011.
4. Sheldon M. Ross, Stochastic Processes, Wiley, 2008.

HS21001/21002	Engineering Economics	L-T-P-C
	IIIrd / IVth Semester (Professional Core)	3-0-0-3

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction:** Definition and scope of Economics; Engineering Economics and the role of engineers in economic decision-making; Theory of Consumer Behaviour: Cardinal and Ordinal Utility analysis.	**4**
Unit-2	**Demand Analysis:** Demand: meaning, law, determinants; Supply: meaning, law, determinants; Market equilibrium and price determination; Elasticity of demand; Demand Forecasting techniques.	**4**
Unit-3	**Theory of Cost and Production:** Meaning and classification of costs; Short-run cost concepts; Fixed cost; Variable cost; Total, average, and marginal cost; Long-run cost curves; Law of Variable Proportion and Returns to scale.	**3**
Unit 4:	**Theory of Product Pricing:** Market Structure: Perfect Competition-Characteristics; Price Determination; Monopoly- Characteristics, Price and Output Determination.	**6**
Unit 5	**National Income Determination**: Concepts and Measurement of National Income; Components of National Income; Methods of National Income Calculation; Problems in Measuring National Income.	**3**
Unit 6	**Macroeconomic issues and International Market:** Unemployment: Definition, types, and causes; Inflation: types, causes, and social costs of inflation; Business Cycle; Schumpeter theory of innovation.	**6**
Unit-7	**Project Evaluation and Management:** Meaning of Project Cycle, Project selection and planning; Project Appraisal; Means of financing and financial appraisal tools; Qualitative Methods for Project Evaluation, Social Cost Benefit Analysis; Externalities and environmental concerns.	**6**
	Total	**32**

Course Outcomes (COs):

After completion of the course, students will be able to

1. To introduce economic principles relevant to engineering decision-making
2. To analyse consumer behaviour, cost functions and producer behaviour for Engineering Decisions
3. To understand national income and macroeconomic issues
4. To apply project evaluation techniques and social and environmental cost-benefit analysis

Text Books/ Reference Books:

1. H. G. Thuesen, W. J. Fabrycky, and G. J. Thuesen (1993), Engineering Economy, Prentice Hall International.
2. F. C. Jelen (1970), Cost and Optimisation Engineering, McGraw-Hill Book Co., New York.
3. Hal R. Varian. Intermediate Microeconomics, 8th Edition, W. W. Norton and Company.
4. N. Gregory Mankiw. Principles of Microeconomics. Cengage Learning
5. N. Gregory Mankiw, Ronald D. Kneebone, Kenneth J McKenzie (2023). Principles of Macroeconomics, 9th Edition. Cengage Canada.
6. Salvatore, D. International Economics (11th ed.). John Wiley & Sons.

CE21003	Fluid Mechanics	L-T-P-C
	B.Tech (Civil Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Basic Concepts:** Continuum Approach; Important physical properties: Density; Specific weight; Viscosity; Surface tension; Capillarity; Compressibility; Vapour pressure; Classification of fluids – ideal and real fluid; non- Newtonian fluids.	**5**
Unit-2	**Fluid Statics:** Pressure at a point-Pascal's Law; pressure variation in a static fluid. Scales of pressure – absolute and gauge pressure; Measurement of pressure-manometers; Forces on submerged plane and curved surfaces; Buoyant Force-centre of buoyancy; metacenter; determination of metacentric height; equilibrium of floating and submerged bodies.	**9**
Unit-3	**Kinematics of Fluid:** Study of fluid motion – Lagrangian and Eulerian methods; Classification of flow-steady and unsteady flow; uniform and nonuniform flow; rotation and irrotational flow; laminar and turbulent flow; 1- ;2- & 3D flow; Concepts of streamlines; pathlines and streakline; stream tube; Continuity equation; Circulation; vorticity; Stream function; Velocity potential; Flownet.	**6**
Unit-4	**Dynamics of fluid flow:** Euler's equation of motion; Bernoulli's equation and its application-venturimeter; orificemeter; Pitot tube; momentum equation and its application to simple problems.	**6**
Unit-5	**Orifice; mouthpiece; Notches and Weirs:** Classification of orifice; discharge through free; submerged and partially submerged orifices; coefficients of orifice and their experimental determination; Classification of mouthpieces; discharge through an External and internal mouthpiece; mouthpiece running full and free. Classification of Notches and Weirs; Velocity of Approach; Discharge Notches and weirs.	**6**
Unit-6	**Laminar Flow:** Navier Stokes equation; Laminar flow through pipes-Hagen Poiseuille law; Laminar flow between parallel plates.	**4**
	Total	**36**

Course Outcomes (COs):

After completion of the course; students will be able to

1. Apply fundamental knowledge of fluid mechanics and analysis of fluid flow problems in civil engineering.
2. Understand the fundamental concepts for design of pressure-pipe and open channel hydraulics in civil engineering.
3. Understand the application of required principles and theorems for various flow measuring devices
4. Understand the fundamental concepts involved in fluid flow.

Text Books / Reference Books:

1. John F. Douglas; Janusz M. Gasiorek and John A. Swaffield. ***Fluid Mechanics.*** Pearson Education.
2. K. L. Kumar. ***Fluid Mechanics.*** S. Chand & Co.
3. Streeter & Wily. ***Fluid Mechanics.*** Mc Graw Hill.
4. R. K. Bansal. ***Fluid Mechanics and hydraulic Mechanics.*** Laxmi Publisher.
5. S. K. Som and G. Biswas. ***Introduction to fluid mechanics and fluid machines.*** Tata Mc Graw Hill.

CE21005	Concrete Technology	L-T-P-C
	B.Tech (Civil Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Cement and Admixtures**: Types of Portland Cement, hydration, setting and hardening process, special hydraulic cements, Admixture, accelerators, and retarders, air-entraining agents, plasticizer and super-plasticizers, mineral admixtures such as fly ash, ground granulated blast furnace slag, microsilica, rice husk ash.	6
Unit-2	**Aggregates**: Shape and texture, bond, strength, specific gravity, bulk-density and moisture content of aggregates, bulking of sand, deleterious substances in aggregates, alkali-aggregate reaction, sieve-analysis and grading curves, fineness modulus, practical grading, gap grades aggregates.	5
Unit-3	**Fresh Concrete**: Rheological aspects such as workability-flow ability, Compatibility, mobility of concrete, factors affecting workability and laboratory determination, segregation, bleeding, laitance, compaction of concrete.	6
Unit-4	**Strength of Concrete**: Compressive strength and factors affecting it, behavior of concrete under various stress stated, testing of hardened concrete – cube and cylinder test, Platen effect, non-destructive testing such as rebound hammer test, USPV test, core-cutting, stress – strain relation and modulus of elasticity, shrinkage, creep of concrete and its effect.	6
Unit-5	**Durability of Concrete**: Corrosion of reinforcing bars, sulphate attack, frost action, Deterioration by fire, Concrete in seawater, acid attack, carbonation, cracks in concrete.	5
Unit-6	**Concrete Mix Design**: Basic consideration – cost, workability, strength and durability, grading, method of mix design, acceptance criteria for concrete.	5
Unit-7	**Advances in Construction Materials**: High strength concrete, fibre-reinforced concrete, concrete containing polymers, heavy weight and light weight concrete, mass concrete, reactive powder concrete, Engineered Cementitious Composites, Geopolymer concrete.	6
	Total	**39**

Course Outcomes (COs):

After completion of the course; students will be able to

1. Identify quality control test on concrete making materials.
2. Understanding properties of fresh and hardened concrete.
3. Design concrete mixes as per Indian Standard and ACI standards.
4. Identify durability requirements of concrete.
5. Understand the need for special concrete and their properties.

Text Books / Reference Books:

1. P.K.Mehta, Concrete : Structure, Properties and Materials. Prentices – Hall, Inc., USA.
2. Aminul Islam Laskar, Concrete Technology Practices. Narosa Publishing House, New Delhi.
3. A.M Neville. Properties of concrete . Longman U.K
4. J.H.Bungey. Testing of Concrete in Structures. Surrey University Press. New York.

CE21007	Highway Engineering	L-T-P-C
	B.Tech (Civil Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction to Transportation and Highway Engineering:** Different Modes of Transportation; Scope of Highway Engineering; History of Road Development in India; Classification of Roads; National Highways Development Projects; Rural Road Development Plans; Road networking, Planning and Surveying for Highway Alignment; Detailed Project Report (DPR) Preparation.	**5**
Unit-2	**Highway Geometric Design:** Highway Cross Sectional Elements: Carriageway, Camber, Kerbs, Road Margins, Formation, Right of Way; Sight Distance; Design of Horizontal Alignment; Design of Vertical Alignment; Placement of Utilities and Services; Design Considerations for Roads in Hilly Regions.	**7**
Unit-3	**Pavement Materials:** Soil and its Characterization; Aggregate Gradations; Various tests on Aggregates; Bituminous Material; Characterization and Uses of Neat Bitumen, Modified Bitumen, Emulsions and Cutbacks, Bituminous Binder Grading; Types of Bituminous Mixes; Mix Volumetrics; Marshall Method of Bituminous Mix design; Cement Concrete for Rigid Pavements.	**7**
Unit-4	**Traffic Engineering:** Introduction to Traffic Engineering; Traffic studies, Fundamentals of Traffic Flow Theory; Traffic Regulations and Control; Traffic Signal, Road Signs and Markings, Design of Traffic Facilities: Intersections, Interchanges, Roundabouts, Road Islands; and Parking Facilities.	**8**
Unit-5	**Analysis and Design of Pavements:** History of Road Construction; Pavement Composition–Flexible and Rigid Pavement; Parameters for Pavement Analysis–Elastic Modulus, Poisson's Ratio, Wheel Load, Wheel Configuration, Tyre Pressure, and Temperature; Analysis of Bituminous Pavement Structures–Elastic Half-Space and Layered Elastic Theory; Introduction to Flexible Pavement Design with IRC-37; Types of Rigid Pavement; Analysis of Concrete Pavement Structures; Stresses in Rigid Pavement; Introduction to Rigid Pavement Design with IRC-58.	**9**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the scope of Highway engineering and comprehend the planning of highway alignment.
2. Understand the design principles of cross-sectional elements.
3. Identify and characterize suitable materials for different pavement layers.
4. Understand traffic stream characteristics, and design various traffic facilities.
5. Analyze and design of flexible and rigid pavements using standard codes.

Text Books/ Reference Books:

1. S.K. Khanna, C.E.G. Justo, and A. Veeraragavan. (2015). Highway Engineering. Tenth Edition, Nem Chand and Brothers.
2. P. S. Kandhal, A. Veeraragavan, and R. Choudhary. (2023). Bituminous Road Construction in India. Second Edition, PHI Learning Pvt. Ltd.
3. Rajib B. Mallick and Tahar El-Korchi. (2022). Pavement Engineering: Principles and Practice. Fourth Edition, Routledge Taylor & Francis Group.
4. E. R. Brown, P. S. Kandhal, F. L. Roberts, Y. R. Kim, D. Y. Lee, & T. W. Kennedy, (2009). Hot mix asphalt materials, mixture design, and construction. NAPA research and education foundation. (Third Edition).
5. P. Chakroborty and A. Das. (2017). Principles of Transportation Engineering, Second Edition, Prentice Hall India.

6. Athanassios Nikolaides. (2015). Highway Engineering: Pavements, Materials and Control of Quality, CRC Press, Taylor & Francis.
7. L. R. Kadyali and N.B. Lal. (2013). Principles and Practices of Highway Engineering. Khanna Publishers.
8. Relevant standard codes of Indian Roads Congress (IRC), Bureau of Indian standards (BIS), Ministry of Road Transport and Highways (MoRTH), American Association of State Highway and Transportation Officials (AASHTO), American Society for Testing and Materials (ASTM), and Asphalt Institute Manuals (AI).

CE21009	Strength of Materials	L-T-P-C
	B.Tech (Civil Engg.)	3-0-0-3

Third Semester (Professional Core)

Prerequisites: Engineering Mechanics (ME 11002)

	Course Content	Hours
Unit-1	**Simple stresses and strains:** Stress; strain; type of stresses; elastic limit; Hooke's law; mechanical properties of materials and their experimental determination; stress-strain curve; factor of safety; elastic constants; initial stiffness; secant stiffness; elongation of bars of varying sections; elongation of bars of composite sections; elongation due to self-weight; bars of uniform strength; complementary shear stresses; thermal stress.	5
Unit-2	**Bending moments and shear forces:** Beam – elastic curve; type of loads; type of supports; SF and BM diagrams for determinate beams; viz.; cantilever; simply supported and overhanging beams; relationship between loading; SF and BM.	8
Unit-3	**Stresses in beams:** Theory of bending; neutral axis; bending stresses in symmetrical sections; section modulus and Moment of resistance of a beam; composite beams; shear stresses in beams.	4
Unit-4	**Compound stresses:** Stresses on inclined plane; stresses on inclined plane due to biaxial normal stresses and shear stresses; pure shear; principal planes; principal stresses and strains; Mohr's circle of stresses.	4
Unit-5	**Thin shells:** Thin cylinders and spherical shells – Hoop stress and longitudinal stress; volumetric changes.	2
Unit-6	**Torsion:** Analysis of torsional stresses in a plane circular shaft; power transmitted; combined bending and torsion; equivalent bending moment and torque.	2
Unit-7	**Deflection of beams:** Relationship among curvature; slope and deflections; slope and deflection for cantilever and simply supported beams; Macaulay's method; Moment-area method; Conjugate beam method.	8
Unit-8	**Theory of columns:** Different types of columns; short column subjected to axial loading (including eccentric loading); long column; slenderness ratio; Euler's theory; crippling load; Rankine's formula.	3
	Total	**36**

Course Outcomes (COs):

After completion of the course; students will be able to

1. Understand the basic concepts and state principles of strength of materials
2. Calculate uniaxial and biaxial stresses and strains under external loadings
3. Calculate deformations in beams due to different types of loadings
4. Analyze different types of columns under axial loading

Text Books/ Reference Books:

1. S. Timoshenko, Strength of Materials; CBS Publishers and Distributors Pvt. Ltd., 3rd ed., 2021
2. S. Timoshenko, Strength of Materials: Advanced Theory and Problems, 3rd ed Part 2
3. R. C. Hibbeler, Structural Analysis. Pearson Education
4. Norris and Wilber, Elementary Structural Analysis. McGraw Hill international

CE22001	**Functional Planning of Building**	**L-T-P-C**
	B.Tech (Civil Engineering)	1-0-2-2
	Third Semester (Professional Core)	

Prerequisites: None

	Course Content	**Hours**
Unit-1	**Introduction:** Building and its components, types of building, introduction to functional planning of building and its objectives, building service integration, site planning, orientation – factors affecting orientation, orientation criteria for Indian conditions, good orientation for different rooms of a building.	**4**
Unit-2	**Principles of building Planning:** Introduction to building planning, Aspect, Prospect, Roominess, Grouping, Furniture requirements, Circulation – horizontal and vertical, Privacy, Sanitation – lighting, ventilation and sanitary convenience, Elegance, Flexibility, Economy etc., Practical considerations.	**4**
Unit-3	**Building Bye-laws:** Introduction to building bye-laws, objectives of bye-laws, local authority, understanding building height, building line and control line, setbacks, setback line, plinth area, plinth area regulation, floor area ratio (FAR), floor space index (FSI), light plan and height of building etc. Requirements of Parts of Building (Standard as per NBC/ Local bye-laws)	**4**
Unit-4	**Drafting Techniques:** Creating site plans for residential and public buildings.	**6**
	Creating building plans for residential and public buildings.	**9**
	Creating elevations for residential and public buildings.	**6**
	Creating sections for residential and public buildings.	**3**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand and analyse the functional requirements of buildings.
2. Implement planning principles in building planning.
3. Implement the building bye-laws for planning different types of buildings.
4. Prepare working drawings for different types of buildings.

Text Books/ Reference Books:

1. Gurcharan Singh and Jagdish Singh, Building Planning, Designing and Scheduling, Standard Publishers & Distributors
2. D N Ghose, A Book of Home Plans, CBS Publishers & Distributors
3. Dr. N. Kumara Swamy and A. Kameswara Rao, Building Planning and Drawing, Charotar Publishing House PRV LTD
4. Dr. S.S. Deodhar, Building Science and Planning, Khanna Publishers
5. National Building Code

CE22003	Material Testing Laboratory	L-T-P-C
	B.Tech (Civil Engg.)	0-0-3-1.5
	Third Semester (Professional Core)	

Prerequisites: Building Materials and Construction (CE 11001)

	Course Content	Hours
Unit-1	**Tests on steel :** a) Tensile strength test: To Determines the tensile strength, yield strength, and elongation of steel b) Proof Stress Test: To determine the proof stress of a material c) Bend-Rebend Test: To evaluate the ductility and flexibility of steel by assessing its ability to withstand bending and rebending without cracking or failure	6
Unit-2	**Tests on Cement** a) Determination of fineness of cement b) Determination of consistency of cement c) Determination of initial and final setting time of cement d) Determination of specific gravity of cement	6
Unit-3	**Tests on Bricks** a) Determination of compressive strength of bricks b) Determination of water absorption of bricks c) Determination of efflorescence of bricks d) Determination of Dimensional Tolerance	6
Unit-4	**Tests on Wood** a) Determination of Compression test on wood b) Determination of Moisture Content of wood c) Determination of Bending value of wood (modulus of rupture and elasticity) by flexural test	6
Unit-5	**Tests on Fine Aggregate** a) Determination of Fineness modulus and grain size distribution b) Determination of specific gravity and water absorption of fine aggregate c) Determination of Bulking of fine aggregate d) Determination of Bulk density of fine aggregate	6
Unit-6	**Tests on Coarse Aggregate** a) Determination of Specific gravity and water absorption of coarse aggregates b) Sieve analysis test of coarse aggregates c) Determination of Aggregate Crushing Value d) Determination of Aggregate Impact value	6
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Determine the mechanical properties of steel.
2. Determine the physical properties of cement
3. Determine the strength of brick and wood.
4. Determine the physical properties of fine and coarse aggregate.

Text Books/ Reference Books:

1. Davis, Troxell and Hawk. ***Testing of Engineering Materials.*** International Student Edition McGraw Hill Book Co. New Delhi.
2. M L Gambhir and Neha Jamwal. Building and construction materials Testing and quality control. McGraw Hill.

CE22005	Fluid Mechanics Laboratory	L-T-P-C
	B.Tech (Civil Engg.)	0-0-3-1.5
	Third Semester (Professional Core)	

Prerequisites: Fluid Mechanics (CE 21003)

	Course Content	Hours
Unit-1	Introduction to FM lab and Study of Bernoulli's Theorem.	6
Unit-2	Determination of Co-efficient (C_d, C_v and C_c) of Orifice and Mouthpiece.	6
Unit-3	Flow Measurement by Venturimeter.	3
Unit-4	Flow Measurement by Orificemeter.	3
Unit-5	Study of Force due to Impact of Jet.	3
Unit-6	Determination of Viscosity and settling velocity of given fluid using Stoke's law	3
Unit-7	Determination of Metacentric Height of and stability of floating objects or Vessels	6
Unit-8	Study of Flow Visualization Apparatus (Hele-Shaw Apparatus)	3
Unit-9	Study of friction losses in pipes	3
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the basic principles and theorems of fluid flow.
2. Use of different flow measuring devices working with specific hydraulics principles.
3. Visualize the streamlines in a flow field.

Text Books/ Reference Books:

1. K.L. Kumar. Engineering Fluid Mechanics Experiments. Eurasia Publishing House.
2. Jagdish Lal. Hydraulic Machines. Metropolitan Book Co., Delhi.
3. P.N. Modi & S.M. Seth. Hydraulics and Fluid Mechanics including Hydraulic Machines (in SI units). Rajsons Publications Pvt. Ltd., 21st Edition.

CE22007	**Computer Programming Lab**	**L-T-P-C**
	B.Tech (Civil Engg.)	0-0-3-1.5
	Third Semester (Professional Core)	

Prerequisites: Basic Engineering Mathematics

	Course Content	**Hours**
Unit-1	**Introduction :** Role of scientific computing in civil engineering, MATLAB environment: command window, scripts, functions, Python environment: Jupyter Notebook / IDE, Variables, data types, basic operations.	**6**
Unit-2	**Interactive Computation** Vectors and matrices; Matrix and array operations; Strings and basic data structures; Command-line functions; Saving and loading data; Built-in functions and help systems; Loops and conditional statements; Basic input/output operations.	**12**
Unit-3	**Scripts and Functions** Script files and function files; Modular programming; Language-specific features; Advanced data structures (arrays, lists, dictionaries, structures); Error handling; Report generation and documentation.	**6**
Unit-4	**Applications** Linear algebraic equations; Nonlinear algebraic equations; Curve fitting and interpolation; Numerical differentiation and integration; Ordinary Differential Equations (ODEs); Introduction to Partial Differential Equations (PDEs) with simple applications in civil engineering.	**12**
Unit-5	**Graphics:** 2D plotting; Multiple plots using subplots; 3D visualization; Graph customization; Handle graphics; Exporting and printing figures.	**6**
	Total	**42**

Course Outcomes (COs):

After completion of the course, students will be able to

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

1. Understanding of MATLAB and Python interactive development Environment for carrying out data analysis.
2. Apply and implement numerical techniques for solving algebraic equations, differentiation, integration, and curve fitting to engineering data.
3. Analyze, visualize, and present engineering data and computational results using appropriate graphical tools.

Text Books/ Reference Books:

1. Pratap, R. (2010). Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers.
2. Matthes, E. (2019). *Python Crash Course: A Hands-On, Project-Based Introduction to Programming* (2nd ed.).
3. Chapra, S. C., & Canale, R. P. (2015). Numerical Methods for Engineers (7th ed.). New York: McGraw-Hill Education.
4. Jain, M. K., Iyengar, S. R. K., & Jain, R. K. (2012). Numerical Methods for Scientific and Engineering Computation (6th ed.).

CE21001/21002	Environmental Science	L-T-P-C
	3rd / 4th Semester (Professional Core)	2-0-0-2

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction and Natural Resources:** Environment, Definition, scope and importance, multidisciplinary nature of environmental studies, Forest Resources –use and over-exploitation of forests, deforestation, water, mineral, land, food resource and energy resources	**5**
Unit-2	**Ecosystem and Biodiversity:** Ecosystem-Concept of an ecosystem, structure and function of an ecosystem, Food chain, food webs and ecological pyramids, Energy flow in ecosystem producers and consumers Ecological Succession, Biodiversity and its Conservation – introduction, definition, genetic species and ecosystem diversity, value of biodiversity, hotspots of biodiversity, threats to biodiversity- habitat loss, poaching of wildlife conflicts, endangered and endemic species in India, conservation of biodiversity	**6**
Unit-3	**Environmental Pollution:** Causes, effects and control measures of air pollution, scales of defining pollutants, various air pollution control equipment, water pollution, wastewater management, primary, secondary and tertiary treatment techniques, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear radiation hazards, Solid waste management, sources of solid waste effects and control measures of urban industrial wastes, hierarchies of solid waste management techniques	**9**
Unit-4	**Environment and society:** Role of an individual prevention of pollution, consumerism and waste products, unsustainable to sustainable development, Environmental Laws, Environmental Impact Assessment, issue involved in enforcement of environmental legalizations, Environment and human health, epidemics, Women and child welfare, Role of information technology in environment and human health.	**4**
	Total	**24**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand scope of environmental science and brief knowledge about natural resources
2. Realize the importance of ecosystem and biodiversity in growth of human civilization.
3. Understand the effects of environmental pollution and different strategies to mitigate it
4. Understand various environmental laws and societal issues related to the environment for the benefit of the community

Text Books/ Reference Books:

1. Henry J.G. and Heinke G.W. ***Environmental Science and Engineering.*** Prentice Hall of India. New Delhi.
2. Chandrasekhar M. ***Environmental Science.*** Hi-Tech Publishers.
3. Masters G.M. ***Environmental Engineering and Science.*** Prentice Hall of India, New Delhi.
4. Garg S.K. and Garg R. ***Ecological and Environmental Studies.*** Khanna Publishers, Delhi.
5. Chawla S. ***Environmental Studies.*** Tata McGraw-Hill Publishers, New Delhi.

CE21004	**Structural Analysis I** B.Tech (Civil Engg.) **Fourth** Semester (Professional Core)	**L-T-P-C** 3-0-0-3

	Course Content	**Hours**
Unit-1	**Concept of Structural Analysis:** Difference between determinate and indeterminate structures, degree of indeterminacy, open tree concept, forms of structures, loads and forces, different types of supports, basic equilibrium equations, principle of superposition.	**8**
Unit-2	**Statically Determinate Beams and Frames:** Different types of beams and frames, axial thrust, bending moment, shear force in beams and frames with concentrated load and distributed loads.	**8**
Unit-3	**Deflection and slope in beams:** Recapitulation of statically determinate beams, Slope and deflection calculation by unit load method.	**4**
Unit-4	**Strain energy and virtual work:** Evaluation of strain energy under axial- deformation, bending, shear and torsion; Castigliano's theorems; principles of virtual work and unit load method; Maxwell- Betti reciprocal theorem; Evaluation of deformation for different structures using energy principles, principle of least work, application of principle of least work with single degree of indeterminancy.	**8**
Unit-5	**Analysis of pin-jointed structures:** Different types of trusses, redundancy of trusses, method of joints, method of sections, deflection of joints, truss with single redundancy, Maxwell's reciprocal theorem, Betti's theorem and their applications	**6**
Unit-6	**Arches and Cables:** Detailed analysis of three hinge arches, introduction to two hinge arches, cables	**4**
	Total	**38**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the fundamental principles of structural analysis.
2. Evaluate force and deformation for various statically determinate structures.
3. Understand fundamentals of energy principles and their applications in structural analysis problems.
4. Solve problems with different types of structures, like arch, cable, truss

Text Books/ Reference Books:

1. Timoshenko and Young. Theory of Structural Analysis. McGraw-Hill International.
2. R.C. Hibbeler. Structural Analysis. Pearson Education.
3. C S Reddy. Basic Structural Analysis. Tata McGraw-Hill.
4. Norris and Wilber. Structural Analysis. McGraw-Hill International.

CE21006	Design of Structures I	L-T-P-C
	B.Tech (Civil Engg.)	4-0-0-4
	Fourth Semester (Professional Core)	

Prerequisites: Structural Analysis I (CE 21004)

	Course Content	Hours
Unit-1	**Introduction:** Limit state approach, working stress method, loads and structural behaviour for concrete members.	**8**
Unit-2	**Design of Beams:** Analysis of rectangular and T-sections, singly and doubly reinforced beams, shear, torsion, and bond design.	**12**
Unit-3	**Design of Slabs:** One-way and two-way slabs, flat slabs, staircases, and deflection checks, crack width calculation as per IS code.	**8**
Unit-4	**Basics in Steel Design:** Introduction to structural design and detailing, properties of structural steel, available materials and sections (steel tables). Limit states design concepts, loads on structures, bearing and friction type of bolts, welding, concentric and eccentric connections.	**12**
Unit-5	**Deign of Compression and Tension Members:** Tension members, compression members, laced and battened columns, splices, and column bases.	**8**
	Total	**48**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Design RC Beam member for flexural, shear and Torsional condition.
2. Design Reinforced Concrete slabs for serviceability condition.
3. Design the steel welding, concentric and eccentric connections.
4. Design of Tension members, compression members

Text Books/ Reference Books:

1. P.C. Varghese. Limit State Design of Reinforced Concrete. PHI, New Delhi
2. S.U. Pillai and D. Menon. Reinforced Concrete Design. Tata McGraw Hill.
3. A.K. Jain. Reinforced Concrete – Limit State Design. Nem Chand and Co.
4. IS: 456 – 2000. Indian Standard Code for RCC Design.
5. IS 800 General Construction in Steel - Code of Practice, Bureau of Indian Standards.
6. SP 6 Handbook for Structural Engineers, (1) Structural Steel Sections, Bureau of Indian Standards.
7. Limit State Design of Steel Structures, Duggal S. K., Tata McGraw Hill Education (India) Private Limited, 2014.
8. Limit State Design of Steel Structures, Chandra R. and Gehlot V., Scientific Publishers, 2009.
9. Fundamentals of Structural Steel Design, Gambhir, M.L., Tata McGraw-Hill Education, 2013.

CE21008	Geotechnical Engineering I	L-T-P-C
	B.Tech (CivilEngg.)	3-0-0-3
	Fourth Semester (Professional Core)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Formation and Properties of Soil:** Introduction; origin and types of soil; three-phase system; index properties of soil; aggregate properties of soil; identification and classification of soils; soil structure and clay mineralogy.	**8**
Unit-2	**Permeability:** Darcy's law of permeability; determination of coefficient of permeability; factors affecting permeability; equivalent permeability for stratified soil; flow nets – principles, construction and application; effective stress analysis; pressure diagrams; quick sand condition; piping; capillarity in soil; filtration criteria.	**4**
Unit-3	**Stress Distribution:** Stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area; influence factors; Isobars; Boussinesq's equation; Westergaard's equation; Newmark's influence chart; contact pressure under rigid and flexible area.	**4**
Unit-4	**Compaction:** Principle of compaction; light and heavy compaction; factors affecting compaction; characteristics of compacted soil; methods of field compaction; compaction specification and field control.	**3**
Unit-5	**Consolidation:** Compressibility; principle and types of consolidation; determination of consolidation parameters; Terzaghi's theory of one-dimensional consolidation; secondary consolidation; estimation of consolidation settlement.	**6**
Unit-6	**Shear Strength:** Mohr-Coulomb failure criterion; strength envelope; determination of shear strength parameters - direct shear test, triaxial shear test, unconfined compression test, vane shear test; shearing characteristics of sand and clay; pore pressure parameters; stress paths.	**8**
Unit-7	**Geology:** Introduction to geology; difference and relations between geology and geotechnology; significance of rock structures in engineering construction; RQD, RMR, RMi, RSR; influence of groundwater in civil engineering; concept of geophysical exploration; sources of construction materials in India.	**3**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Analyze the engineering properties of soil and rock mass and classify the soil.
2. Assess the response of the soil due to seepage and stress distribution.
3. Select between compaction and consolidation to modify soil as per the requirement.
4. Determine appropriate shear strength parameters considering geological formation and mechanics of soil.

Text Books/ Reference Books:

1. B. M. Das. Introduction to Soil Mechanics. Galgotia Publication.
2. B. C. Punmia. Soil Mechanics and Foundation Engineering. Dhanpat Rai & Sons.
3. G. Ranjan and A. S. R. Rao. Soil Mechanics. Dhanpat Rai & Sons.
4. Whitman and Lambe. Soil Mechanics. John Willey.
5. V. N. S. Murthy. Soil Mechanics & Foundation Engineering. Dhanpat Rai & Sons.

CE21010	Water Supply Engineering	L-T-P-C
	B.Tech (Civil Engg.)	3-0-0-3
	Fourth Semester (Professional Core)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Water supply systems:** Need for planned water supply schemes, Components of water supply system; Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards.	**6**
Unit-2	**Water demand:** Water demand for various purposes, Methods of population forecasting: arithmetic increase method, geometric increase method, incremental increase method, logistic curve method, design period, fire demand, factors affecting consumption and fluctuation of demand.	**5**
Unit-3	**Collection, conveyance and distribution of water:** Intakes, Types of pipes, Methods of water supply and distribution, Storage and distribution reservoirs, Method of layout, Pressure requirements, Power requirements of pumps, Hydraulic design of pumps and conduits.	**6**
Unit-4	**Primary treatment:** Screening, aeration, sedimentation and different types of settling phenomenon: theory of sedimentation, settling velocity, partial removal of lighter particles, coagulation flocculation: theory of coagulation, design of sedimentation tank and clariflocculator	**8**
Unit-5	**Filtration and disinfection of water:** filtration: theory of filtration, different mechanisms, types of filters, design of different filter units, disinfection: types of disinfection, chlorination: action of chlorine, types of chlorination, factors affecting chlorination, ozonation, water softening	**7**
Unit-6	**Advanced water treatment processes:** adsorption, ion exchange, membrane processes, advanced oxidation process	**4**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the basic concepts of water supply engineering and design aspects.
2. Characterize the water quality, estimate the water demand and quantity for proper water supply
3. Analyze and design water treatment methods for the community

Text Books/ Reference Books:

1. Davis ML & Cornwell DA. ***Introduction to Environmental Engineering (SIE).*** Tata McGraw Hill Publication
2. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, ***Water Supply Engineering.*** Laxmi Publications.
3. P. N. Modi. ***Water Supply Engineering.*** Standard Book House Publications.
4. H. S. Peavy, D. R. Rowe and G. Tchobanoglous. ***Environmental Engineering***. McGraw Hill Publication.
5. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.

CE21012	Hydraulic Engineering	L-T-P-C
	B.Tech (Civil Engg.)	3-0-0-3
	Fourth Semester (Professional Core)	

Prerequisites: Fluid Mechanics (CE 21003)

	Course Content	Hours
Unit-1	**Flow through Pipes and Pipe network systems:** Losses in pipes flow- major loss (Loss due to friction), Darcy Weisbach equation, Minor losses, Hydraulic gradient lines, Total energy lines, Pipes in series, Pipes in parallel, equivalent pipe, Siphon, Introduction to pipe networks, Components of water distribution systems, Simulation of network, Hardy-cross method, linear theory method, optimization of water distribution system.	**6**
Unit-2	**Laminar Flow and Turbulent Flow:** Types of fluid flow, laminar flow, laminar flow in pipe, and flow of laminar fluid between parallel plates, laminar-Turbulent transition, Reynolds decomposition of turbulent flow, intermittency, derivation of governing equation of turbulent flow, apparent stress or Reynold stress, Prandtl's mixing length hypothesis, Von Kármán constant.	**5**
Unit-3	**Dimensional Analysis and Hydraulic Similitude:** Dimensional- fundamental and derived qualities, dimensional homogeneity, methods of dimensional analysis- Rayleigh's method and Bucklingham's π Theorem, Similarity laws and model studies.	**5**
Unit-4	**Boundary layer theory:** Boundary layer theory- its thickness, momentum, boundary layer characteristics, equation for boundary layer along a flat plate, Laminar and turbulent boundary layers, Boundary layer separation.	**4**
Unit-5	**Flow around submerged bodies:** Drag and lift- types of drag, dimensional analysis of drag and lift, drag on flat plate sphere and cylinder, Karman trail, circulation, lift on a cylinder with circulation- Magnus effect.	**4**
Unit-6	**Open Channel Flow:** Channel Characteristics and parameters, Uniform flow, Critical flow, Specific Energy concepts, Gradually Varied Flows, Rapidly Varied flow with special reference to hydraulic jump, most efficient channel sections.	**6**
Unit-7	**Hydraulic Machines:** Classification of turbines, Pelton wheel; Francis turbine; Kalpan turbine; work done, power, heads and efficiencies of turbines. Classification of pumps, work done, heads and efficiencies of centrifugal pump, minimum starting speed, multi stage pump; Reciprocating pump-classification, discharge, work done and power.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Analyse and design pipe flow under different flow conditions and compute losses in pipe networks.
2. Apply fundamental knowledge of fluid flow and boundary layer theory and determine lift and drag forces on a submerged body.
3. Design and analyse flow parameters for an open channel and evaluate conditions for the most economic section.
4. Utilize dimensional analysis and hydraulic similitude to design, model, and predict prototype behavior.
5. Determine characteristics and efficiency of hydraulic machines (turbines and pumps).

Text Books/ Reference Books:

1. P.N. Modi & S.M. Seth. Hydraulics and fluid Mechanics including Hydraulics Machines (in SI Units). Rajsons Publication Pvt. Ltd., 21st edition.
2. John F. Douglas, Janusz M. Gasiorek and John A. Swaffield. Fluid Mechanics. Pearson Education.
3. K L Kumar. Fluid Mechanics. S. Chand& Co.
4. Streeter & Wily. Fluid Mechanics. McGraw Hill.
5. R K Bansal. Fluid Mechanics and hydraulic mechanics. Laxmi Publisher.
6. S K Som and G. Biswas. Introduction to fluid mechanics and fluid machines. Tata Mc Graw Hill.
7. R. K. Rajput. Fluid Mechanics and Hydraulic Machines. S. Chand Publishing

CE22002	**Field Surveying** B.Tech (Civil Engg.) **Fourth** Semester (Professional Core)	**L-T-P-C** **0-0-4-2**

Prerequisites: Surveying (CE 11002)

Unit	Course Content	Hours
Unit-1	**Introduction to Field Surveying and Reconnaissance:** a. Objectives and scope of field surveying b. Reconnaissance survey and its importance in project planning c. Selection of survey stations d. Field safety practices and ethical responsibilities e. Care, handling, and adjustment of surveying instruments f. Field book types, entries, and standard recording practices.	4
Unit-2	**Linear Measurements and Chain Survey:** a. Distance measurement using chain and tape b. Chain survey by perpendicular offsets c. Chain survey by oblique offsets	4
Unit-3	**Compass Survey:** a. Measurement of bearings using prismatic compass b. Local attraction and correction of bearings c. Open and closed traverse surveys	4
Unit-4	**Plane Table Survey:** a. Plane table surveying methods: i. Radiation ii. Intersection iii. Resection	8
Unit-5	**Levelling:** b. Differential levelling, c. Profile and cross-section levelling, d. Reciprocal levelling using dumpy/auto level	8
Unit-6	**Contouring:** a. Preparation of contour maps using (a) direct and indirect methods	4
Unit-7	**Theodolite Survey:** a. Measurement of horizontal angles: i. Repetition method ii. Reiteration method b. Measurement of vertical angles using theodolite c. Theodolite traversing	8
Unit-8	**Tacheometric Surveying:** a. Determination of horizontal distance and elevation difference using the stadia method of tacheometric surveying	4
Unit-9	**Modern Surveying Techniques:** a. Introduction and field demonstration of Total Station b. Introduction and field demonstration of DGPS	4
	Total	**48**

Course Outcomes (COs)

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

1. Plan and conduct field surveys using appropriate surveying techniques
2. Accurately measure distances, angles, and elevations under field conditions
3. Apply tacheometric principles for height and distance determination
4. Identify, analyze, and minimize common surveying errors
5. Maintain standard field records and interpret survey data for engineering applications
6. Integrate conventional and modern surveying methods for real-world projects.

Text Books / Reference Books

1. B.C. Punmia, Surveying, Vol. I & II, Laxmi Publications.
2. S.K. Duggal, Surveying, Tata McGraw-Hill.

CE22004	Highway Engineering Laboratory	L-T-P-C
	B.Tech (Civil Engg.)	0-0-3-1.5
	Fourth Semester (Professional Core)	

Prerequisites: Highway Engineering (CE 21007)

	Course Content	Hours
Unit-1	**Tests on Subgrade Soil** :	
	Experiment 1 : Determination of California Bearing Ratio (CBR) of subgrade soil	**6**
Unit-2	**Tests on Aggregate:**	**18**
	Experiment 2: Determination of Particle Size Distribution of Aggregate by Sieve Analysis Experiment 3: Determination of Aggregate Crushing Value Experiment 4: Determination of Aggregate Impact Value Experiment 5: Determination of Resistance to Abrasion of Aggregate Using Los Angeles Abrasion Test Experiment 6: Determination of Shape test of Aggregate (Flakiness and Elongation Index) Experiment 7: Determination of Soundness of Aggregate Experiment 8: Determination of Stripping Value of Bituminous Mixes (Stripping Test) Experiment 9: Determination of Water Absorption of Aggregate Experiment 10: Determination of Specific Gravity of Aggregate	
Unit-3	**Tests on Bitumen :**	**12**
	Experiment 11: Determination of Penetration Value of Bitumen Experiment 12: Determination of Ductility of Bitumen Experiment 13: Determination of Softening Point of Bitumen by Ring and Ball Method Experiment 14: Determination of Viscosity of Bitumen Experiment 15: Determination of Specific Gravity of Bitumen Experiment 16: Determination of Flash and Fire Points of Bitumen Experiment 17: Determination of Solubility of Bitumen	
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the different techniques for testing highway materials.
2. Evaluate the suitability of different materials for highway construction as per relevant IRC/IS specifications.
3. Prepare structured laboratory test reports and draw engineering conclusions based on experimental results.
4. Understand and apply appropriate laboratory safety practices while conducting laboratory tests.

Text Books/ Reference Books:

1. S.K. Khanna and C.E.G. Justo. Highway Material Testing. New Chand & Bros.
2. IS:2720-Part 16. Methods of Test for Soil: Laboratory Determination of CBR. Bureau of Indian Standards (BIS).
3. IS:73, 2013. Paving Bitumen- Specification (Fourth Revision), Indian Standard.
4. IS:1201-1220, 1978. Methods for Testing Tar and Bituminous Materials. Bureau of Indian Standards, 1st Revision.
5. IS:2386-Part I-V, 1963. Indian Method of test for aggregate for concrete. Bureau of Indian Standards (BIS).
6. MoRTH, 2013. Specifications for Road and Bridge Work. Indian Roads Congress.

DEPT. OF COMPUTER SCIENCE & ENGINEERING

Algebra and Calculus

	B. Tech (For ALL Branches)	**L-T-P-C**
MA11001	**First Semester (Professional Core)**	**3- 0-0- 3**

Pre-requisites: *Matrix and determinants, Limit, Continuity, Differentiability, Basic idea of integration*.

	Course Content	**Hours**
Unit-1	**Linear Algebra:** R^n as a vector space, Linear dependence and independence of vectors in R^n, Basis & Dimension; Rank and nullity of a matrix, Elementary transformations, Consistency of a System of linear equations & their solutions by Direct Methods: Gaussian Elimination method, Gauss-Jordan method; Eigenvalues & Eigenvectors, Hermitian, Skew-Hermitian & Unitary matrices, Cayley-Hamilton's theorem & its applications.	**8**
Unit-2	**Infinite Series:** Definition of Sequence & Infinite Series, Convergence & Divergence of real Sequence & Infinite Series, Tests of Convergence of positive term infinite series: Comparison Test, D' Alembert's Ratio Test, Raabe's Test, Cauchy's root Test, Integral Test, Alternating Series, Leibnitz's Test (all tests without proofs).	**8**
Unit-3	**Differential Calculus:** Successive Differentiation, Leibnitz's Theorem, Rolle's theorem, Lagrange's & Cauchy's Mean value theorems, Curvature, Radius & centre of curvature, Partial differentiation, Euler's theorem, Jacobian, Taylor's & Maclaurin's Theorems with Lagrange's form of remainder for functions of one and two variables, Expansions of functions of one and two variables, Extreme values for functions of two or more variables, Lagrange's method of undetermined multipliers.	**14**
Unit-4	**Integral Calculus:** Reduction Formulae. Application of integrals in Quadrature, Rectification, Volume and surface area of solids of revolution.	**6**
		Total: 36

Course Outcomes:

On completion of this Course,

1. The students will be able to apply the consistency concepts, eigenvalues, and eigenvectors concepts in engineering problems.

2. The students will be able to apply the concept of convergence of infinite series in mathematical & engineering problems.

3. The students will be capable of applying the knowledge of differentiation in the expansion of functions and optimizing functions appearing in engineering and daily life problems.

4. The students will be able to apply knowledge of integration in finding area, length of arc of curves, volume, and surface area appearing in engineering and real-life problems.

PH11001	Wave Mechanics and Optics	L-T-P-C
	B.Tech (CE, CSE and ME)	3-0-0-3
	First Semester (Common)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Waves and Oscillation:** Introduction to Vibrations and Oscillations, Review on Free Oscillations, Damped motions -under damping -Logarithmic decrement, relaxation time and Q-Factor, overdamping and critical damping, Forced oscillations with damping - Steady state solution and its frequency response, Power absorbed and dissipation in forced oscillator, Resonance- amplitude, velocity and power- sharpness of resonance.	**7**
	Coupled oscillations, introduction of normal modes and normal coordinate and their physical significance- general solutions, wave equation in one dimension, Characteristics and solution, superposition, travelling and standing waves, phase and group velocity.	**5**
Unit-2	**Electromagnetic Waves:** Vector Calculus : Scalar and Vector Fields – Differential calculus, Del operator, Gradient, Divergence and Curl, Product rules, Second Derivative with Del operator, Laplacian operator –Line, Surface and Volume Integrals (definition), Fundamental theorem of Integral calculus qualitatively (Gradient, Divergence and Curl)	**4**
	Electromagnetic theory: Maxwell's equations, Displacement current, Maxwell's equation in matter, Electromagnetic waves: The wave equation, Sinusoidal waves, Polarization EM waves in vacuum, Monochromatic plane waves, Energy in electromagnetic waves, EM waves in conductors, Conservation laws: continuity equation, Poynting's theorem, boundary conditions, reflection and transmission at normal incidence.	**6**
Unit-3	**Wave Optics:** Wave fronts- Huygens Principle, Temporal and spatial coherence, Division of wave front and amplitude, intensity distribution in an interference pattern, Young's double slit experiment, diffraction - single slit, double slit, grating, polarization – polarisation by reflection, refraction and scattering.	**6**
Unit-4	**Modern Physics and Quantum Mechanics:** Failure of classical physics, qualitative review of relevant experiments such as blackbody radiation, photo- electric effect, Compton scattering, de Broglie matter waves and Davison-Germer experiment, Uncertainty principle, Wave packet.	**3**
	Basic postulates of quantum mechanics, Wavefunction, normalization of wave function, quantum mechanical operators, probability density, expectation value, Development of Schrödinger equation (time dependent & time independent), particle on a 1D infinite potential well, potential barrier and quantum tunnelling.	**5**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the fundamental concepts of **classical and quantum wave mechanics.**
2. Interpret fundamental physical laws and principles for relevant engineering applications.
3. Apply principles of physics to solve numerical problems in **classical and quantum wave mechanics**.
4. Analyze various physical phenomena using appropriate concepts such as superposition, wave-particle duality, polarization, and quantization.
5. Evaluate the validity and limitations of theories in waves, electromagnetism, and quantum physics through comparison with experimental observations.

Text Books/ Reference Books:

1. Vibration and waves, A. P. French, CBS Publishers
2. Introduction to Electrodynamics, D. J. Griffiths, *Pearson*
3. *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*, Resnick and Eisberg, John Wiley & Sons
4. Quantum Mechanics, D. J. Griffiths, Cambridge University Press
5. Principles of Optics, Max Born and Emil Wolf, Cambridge University Press
6. Optics, Ajoy Ghatak, ata Mcgraw-Hill Publishing Company

CS11001

Programming and Data Structure **L-T-P-C**

B.Tech (CE, CSE and ME) 2-0-2-3

First Semester (Professional Core)

Prerequisites: Nil

		Hours
Unit-1	**Introduction:** Basic operations of digital computers, basic concepts of integer and floating point number representation, algorithm and efficiency.	**4**
Unit-2	**(Elements of C Programming)**: Data types, variables, operators, expression and assignment statements, conditional and branch statements, Loops and iteration statements, 1-d arrays, functions and parameter passing, recursions, Strings, pointers and structures, dynamic memory allocations.	**12**
Unit-3	**(Linear Data Structures): 2-d arrays, linked lists, stacks, and queues.**	**10**
Unit-4	**(Searching and Sorting):** Linear and binary search, bubble sort, insertion sort, merge sort, quick sort.	**8**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Learn the syntax and semantics of C programming language.
2. Test and execute the programs and correct syntax and logical errors.
3. Implement conditional branching, iteration and recursion.
4. Use basic data-structures (arrays, link lists, stacks, and queues) to formulate algorithms and programs.
5. Understand and analyse different searching sorting techniques.

Text Books/ Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
6. R. G. Dromey, How to Solve it by Computer, Prentice-Hall of India.

HS11001/11002	**English for Technical Communication** Ist / IInd Semester (Professional Core)	L-T-P-C 2-0-2-3

	Course Content	**Hour**
Unit 1	**Organizational Communication:** Introduction to the Course Importance and Relevance of the Course Why Communicative English? What is Communication? Barrier to Communication Non-verbal/Oral/(In)Formal Communication	6
Unit II	**Reading Comprehension** **Ignited mind** (Two Chapters) by APJ Abdul Kalam Essay: **Religion of the forest** by Rabindranath Tagore Essay: **Is Google Making Us Stupid?** by Nicholas Carr **The Story of My Sanskrit** (A chapter) by Kumud Pawde	**8**
Unit III	**Written Communication:** Letter Writing Cover Letter CV/Resume Writing Précis writing Essay Writing Report Writing Email Etiquettes Idioms and Phrases One Word Substitution Technical Communication Documentation and Minutes of Meeting Debate	**12**
Unit IV	**Oral Communication:** Job interviews (Process, stages in job interviews, types of interviews, preparation, use of verbal and non-verbal cues, mock interview sessions) Group Discussion (Features, uses-recruitment, selection, stages, positive and negative roles, organizational GD's (Brain Storming, Normal Group techniques, Delphi Technique)) Pictorial Essays.	**6**

Course Outcomes:

1. Students will recall the content and make inferences on organizational communication setup
2. Students will be able to read faster and comprehend better
3. Students will be able to express their ideas and thoughts clearly and systematically in the form of essays and reports
4. Students will be able to conduct short meetings with the skill to draft simple and short minutes of the meeting.
5. Students will demonstrate the ability to face the employment selection and answer interview questions, and they will be able to participate in group discussions confidently and assertively

Reference Books:

1. Barun K. Mitra & Basundhara Mitra, *Personality Development and Soft Skills.* Oxford University Press, 2024.

2. Meenakshi Raman & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press, 2015. https://d.docs.live.net/0af95281db477321/Desktop/question%20papers%20NITS/Technical%20Communication.pdf

3. Michael Swan. *Practical English Usage*. Oxford University Press, 2016.

4. Nilanjana Gupta. *English for All*. Macmillan Publishers India Ltd, 2011.

5. S. Miglani & S. Goyal. *English for Professionals- A Practical Book of Communication Skills in English*. Vayu Education of India, 2010.

6. Sanjay Kumar & Pushp Lata. *Communication Skills*. Oxford University Press, 2015.

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CS11003	Foundation of Data Science	L-T-P-C
	B.Tech (Computer Science & Engg.)	3-0-0-3
	First Semester (Professional Core)	

Prerequisites: Nil

		Hours
Unit-1	**(Introduction to Data Science):** A brief introduction to data – structured, unstructured, semi-structured, data sets & patterns, Brief history of Data Science, Introduction to Data Science, Importance of Data Science, Differences between AI, ML, DL, Data Science & Data Analytics, Real world applications of data science, Steps in data science process.	**8**
Unit-2	**(Statistical Foundations of Data Science):** Elements of descriptive statistics, averages, dispersion, skewness, quantiles; graphical displays, pie charts, bar charts, histograms, scatter plots, box plots, steam and leaf plots. Axioms of probability, conditional probability, independence, random variables, probability distributions (both discrete and continuous), and expected values .	8
Unit-3	**(Data Collection and Preprocessing):** Data sources and types of Data acquisition; Data cleaning - Missing Values Noisy Data, Data Cleaning as a Process, Data Integration, Data Reduction, Data transformation and Data Discretization. Introduction to Data Exploration and Data Visualization.	7
Unit-4	**(Classification Models and Cluster Analysis):** Classification - Basic Concepts, Decision Tree Induction, Bayes Classification Methods- Naıve Bayesian Classification, Rule-Based Classification, Lazy Learners- K-Nearest-Neighbour Classifiers; Cluster Analysis, Partitioning Methods, Hierarchical Methods, Agglomerative versus Divisive Hierarchical Clustering, Distance Measures in Algorithmic Methods. Density-Based Methods – DBSCAN. **(Evaluation):** Evaluating model performance-Confusion matrices, Precision and recall, Sensitivity and specificity, F-measure, ROC curves, Cross validation, K-fold cross validation, Bootstrap sampling.	15

Text Books/ Reference Books:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
2. Sanjeev J. Wagh, Manisha S. Bhende, and Anuradha D. Thakare, Fundamentals of Data Science, CRC press
3. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017.
4. Cathy O’Neil and Rachel Schutt, “Doing Data Science, Straight Talk From The Frontline”, O’Reilly, 2014.
5. Brett Lantz, Machine Learning with R, Second edition, PackT publishing 2015

Course Outcomes (COs):

After completion of the course, students will be able

1. To understand and apply statistical and probabilistic concepts and methods of data science for data analysis.
2. To understand and extract effective insights of data using data exploration and data visualization techniques.
3. To gain skills in data collection and data pre-processing using effective data management.
4. To learn and apply machine learning algorithms for building predictive models and solving problems.

CE12001	Computer Aided Drawing and Graphics	L-T-P-C
	B.Tech (CE, CSE and ME)	1-0-2-2
	First Semester (Professional Core)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction to Engineering Drawing:** Importance and application in engineering, general instruction regarding instruments, dimensions and lettering, types of lines, concept of scales, geometrical constructions.	**9**
Unit-2	**Orthographic Projections:** Introduction to orthographic projections, elements and angles of projections, projection of points, projection of straight lines, projection of planes, conversion of pictorial views of objects into orthographic projections.	**6**
Unit-3	**Projections of Solids:** Orthographic projection of regular solids: Cubes, prisms, pyramids, cylinders, cones, tetrahedrons. Projections of frustum of solids.	**6**
Unit-4	**Isometric View:** Principles of isometric view, isometric view of simple objects, conversion of orthographic projections into isometric views.	**3**
Unit-5	**Introduction to CAD:** Introduction to CAD and advantage of CAD in engineering field, windows and system of AutoCAD, drawing area, command line, model space, layout space and work space. Drawing settings - Unit and limits, pan and zoom. Drafting settings - Grid, object snap, ortho on/off.	**3**
Unit-6	**Drafting Tools in CAD:** Tools and short commands for line, polyline, circle, polygon, arc, rectangle, ellipse, elliptical arc, hatch, spline, construction line, multiline, multiline style, point. Isometric drawing in AutoCAD.	**3**
Unit-7	**Modifying Tools in CAD:** Tools and short commands for move, rotate, trim, extend, copy, mirror, fillet, chamfer, erase, explode, offset, lengthen, edit polyline (fill on/off), edit hatch, edit array, edit multiline, align, break, point break and join. Object properties – Properties of windows, colour, linetype, linetype scale, line weight and match properties.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

5. Produce geometric constructions with appropriate scale and dimension.
6. Apply the skill for preparing detail 2D drawing of engineering objects.
7. Visualize and develop the 3D view of engineering objects.
8. Create basic 2D drawings using AutoCAD software.

Text Books/Reference Books:

5. Bhatt, N. D., Engineering Drawing: Plane and Solid Geometry, 54th Edition, Charotar Publishing House Pvt. Limited, 2023.
6. Venugopal, K., and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, 6th Edition, New Age International, New Delhi, 2022.
7. Narayana, K. L., and Kannaiah, P., Text book on Engineering Drawing, 2nd Edition, Scitech Publishers, 2011.
8. Gopalakrishna, K. R., and Gopalakrishna, S., Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017.

PH12001	**Physics Laboratory**	**L-T-P-C**
	B.Tech (CE, CSE and ME)	0-0-2-1
	First Semester (Common)	

Prerequisites: None

List of Experiments

1. To calibrate an ammeter with the help of a potentiometer.
2. To study the twist in the thin rod by statical method using Barton's horizontal apparatus and thus to determine the modulus of rigidity of the material of the rod.
3. To study the bending of a beam supported at its ends and loaded at the middle and thus to determine the Young's modulus of the material of the beam.
4. To determine the refractive index of the material of a given prism using a spectrometer.
5. To determine frequency of a transverse waves and mass per unit length of given wire by using sonometer apparatus.
6. To study the charging and discharging of a capacitor and hence to determine it's time constant.
7. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
8. To determine the wavelength of sodium light using single slit diffraction.
9. Comparison of two low resistances by using Meter Bridge.

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply the various experimental procedures and techniques for physics related experiments.
2. Use the different measuring devices and setups to record the data with precision.
3. Apply the underlying physical concepts/theories to obtain quantitative results.
4. Evalute and analyze the error in the experiment with respect to the standard values of physical quanties.
5. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Text Books/ Reference Books:

1. University Practical Physics, D. C. Tayal, HPH Publisher
2. B.Sc. Practical Physics, Samir Kumar Ghosh, New Central Book Agency

Numerical and Mathematical Methods for Differential Equations

MA11002

B. Tech. (For CE, CSE and ME)

Second Semester (Professional Core)

L -T-P- C

3- 0 - 0 - 3

Pre-requisites*: Linear Algebra and Calculus.*

	Course Content	**Hours**
Unit-1	**Ordinary Differential Equation:** Exact differential equation of first order, integrating factors. Second & higher order linear differential equations with constant coefficients, Homogeneous (Cauchy's) linear differential equation, Method of variation of parameters.	**8**
Unit-2	**Partial Differential Equation:** Formation of partial differential equations (PDE), Solution of PDE by direct integration, Lagrange's linear equation & its solution, Non-linear PDE of first order, Charpit's method of solution, Homogeneous and Non-homogeneous linear equations with constant coefficients. Second-order PDE with constant coefficients, solution by the method of separation of variables.	**9**
Unit-3	**Laplace and Fourier Transform:** Basic idea of Integral Transform, Laplace and inverse Laplace transforms & their properties, Convolution Theorem, Solution of ODE by Laplace transform method. Periodic functions, Fourier series representation of a function, half-range series, and the Fourier integral formula. Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting, and time shifting properties. Convolution theorem.	**10**
Unit-4	**Numerical Analysis:** Finite difference, Interpolation: Newton's forward and backward interpolation formulae, Lagrange's formula. Solution of algebraic and transcendental equations: Fixed point Iteration method, Bisection, Secant, Newton-Raphson Method. Solution of a system of linear equations by Iterative Methods: Gauss-Jacobi's method & Gauss-Seidel method. Solution of ODE: Picard's method, Taylor series method, and Runge-Kutta method (Fourth order).	**9**
		Total: 36

Course Outcomes:

On completion of this course

1. The students will be able to apply ordinary differential equations in engineering and real-life problems.
2. The students will be capable of applying partial differential equations in engineering and real-life problems.

3. The students will be able to apply the Laplace/Fourier transform in engineering problems.
4. The students will be able to apply numerical techniques in engineering problems.

Course Objectives:

1. To enable the students to understand the basic ideas of ordinary differential equations and their solutions, and also the application of series in solving ordinary linear differential equations.
2. To enable the students to understand the basic ideas of partial differential equations and their solutions, and also the applications in IVP & BVP.
3. To enable the students to solve ODE/PDE by using Laplace and Fourier transforms.
4. To enable students to clear their basic concept of solutions of algebraic/transcendental equations and ODE by numerical techniques.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10^{th} Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44^{th} Edition, Khanna Publishers, 2017

Reference Books:

1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand & Company Ltd, 2020.
2. G.F. Simmons, Differential Equations, Tata McGraw-Hill, 2nd edition, 2017.
3. M. K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical Method for Scientific and Engineering Computation, 2022.
4. S. Sreenadh, Fourier Series and Integral Transforms, S. Chand Publication, 2014.

CY11002	Engineering Chemistry	L-T-P-C
	B.Tech (CE, CSE and ME)	3-0-0-3
	Second Semester	

Prerequisites: None

	Course Content	Hours
Unit-1	**Polymer & Composite materials:** Classification of polymers, methods of polymerization, thermosetting and thermoplastic polymers, conducting and biodegradable polymers, synthesis, properties and applications of polyethylene, chloropolyvinyl chloride (CPVC), Composite materials: Classification and basic requirement of composite materials, applications.	**6**
Unit-2	**Fuel & Petroleum:** Fuel: Introduction, classification of fuel, calorific value (HCV and LCV), determination of calorific value by bomb calorimetry, bio-fuels. Petroleum, knocking, octane number and cetane number, petrochemical.	**6**
Unit-3	**Nanomaterials & Green Chemistry:** Nanomaterials: Introduction; synthesis, characterization and applications of nanomaterials. Principles and application of Green Chemistry.	**6**
Unit-4	**Electrochemistry & Corrosion:** Electrode potentials and its relevance to oxidation and reduction, types of electrodes, galvanic cell, measurement of EMF and application of EMF, types of reference electrodes, determination of pH. Dry Cells, lead acid cell and Fuel Cells: Construction, reaction, advantages and applications. Corrosion: Types of corrosion, factors affecting corrosion and corrosion control.	**6**
Unit-5	**Water & its treatment:** Sources of impurities in water; hardness in water and its disadvantages; boiler scale and its prevention; caustic embrittlement; boiler corrosion: treatment of water at industrial and domestic level; biological oxygen demand (BOD) and chemical oxygen demand (COD) and their significance.	**6**
Unit-6	**Spectroscopy:** Basics of spectroscopy, electromagnetic spectrum, Basic principles of IR, UV-Visible and NMR spectroscopy, Application of IR, UV-Visible and NMR spectroscopy in structure elucidation and material characterization.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the properties and applications of polymers, composites, petroleum-based fuels for engineering and industrial use.
2. Apply the concepts of nanomaterials and green chemistry in the development of sustainable engineering solutions.
3. Analyze electrochemical processes and corrosion mechanisms to propose suitable mitigation techniques.
4. Assess water quality and treatment methods, and interpret spectroscopic data for material analysis.

Text Books/ Reference Books:

1. Jain, P.C., and Jain, M., Engineering Chemistry (2025), Dhanpat Rai Publishing Company
2. Chawla, S., Engineering Chemistry (2019), Dhanpat Rai Publishing Company
3. Glasstone, S., Physical Chemistry (1948), McMillan India
4. Dey, A. K., Environmental Chemistry (2003), New Age International
5. Rao, C. N. R., Müller A., Cheetham, A. K. (Editor), The Chemistry of Nanomaterials Synthesis, Properties and Applications, Chemistry of Nanomaterials (2004) (Wiley-VCH)

ME11002	Engineering Mechanics	L-T-P-C
	B.Tech (CE,CSE and ME)	2-1-0-3
	Second Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	Equivalent Force System, Equilibrium of Rigid Bodies, Law of Coulomb friction: Applications of dry friction in wedge and belt.	**9**
Unit-2	Equilibrium of simple plane trusses. Analysis of trusses by the method of joints and method of section. Principle of virtual work, Simple applications of Principle of virtual work for rigid bodies in static equilibrium.	**9**
Unit-3	Centroid of simple and composite plane figures. Pappus theorem and its applications. Area moment of inertia of simple and composite figures, Perpendicular axis theorem. Parallel axis theorem, Polar moment of inertia.	**6**
Unit-4	*Kinematics of particles:* Rectilinear motion of particles, plane curvilinear motion of particles in different coordinate systems, constrained motion of connected particles. *Plane kinematics of rigid bodies:* Translation of a rigid body in plane motion, rotation of rigid bodies about a fixed axis. *Kinetics of particles:* Applications of Newton's laws of motion, D'Alembert's principle, Principle of work-energy and Impulse-momentum in particle dynamics, Direct central impact and oblique central impact. *Plane kinetics of rigid bodies:* Equation of plane motion of a rigid body, Principle of work-energy in plane motion of a rigid body.	**12**
	Total	**36**

Course Outcomes (COs):

Upon the completion of this course, the students are expected

6. To build a fundamental understanding of static equilibrium in particles, rigid bodies, and friction, and apply it to solve related engineering problems.
7. To develop the ability to analyze simple plane trusses and apply the principle of virtual work to systems in static equilibrium.
8. To apply the theorem of Pappus. Parallel axis theorem and Perpendicular axis theorem.
9. To apply the concept of centroid and moment of inertia in analyzing the simple and composite figures.
10. To develop the ability to apply for solving the practical problems on kinematics and kinetics of motion of particles and rigid bodies.

Text Books:

6. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Statics, John Wiley & Sons, Inc; 3/e.
7. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Dynamics, John Wiley & Sons, Inc; 3/e.
8. F. P. Beer, Jr., E. R. Johnston, E. R. Eisenberg, P. J. Cornwell, D. Mazurek. Vector Mechanics for Engineers- Statics & Dynamics, McGraw-Hill Higher Education; 9/e.
9. 1. H. Shames, Engineering Mechanics - Statics and Dynamics, 4lh edition, Prentice-Hall of India.
10. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati. Engineering Mechanics, McGraw Hill Education; 5/e.

Reference Books:

3. S. Timoshenko, D.H. Young, Engineering Mechanics, 4th edition, McGraw- Hill.
4. R.C. Hibbeler. Engineering Mechanics - Statics & Dynamics, Pearson Education, 4/e.

EE11002	Electrical and Electronics Science	L-T-P-C
	B.Tech (CE, CSE and ME)	3-0-0-3
	Second Semester (Professional Core)	

Prerequisites: Nil

	Course Content	Hours
Unit-1	Electrical safety: Definition, precautions D.C. Circuit & Networks: KVL and KCL, Superposition Theorem, Thevenin's and Norton's Theorems, Maximum power transfer theorem	**4**
Unit-2	A.C. Circuit: A.C. Fundamentals, phasor representation and algebra, Series R-L, R-C and R-L-C circuits, power calculations in A.C. circuit, phasor diagrams. Balanced Star-Delta connections, phase and line currents and voltages and their relations	**6**
Unit-3	Measuring instruments: Ammeter, voltmeter, wattmeter, energy meter – types & connection, concepts of grounding and earthing	**3**
Unit-4	Electrical Machines: D.C machine fundamentals and Transformer (Brief construction, types, working principle, voltage equation and application), 3-phase induction motor (Brief construction, principle, types, applications).	**5**
Unit-5	Introduction to Electronic devices, **Diode:** Basic structure and operating principle, **Diode Applications:** rectifier circuits (half-wave and full-wave rectifier), voltage regulator using Zener diode, clipper circuits, clamper circuits	**5**
Unit-6	**BJT:** Basic structure, operation of transistor in active and saturation mode, DC analysis. **MOSFET:** Introduction to MOSFET Operation and characteristics.	**5**
Unit-7	**Operational Amplifier (Op-Amp):** Ideal op-amp, inverting amplifier, non-inverting configuration, transfer characteristics, op-amp applications like difference amplifier, summing amplifier, integrator, and differentiator.	**3**
Unit -8	**Basic Digital Electronics:** Logic gates, Boolean algebra, De-Morgan's theorem, K-Map, combinational circuits like adder, multiplexer, and demultiplexer.	**5**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the basic structure and operating principle of electronics devices and analyse DC and AC networks.
2. Measure different electrical quantities in simple 1-phase and 3-phase circuits.
3. Classify the electrical machines and the electronics devices; explain their working principles, characteristics and applications.
4. Design and implement simple analog and digital electronic circuits.

Text Books/ Reference Books:

1 Gupta, J. B., *Basic Electrical Engineering*, S. K. Kataria & Sons.
2 Husain, A., and Ashfaq, H., *Basic Electrical Engineering*, Dhanpat Rai & Co.
3 Nashelsky, L., and Boylestad, R., *Electronic Devices and Circuit Theory*, 10th Edition, Pearson India.
4 Kumar, A. Anand, *Fundamentals of Digital Circuits*, 4th Edition, PHI.

CS11004	Discrete Structure	L	T	P	C
	B.Tech (CSE)	3	0	0	3

Prerequisite: Nil Second Semester (Core)

		Hours
Unit-1	**Logic**: Propositional logic and its applications; Propositional equivalences; Predicates and Quantifiers; Rules of inference; Introduction to Proofs; Proof Methods; Proof by Mathematical Induction (Weak and Strong).	**8**
Unit-2	**Set theory, Functions and Algebraic Structures**: Sets, operations on sets, cardinality, inductive definition of sets and proof by induction; Relations, representation of relations, properties of relations, equivalence relations and partitions; Partial orderings; Posets; Well-ordered sets. Mappings; Injection and Surjection; Composition of functions; Inverse functions; Special functions; recursive function theory. Definition and elementary properties of groups; semigroups; monoids; rings; fields, vector spaces; lattices and Boolean Algebra.	**12**
Unit-3	**Elementary combinatorics**: Basic Counting Principles; Permutations and Combinations; Binomial Coefficients and Identities; Generalized Permutations and Combinations; Sterling's number of the second kind; Pigeon-hole Principle and its application; Inclusion-Exclusion Principle and its application; Recurrence Relations; Solving Linear Recurrence Relations; Generating Functions; Catalan Numbers; Fibonacci numbers.	**10**
Unit-4	**Number Theory**: Divisibility and Modular Arithmetic; Integer Representations and Algorithms; Prime numbers and related Theorems; Greatest Common Divisors; Euclid's Algorithm; Solving Congruence; Applications of Congruence, Fermat's Little Theorem, The Chinese Remainder Theorem; Applications in Cryptography.	**10**

Books:

1. K. H. Rosen , *Discrete Mathematics and Applications,* TMH
2. C. L. Liu, D. P. Mohapatra*, Elements of Discrete Mathematics* , McGraw-Hill
3. J. L. Mott, A. Kandel, T. P. Bake, *Discrete Mathematics for Computer Scientists and Mathematicians* , PHI
4. J. P. Tremblay, R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, McGraw-Hill

Course Outcomes (COs):

At the end of the course, students are expected to

1. Understand the interpretations of propositional and predicate logic and express mathematical properties formally via the formal language of propositional and predicate logic.
2. Learn and manipulate basic mathematical objects such as sets, functions, and relations and verify simple mathematical properties that these objects possess.
3. Understand the elementary combinatorics and recurrence relations and apply combinatorial ideas to practical problems.
4. Learn the concepts of number-theory and modular arithmetic essential for the mastery of some of the higher-level computer science courses and solving engineering problems.
5. Use different methods of proofs to formulate and solve applied problems, to analyze and interpret algorithms and functions and logically verify them.

ME12002	Workshop Practice	L-T-P-C
	B.Tech. (CE, CSE and ME)	0-0-3-1
	Second Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	General safety precautions in workshop and introduction.	**3**
Unit-2	**Carpentry Shop:** Safety precaution, Kinds of wood and timber, Application of timber as per their classification, Carpentry hand tools and machines, Different types of carpentry joint, Demonstration of wood working machine like, band saw, circular saw, thickness planner, wood working lathe, surface planners, etc.	**6**
Unit-3	**Welding Shop:** Safety precaution in welding shop, Introduction to gas and arc welding, Soldering and brazing etc. Welding equipment and welding material.	**6**
Unit-4	**Fitting Shop:** Safety precaution, Introduction to fitting shop tools, equipment, Operation and their uses, Marking and measuring practice.	**6**
Unit-5	**Machine Shop:** Safety precautions, Demonstration and working principles of some of the general machines, like lathe, shaper, milling, drilling, grinding, slotting etc., General idea of cutting tools of the machines.	**6**
	Total	**27**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Know the importance of general safety precautions on different shop floors.
2. Identify the basics of tools and equipments used in fitting, carpentry, sheet metal, machine, welding and smithy.
3. Do fabrication of wooden joints and understand joining of metals.
4. Make metal joints and sheet metal work.
5. Understand the basics of removal of material from work piece surface to attain specific shape.
6. Familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.

Text Books/ Reference Books:

1. S K Hajra Choudhury, A K Hajra Choudhury, N. Roy. Workshop Technology Vol I & II, Media Promoters & Publishers Pvt. Ltd; 9/e.
2. H S Bawa. Workshop Practice, McGraw Hill Education; 2nd edition, 2/e.

EE12002	Electrical and Electronics Science Laboratory	L-T-P-C
	B.Tech (CE, CSE and ME)	0-0-2-1
	Second Semester (Professional Core)	

Prerequisites: Nil

Sl. No.	Experiments
1	Verification of Thevenin's and Norton's Theorems in a DC circuit.
2	Verification of Superposition Theorem in DC circuits.
3	Measurement of power in single phase AC circuit using three ammeter method
4	Measurement of three phase power in an AC circuit with star and delta connected variable loads.
5	Familiarization with the components and instruments.
6	Design of a clipper and clamper circuits (both positive and negative)
7	Plot the VI characteristics of a PN junction diode and Zener diode and compare their difference
8	Implement Boolean functions using logic gates.
9	Design of circuits using operational amplifier

Course Outcomes (COs):

After completion of the course, students will be able to

1. Develop practical skills using electrical and electronic components and measuring equipment.
2. Demonstrate and justify results of Network theorems in DC circuits.
3. Compute and verify power consumptions for single and three phase loads.
4. Understand the characteristics of various electronics devices.
5. Design and analyze simple analog and digital circuits.

CY12002	**Chemistry Laboratory**	**L-T-P-C**
	B.Tech (CE, CSE and ME)	0-0-2-1
	Second Semester	

Prerequisites: None

List of Experiments:

Experiment 1: To determine the total hardness of pond water/ supplied water using the standard EDTA solution
Experiment 2: Estimation of magnesium from the supplied solution using standard EDTA
Experiment 3: Estimation of calcium from the supplied solution using standard EDTA
Experiment 4: Determination of dissolved oxygen (DO) of lake water
Experiment 5: Determination of total alkalinity of supplied aqueous solution.
Experiment 6: To determine the strength of the $KMnO_4$ solution using a standard oxalic acid solution
Experiment 7: To determine the amount of Fe(II) present in the supplied solution using the standard $KMnO_4$ solution
Experiment 8: To determine the amount of Fe(III) present in the supplied solution using the standard $K_2Cr_2O_7$
Experiment 9: Quantitative determination of Copper (II) using standard HYPO ($Na_2S_2O_3$) solution
Experiment 10: Estimation of calcium in milk powder using standard EDTA solution
Experiment 11. Detection of special elements in supplied organic compounds.
Experiment 12: Determination of functional groups in the supplied organic compounds
Experiment 13: Preparation of Copper (II) glycinato complex
Experiment 14: Determination of the relative viscosity of the given organic compound by Ostwald Viscometer
Experiment 15: Determination of the surface tension of the given organic compound by the stalagmometer

Course Outcomes (COs): After completion of the course, students will be able to

1. Know about the methods for the determination of water quality parameters. They can assess the quality of water for drinking purposes, etc., by performing experiments such as determining total hardness, Ca^{2+}, Mg^{2+}, total alkalinity, and dissolved oxygen.
2. Determine presence of Fe^{3+}, Fe^{2+}, Cu^{2+} ions in water
3. Determine the physical properties of liquids by performing experiments, such as viscosity. They will also be able to determine the viscosity of the lubricating oil. The generated knowledge can be used for industrial product development, like detergent formulation.
4. Determine the surface tension of liquids
5. Synthesise coordination complexes of biologically important transition metal ions.
6. To perform the chemical reactions to find out different elements, functional groups or nonmetals present in the organic compounds. This will also help them to understand the role of different functional groups in chemical reactivity.

Text Books/ Reference Books:

1. Das, S. C., Advanced Practical Chemistry (2024), The World Press Private Limited
2. Laboratory Manual, Dept. of Chemistry, NIT Silchar

MA21001

Applied Mathematical Analysis and Statistics
B.Tech.(For CE,CSE,ME)
Third Semester (Professional Core)

L -T-P- C
3- 0 - 0 - 3

Prerequisites: Ordinary & Partial differentiation, Elementary integration, Vector operations.

	Course Content	Hours
Unit-1	**Vector Integral Calculus:** Line integral, Double integral, Surface integral, Triple integral, Green's theorem, Stokes' theorem and Gauss Divergence theorem and their applications.	**10**
Unit-2	**Complex Analysis:** Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integrals.	**10**
Unit-3	**Probability & Statistics:** Introduction to probability, Additive & multiplicative Laws of probability, Conditional probability, Independent events, Baye's theorem, Random variable, Probability mass function, Probability density function, Cumulative distribution function, Binomial, Poisson & Normal distributions. Curve fitting: Fitting of straight lines & parabolas by the method of least squares. Correlation & Regression analysis: Coefficient of correlation, Coefficient of regression, Lines of regression.	**12**
Unit-4	**Stochastic Process:** Definition of Stochastic process, Classification and properties of stochastic processes, Simple Markovian stochastic processes, Gaussian processes, Stationary processes.	**6**
	Total	**38**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply concepts of Vector Calculus to solve multivariable integration and field problems.
2. Analyze complex functions using methods of Complex Analysis.
3. Use techniques of Probability and Statistics for data analysis and uncertainty modelling.
4. Model random systems using Stochastic Processes and related probabilistic methods.

Text Books:

5. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
6. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publisher, 2017.
7. J. Ravichandran, Probability and Statistics for Engineers. Wiley India Pvt. Ltd., New Delhi, 2010.
8. A. Papoulis, S. U. Pillai, Probability Random Variables and Stochastic Processes, CBS Publishers and Distributors Pvt. Ltd, 2025.

Reference Books:

1. M.D. Raisinghania, Vector Analysis, S.Chand & Company Ltd, 2020.
2. S. Lipschutz and J. J. Schiller, Complex Variables, Schaum's Outline series, 2009.
3. S. Lipschutz and J. J. Schiller. Introduction to Probability and Statistics. Schaum's Outline Series, 2011.
4. Sheldon M. Ross, Stochastic Processes, Wiley, 2008.

HS21001/21002	Engineering Economics	L-T-P-C
	IIIrd / IVth Semester (Professional Core)	3-0-0-3

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction:** Definition and scope of Economics; Engineering Economics and the role of engineers in economic decision-making; Theory of Consumer Behaviour: Cardinal and Ordinal Utility analysis.	**4**
Unit-2	**Demand Analysis:** Demand: meaning, law, determinants; Supply: meaning, law, determinants; Market equilibrium and price determination; Elasticity of demand; Demand Forecasting techniques.	**4**
Unit-3	**Theory of Cost and Production:** Meaning and classification of costs; Short-run cost concepts; Fixed cost; Variable cost; Total, average, and marginal cost; Long-run cost curves; Law of Variable Proportion and Returns to scale.	**3**
Unit 4:	**Theory of Product Pricing:** Market Structure: Perfect Competition-Characteristics; Price Determination; Monopoly- Characteristics, Price and Output Determination.	**6**
Unit 5	**National Income Determination**: Concepts and Measurement of National Income; Components of National Income; Methods of National Income Calculation; Problems in Measuring National Income.	**3**
Unit 6	**Macroeconomic issues and International Market:** Unemployment: Definition, types, and causes; Inflation: types, causes, and social costs of inflation; Business Cycle; Schumpeter theory of innovation.	**6**
Unit-7	**Project Evaluation and Management:** Meaning of Project Cycle, Project selection and planning; Project Appraisal; Means of financing and financial appraisal tools; Qualitative Methods for Project Evaluation, Social Cost Benefit Analysis; Externalities and environmental concerns.	**6**
	Total	**32**

Course Outcomes (COs):

After completion of the course, students will be able to

1. To introduce economic principles relevant to engineering decision-making
2. To analyse consumer behaviour, cost functions and producer behaviour for Engineering Decisions
3. To understand national income and macroeconomic issues
4. To apply project evaluation techniques and social and environmental cost-benefit analysis

Text Books/ Reference Books:

1. H. G. Thuesen, W. J. Fabrycky, and G. J. Thuesen (1993), Engineering Economy, Prentice Hall International.
2. F. C. Jelen (1970), Cost and Optimisation Engineering, McGraw-Hill Book Co., New York.
3. Hal R. Varian. Intermediate Microeconomics, 8th Edition, W. W. Norton and Company.
4. N. Gregory Mankiw. Principles of Microeconomics. Cengage Learning
5. N. Gregory Mankiw, Ronald D. Kneebone, Kenneth J McKenzie (2023). Principles of Macroeconomics, 9th Edition. Cengage Canada.
6. Salvatore, D. International Economics (11th ed.). John Wiley & Sons.

CS21001	Data Structures and Algorithms B. Tech. (Computer Science and Engineering) **Third** Semester (Professional Core)	L-T-P-C 3-1-0-4

Prerequisite: Programming and Data Structure

		Hours
Unit - I:	(Introduction) ADT, Asymptotic notations, Algorithms as a technology, Types of algorithms, Complexity analysis of algorithms.	6
Unit - II:	(Linear Data Structures) Singly linked lists, Doubly linked lists, and Circular linked lists. Stacks, application of stacks-recursions, infix, prefix, and postfix expression evaluations, queues, application of queues -priority queues, min-priority queues.	10
Unit - III:	(Non-Linear Data Structures): Introduction, Binary trees, Tree-Traversal, Binary search trees, AVL trees, multiway search trees, B trees, and B+ trees. Basic concepts and representation of Graphs, Graph traversals: BFS and DFS, minimum spanning trees.	14
Unit - IV:	(Searching and Sorting algorithms): Binary Search, Hashing, Hash Table, Insertion sort, Selection sort, Merge sort, Quick sort, Heap sort, Counting sort, and Bucket sort, Complexity analysis of sorting and searching algorithms.	10

Total 40 Hours

Books: Text / References

1 Aho V., Ullman J.D., *Data Structure Addision*, Wesley
2 Tanenbaum A.S., Langsam Y., Augenstein M. J. , *Data Structures using C/C++,* PHI
3 Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
4 T. H. Coremen, C. E. Leiserson, R. L. Rivest, C. Stein , *Introduction to Algorithms*, McGraw-Hill
5 Michael T. Goodrich, R. Tamassia , *Algorithm Design and Applications* , Wiley
6 E. Horowitz, S. Sahni, S. Rajasekaran , *Fundamentals of Computer Algorithms* , University Press

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Select an appropriate data structure and algorithm to be used for the specified problem definition.
CO2: Implement linear and non-linear data structures.
CO3: Handle operations like searching, insertion, deletion, traversal etc. on various data structures.
CO4: Implement projects by using the required learned data structures.

CS21003	Digital Logic and Microprocessor	L-T-P-C
	B. Tech. (Computer Science and Engineering) **Third** Semester (Professional Core)	3-1-0-4

Prerequisite: Basic Electronics

		Hours
Unit - I:	Digital Logic Fundamentals: Boolean Minimization- K-Maps, Quine-McCluskey method. Combinational Circuits: Adders, Subtractors, Code Converters, Encoders, Decoders, Multiplexers, and De-multiplexers. Sequential Logic Design: Flip-Flops: SR, JK, D, and T flip-flops; Master-Slave configuration; Excitation tables. Registers & Counters: Shift registers (SISO, PIPO), Synchronous and Asynchronous counters, Ring counter, Johnson counter.	10
Unit - II:	Microprocessor Architecture: 8085/8086 Microprocessor: Architecture, Pin diagram, Register organization. System Bus: Data, Address, and Control buses; Multiplexing of Address/Data bus. Timing & Control: Instruction cycle, Machine cycle, T-states, ALE, and Wait states.	10
Unit - III:	Instruction Set & Programming: Addressing Modes: Immediate, Direct, Register, Register Indirect, and Implied. Instruction Set: Data transfer, Arithmetic, Logical, Branching, and Stack instructions. Programming: Loops, Subroutines, Delay calculations, and Software interrupts.	10
Unit - IV:	Interfacing and Peripheral Devices: Memory Interfacing: Decoding logic, RAM/ROM interfacing. I/O Interfacing: I/O mapped I/O vs. Memory-mapped I/O. Peripheral ICs: Functional study of 8255 PPI (Programmable Peripheral Interface) and 8259 PIC (Programmable Interrupt Controller).	10
		Total 40 Hours

Books: Text / References

1 "Digital Design", Publisher: Pearson, By M. Morris Mano.
2 "Microprocessor Architecture, Programming, and Applications with the 8085", Publisher: Penram International Publishing By Ramesh Gaonkar.
3 "The Intel Microprocessors", Publisher: Pearson, By Barry B. Brey.
4 "Microprocessors: Theory And Applications", Publisher: Pearson By. Rafiquzzaman

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Simplify complex Boolean expressions and design efficient combinational logic circuits.
CO2: Analyze and design clocked sequential circuits like counters and registers.
CO3: Explain the internal architecture, register organization, and control signals of the 8085/8086 microprocessor.
CO4: Write, debug, and execute Assembly Language Programs for mathematical, logical, and interrupt operations.
CO5: Design interfacing circuits for memory and I/O devices to create a functional microcomputer system.

CS21005	Object-Oriented Programming B. Tech. (Computer Science and Engineering) **Third** Semester (Professional Core)	L-T-P-C 2-0-2-3

Prerequisite: Programming and Data Structure

		Hours
Unit - I:	Fundamentals of C++ and OOP Concepts: Introduction to C++, Structure of a C++ program, Difference between C and C++, Tokens, identifiers, keywords, and data types, Input/output, Control statements and loops, Introduction to Object-Oriented Programming.	8
Unit - II:	Classes, Objects, and Constructors: Defining classes and creating objects, Access specifiers: private, public, protected, Member functions, Constructors and destructors, Types of constructors, Static data members and member functions, Scope resolution operator.	10
Unit - III:	Inheritance and Polymorphism: Concept of inheritance, Types of inheritance, Constructor and destructor in inheritance, Function overloading, Operator overloading, Virtual functions, Runtime polymorphism, Base class pointer and derived class object.	10
Unit - IV:	Advanced OOP Concepts and File Handling: Templates (function and class templates), Exception handling, Standard Template Library (STL): vector, list, map (introduction), File handling, Streams: ifstream, ofstream, fstream, Applications of OOP in real-world problems.	10
		Total 38 Hours

Books: Text / References

1 E. Balagurusamy, *Object-Oriented Programming with C++*, McGraw-Hill Education.
2 Bjarne Stroustrup, *The C++ Programming Language*, Addison-Wesley.
3 Formal Languages and Automata Theory, C.K Nagpal, Oxford Higher Education
4 Robert Lafore, *Object-Oriented Programming in C++*, Sams Publishing.
5 Stanley B. Lippman, Josée Lajoie, Barbara E. Moo, *C++ Primer,* 5th Edition, Pearson Education.
6 Venugopal, K. R., & Buyya, R., *Mastering C++, 2nd edition* Tata McGraw-Hill Education

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Understand the fundamental principles of object-oriented programming and the basic syntax of C++.
CO2: Design and implement programs using classes and objects to solve given problems.
CO3: Apply and analyze inheritance and polymorphism to solve complex programming problems.
CO4: Use advanced C++ features such as templates, exception handling, the Standard Template Library (STL), and file handling in program development.
CO5: Develop efficient, modular, and reusable C++ programs by effectively applying object-oriented programming principles

CS21007	Introduction to Data Communication	L-T-P-C
	B. Tech. (Computer Science and Engineering) **Third** Semester (Professional Core)	2-0-2-3

Prerequisite:

		Hours
Unit - I:	Data Communications, Networks and the Internet, Protocols and Standards, Network Models: OSI model, TCP/IP model, Addressing. Data and Signals: Analog and Digital Data, Signals, and Classification of Signals.	6
Unit - II:	System: Linear system, Baseband system, Time-varying systems, Time-Invariant System, Linear Time-Invariant (LTI) Systems, Linear time-varying Systems, Properties of System, Convolution representation of LTI System, Signals in terms of frequency components, Fourier transform as limiting form of Fourier series, Properties, Response to sinusoidal, periodic, and aperiodic inputs.	10
Unit - III:	Sampling, modulation and demodulation of signals, simultaneous transmission of signals, analog and digital data transmission, transmission impairments, and channel capacity.	10
Unit - IV:	Transmission Media, Signal Encoding Techniques, Bandwidth Utilization: Multiplexing and Spreading, Switching, Using Telephone and Cable Networks for Data Transmission.	10

Total 36 Hours

Books: Text / References

1 B.A. Forouzan, Data Communications and Networking, Tata McGraw-Hill
2 Oppenheim A.V, Willsky A.S., and Nawab A.H., Signals and Systems, PHI
3 Das A., Digital Communication: Principles and System Modelling, Springer
4 Haykin S., Veen B. V., Signals and Systems, Wiley
5 Stallings W. Data and Computer Communications, Pearson Ed
6 Roden M. S., Digital and Data Communication Systems, Prentice Hall

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Explain the fundamentals of data communication, network models (OSI and TCP/IP), protocols, and signal classification.

CO2: Analyze linear and time-invariant (LTI) systems using convolution and Fourier transform techniques to determine system responses.

CO3: Apply sampling, analog, and digital modulation/demodulation techniques for efficient signal transmission.

CO4: Evaluate transmission media, encoding techniques, multiplexing, switching methods, transmission impairments, and channel capacity in communication systems.

CS22001	Data Structures and Algorithms Laboratory	L-T-P-C
	B. Tech. (Computer Science and Engineering) **Third** Semester (Professional Core Laboratory)	0-0-3-1.5

Prerequisite:

Design and implement linear data structures, including singly, doubly, and circular linked lists with standard operations. Implement stack and queue data structures using arrays and linked lists. Construct and traverse tree and graph data structures using recursive and non-recursive techniques across various balanced trees and multiway trees. Apply sorting algorithms such as Insertion sort, Selection sort, Merge sort, Quick sort, Heap sort, Counting sort, and Bucket sort for organizing data efficiently.

Books: Text / References

1 Aho V., Ullman J.D., *Data Structure Addision*, Wesley
2 Tanenbaum A.S., Langsam Y., Augenstein M. J. , *Data Structures using C/C++,* PHI
3 Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
4 T. H. Coremen, C. E. Leiserson, R. L. Rivest, C. Stein , *Introduction to Algorithms*, McGraw-Hill
5 Michael T. Goodrich, R. Tamassia , *Algorithm Design and Applications* , Wiley
6 E. Horowitz, S. Sahni, S. Rajasekaran , *Fundamentals of Computer Algorithms* , University Press

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Be capable of identifying the appropriate data structure for a given problem.
CO2: Be able to analyze the time and space complexity of the data structure and algorithm.
CO3: Apply concepts of linear and non-linear data structures for application-specific problem solving.

CS22003	Digital Logic and Microprocessor Laboratory	L-T-P-C
	B. Tech. (Computer Science and Engineering) **Third** Semester (Professional Core Laboratory)	0-0-3-1.5

Prerequisite:

Digital Logic Design (Foundation Experiments): Realization of Logic Gates using Universal NAND/NOR) Gates. [Digital IC Trainer Kit]. Design of 4-bit Magnitude Comparator. [74xx Series ICs]

Implementation of 8:1 Multiplexer using IC 74151. [Digital IC TrainerKit], Design of 3-bit Asynchronous Ripple Counter. [Flip-Flop ICs (7476)].

8085/8086 Assembly Language Programming: Addition/Subtraction of two 8-bit hex numbers (with carry/borrow). [8085/8086 Kit / Simulator], Sorting of N number in a data array. [8085/8086 Kit / Simulator], BCD to Hexadecimal conversion. [8085/8086 Kit / Simulator].

Interfacing and Peripheral Programming: Interfacing a Stepper Motor to 8085/8086 using 8255. [8255 Interface Card], Square wave generation using 8255. [CRO and 8085 Kit].

Application-Based Experiments and Mini Project: Digital Clock implementation. Mini Project: Digital Clock or Traffic Light Controller. [Integrated HW/SW]

Books: Text / References

1 "Digital Design", Publisher: Pearson, By M. Morris Mano.
2 "Microprocessor Architecture, Programming, and Applications with the 8085", Publisher: Penram International Publishing By Ramesh Gaonkar.
3 "The Intel Microprocessors", Publisher: Pearson, By Barry B. Brey.
4 "Microprocessors: Theory And Applications", Publisher: Pearson By. Rafiquzzaman

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Simplify complex Boolean expressions and design efficient combinational logic circuits.
CO2: Analyze and design clocked sequential circuits like counters and registers.
CO3: Explain the internal architecture, register organization, and control signals of the 8085/8086 microprocessor.
CO4: Write, debug, and execute Assembly Language Programs for mathematical, logical, and interrupt operations.
CO5: Interfacing and Peripheral Programming and Application-Based Experiments

CS22005	Computational Tools and Programming Laboratory	L-T-P-C
	B. Tech. (Computer Science and Engineering) **Third** Semester (Professional Core Laboratory)	0-0-3-1.5

Prerequisite: Programming fundamentals

Basics of Python: lists, tuples, functions, and fundamental programming constructs; Computational problem solving: matrix operations and mathematical analysis, database interaction, web scraping, and XML data processing; Data analysis and visualization: statistical computation, plotting, and curve fitting using SciPy, Matplotlib, Seaborn, and Plotly; Source code management (Git and GitHub): concepts of version control systems, repository creation and management, branching and merging, distributed workflows, and collaborative development practices including code sharing, version tracking, and project collaboration.

Books: Text / References

1 John V. Guttag, *Introduction to Computation and Programming Using Python with Application to nderstanding Data,* The MIT Press Cambridge, 2017, Second Edition.

2 Mariot Tsitoara, *Beginning Git and GitHub: Version Control, Project Management and Teamwork for the New Developer,* Apress, 2024, Second Edition.

3 Scott Chacon, Ben Straub, *Pro Git*, 2024, Second Edition.

4 Wes Mckinney*, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter,* O'Reilly Media, 2022, Third Edition.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Apply fundamental programming concepts, including data structures and functions, to develop computational solutions for mathematical problems.

CO2: Perform numerical and matrix-based computations to solve mathematical and analytical problems.

CO3: Conduct statistical analysis, curve fitting, and graphical representation of data using appropriate computational and visualization frameworks.

CO4: Implement version control practices to manage source code, support collaborative development, and project workflows.

CE21001/21002	Environmental Science	L-T-P-C
	3rd / 4th Semester (Professional Core)	2-0-0-2

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction and Natural Resources:** Environment, Definition, scope and importance, multidisciplinary nature of environmental studies, Forest Resources –use and over-exploitation of forests, deforestation, water, mineral, land, food resource and energy resources	**5**
Unit-2	**Ecosystem and Biodiversity:** Ecosystem-Concept of an ecosystem, structure and function of an ecosystem, Food chain, food webs and ecological pyramids, Energy flow in ecosystem producers and consumers Ecological Succession, Biodiversity and its Conservation – introduction, definition, genetic species and ecosystem diversity, value of biodiversity, hotspots of biodiversity, threats to biodiversity- habitat loss, poaching of wildlife conflicts, endangered and endemic species in India, conservation of biodiversity	**6**
Unit-3	**Environmental Pollution:** Causes, effects and control measures of air pollution, scales of defining pollutants, various air pollution control equipment, water pollution, wastewater management, primary, secondary and tertiary treatment techniques, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear radiation hazards, Solid waste management, sources of solid waste effects and control measures of urban industrial wastes, hierarchies of solid waste management techniques	**9**
Unit-4	**Environment and society:** Role of an individual prevention of pollution, consumerism and waste products, unsustainable to sustainable development, Environmental Laws, Environmental Impact Assessment, issue involved in enforcement of environmental legalizations, Environment and human health, epidemics, Women and child welfare, Role of information technology in environment and human health.	**4**
	Total	**24**

Course Outcomes (COs):

After completion of the course, students will be able to

5. Understand scope of environmental science and brief knowledge about natural resources
6. Realize the importance of ecosystem and biodiversity in growth of human civilization.
7. Understand the effects of environmental pollution and different strategies to mitigate it
8. Understand various environmental laws and societal issues related to the environment for the benefit of the community

Text Books/ Reference Books:

6. Henry J.G. and Heinke G.W. ***Environmental Science and Engineering.*** Prentice Hall of India. New Delhi.
7. Chandrasekhar M. ***Environmental Science.*** Hi-Tech Publishers.
8. Masters G.M. ***Environmental Engineering and Science.*** Prentice Hall of India, New Delhi.
9. Garg S.K. and Garg R. ***Ecological and Environmental Studies.*** Khanna Publishers, Delhi.
10. Chawla S. ***Environmental Studies.*** Tata McGraw-Hill Publishers, New Delhi.

CS21002	Computer Architecture and Organization B. Tech. (Computer Science and Engineering) **Fourth** Semester (Professional Core)	L-T-P-C 3-0-0-3

Prerequisite:

		Hours
Unit - I:	Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study - instruction sets of some common CPUs. Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic-integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, carry save multiplier, etc. Division - non-restoring and restoring techniques, floating point arithmetic.	17
Unit - II:	Control Unit Design: hardwired and micro-programmed design approaches, Case study - design of a simple hypothetical CPU. Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards	10
Unit - III:	Peripheral devices and their characteristics: Input-output subsystems, I/O transfers - program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes- role of interrupts in process state transitions.	5
Unit - IV:	Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs block size, mapping functions, write policy.	8

Total 40 Hours

Books: Text / References

1 Computer system Architecture, M.Morris Mano, Pearson Education.
2 Computer Organization and Design, David A.Patterson, John L. Hennessy ARM Edition.
3 Computer System Organization & Architecture, John D.Carpinelli.
4 Computer Architecture and organization, Hayes (TMH)
5 Computer Organization and Architecture: Designing for Performance, Pearson E, William Stallings

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Explain the basic organization of a computer system, including functional units, instruction set architecture, instruction execution cycle, and addressing modes.

CO2: Analyze and apply data representation techniques and computer arithmetic algorithms for integer and floating-point operations.

CO3: Analyze the design of CPU control units, pipelined processors, and evaluate the impact of pipeline hazards on performance.

CO4: Explain and evaluate input-output organization, interrupt mechanisms, and memory hierarchy, including cache mapping, replacement, and write policies.

CS21004	Design and Analysis of Algorithms B. Tech. (Computer Science and Engineering) **Fourth** Semester (Professional Core)	L-T-P-C 3-1-0-4

Prerequisite:

		Hours
Unit - I:	Introduction: Algorithms as a technology, Analyzing algorithms, Order notations, and recurrence relations	6
Unit - II:	Design and analysis techniques: Divide-and-conquer algorithms, Greedy algorithms, Dynamic programming, Amortized analysis, Backtracking, Branch and bound	10
Unit - III:	Array algorithms: Selection and median-finding, String matching- Rabin-Karp and Knuth-Morris-Pratt algorithms Graph Algorithms: Topological sort, Minimum spanning trees and disjoint set union data structures, Shortest path, Network flow	10
Unit - IV:	NP-completeness: Classes P and NP, reductions, NP-completeness, examples of NP-complete problems, Approximation algorithms: Constant ratio approximation algorithms	10

Total 36 Hours

Books: Text / References

1 T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, Introduction to Algorithms, MIT Press, 2001.

2 Aho, J. E. Hopcroft and J. D. Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley, 1974.

3 E. Horowitz and S. Sahni, Fundamentals of Computer Algorithms, Galgotia Publishers, 1984.

4 M. T. Goodrich and R. Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, John Wiley, 2001.

5 Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Analyze the complexity and prove the correctness of an algorithm

CO2: Design algorithms using the different algorithm design techniques

CO3: Identify and use the standard array and graph algorithms to solve real-world problems

CO4: Explain the selection of a specific data structure or algorithm to solve a given problem by analyzing its time and space complexity.

CO5: Inspect and identify NP-complete problems and formulate appropriate approximation algorithms.

CS21006	Database Management System B. Tech. (Computer Science and Engineering) **Fourth** Semester (Professional Core)	L-T-P-C 3-0-0-3

Prerequisite:

		Hours
Unit - I:	Conceptual Database Design: Purpose and Applications of Database Systems; File System vs. DBMS; 3-level architecture of Database; Data Abstraction; Components of DBMS; Data models; Entity-Relationship Model; ER Constraints, ER Diagram.	8
Unit - II:	Relational Model: Structure of Relational Databases; Database Schema; Keys; Relational constraints; Schema Diagrams; ER to Relational Mapping; Relational Query Languages: Relational Algebra; Relational Calculus; Structured Query Language (SQL).	8
Unit - III:	Functional dependency & Normalization: Features of Good Relational Designs; Functional Dependency Theory; Atomic Domains and First Normal Form; Decomposition using Functional dependencies; Second Normal Form, Third Normal Form, Boyce-Codd Normal Form; Other Normal forms, Multi-valued dependency and Fourth Normal Form.	8
Unit - IV:	Transactions Management: Transaction concepts; ACID properties of Transactions and their necessity, Serializability; Transaction Isolation Levels; Concurrency Control: Lock-based protocols, 2-phase locking; Deadlock Handling; Multiple Granularity; Timestamp-based protocol.	8
		Total 32 Hours

Books: Text / References

1 R. Elmasri, S. Navathe, Fundamentals of Database Systems, 6th edition, Addison-Wesley.
2 A. Silberschatz, H. Korth, and S. Sudarshan, Database System Concepts, 6th Ed., McGraw-Hill.
3 R. Ramakrishnan, J. Gehrke, Database Management Systems, 3rd Ed., McGraw-Hill.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Understand the basic terms and concepts related to database design and management, database Models & Conceptual database design using Entity Relationship model.
CO2: Understand principles of Relational Database design and querying.
CO3: Understand functional dependency and Normalization of database design
CO4: Understand fundamental issues of transaction management and concurrency control

CS21008	Artificial Intelligence B. Tech. (Computer Science and Engineering) **Fourth** Semester (Professional Core)	L-T-P-C 3-0-0-3

Prerequisite:

		Hours
Unit - I:	Introduction to Artificial Intelligence: Definition, scope, and history of AI, Ai-Problems and Techniques, Intelligent agents, Turing Test, Agent vs Environment, Structure of intelligent agents, types of Agents, Environment types, Applications of AI - weak vs strong; AI vs Human Intelligence, Components of AI - Theoretical and Hardware/ software. Problem Solving and Search Techniques: Problem formulation, Example of AI problems - Tic-Tac-Toe, 8-puzzle problems, Tower of Hanoi Problem, Traveling Salesman Problem,; State space representation; Uninformed search strategies: BFS, DFS, Uniform cost search, Depth Limited Search, Bi-directional Search, Hill Climbing Search, Concept of Heuristic Knowledge, Types of Heuristic Search Techniques, Informed search strategies: Heuristic functions, Best-first search, A* algorithm, AO* Algorithms.	10
Unit - II:	Knowledge Representation and Reasoning: Knowledge representation techniques; Propositional logic; Predicate logic; Inference mechanisms, Inferencing by Resolution Refutation, Classical Planning; Forward and backward chaining; Introduction to ontologies, Uncertain Knowledge and Reasoning - uncertainty, Basic Probability Theorem, Joint Probability, Baye's Theorem.	4
Unit - III:	Adversarial Search for Game Playing: Basic Concepts, Minimax Search, Alpha-Beta Pruning. Machine and Deep Learning Basics: Introduction to Machine Learning; Types of learning: supervised, unsupervised, semisupervised, reinforcement; Decision trees; k-Nearest Neighbor; Naïve Bayes classifier; Basics of neural networks, Various RNN Model - LSTM, Attention, Transformer.	10
Unit - IV:	AI Applications: Natural Language Processing basics, Language Models, Current Trends of AI , Large Language Models (LLMs); Expert systems; AI in healthcare, finance, and education; AI Ethics: Ethical issues in AI; Bias, fairness, transparency, and sustainability.	8
		Total 32 Hours

Books: Text / References

1 Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Fourth Edition, 2022, Pearson.
2 Kevin Night and Elaine Rich, Nair B., Artificial Intelligence, McGraw Hill, 2008.
3 Nils J. Nilsson, Artificial Intelligence: A New Synthesis MorganKaufmann, 1998.
4 Deepak Khemani, First Course In Artificial Intelligence, McGraw Hill, 2017.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Understand the basic concepts of AI.

CO2: Explain core AI concepts and intelligent agent models.

CO3: Apply search, reasoning, and learning techniques to solve problems.

CO4: Analyze AI applications and address ethical and societal issues.

CS22002	Design and Analysis of Algorithms Laboratory B. Tech. (Computer Science and Engineering) **Fourth** Semester (Professional Core Laboratory)	L-T-P-C 0-0-3-1.5

Prerequisite:

Designing and analyzing algorithms using different algorithm design techniques - Divide and conquer, Greedy method, Dynamic programming, Amortization, Backtracking, Branch and bound. Selection and median-finding, String Algorithms: Rabin-Karp algorithm and Knuth-Morris-Pratt algorithm. Graph algorithms: Topological sort, Prim's algorithm using heap data structure, Kruskal's algorithm using disjoint set union data structures, Shortest path using greedy and dynamic approach, Ford-Fulkerson algorithm for maximum-flow.

Books: Text / References

1 T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein, Introduction to Algorithms, MIT Press, 2001.

2 Aho, J. E. Hopcroft and J. D. Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley, 1974.

3 E. Horowitz and S. Sahni, Fundamentals of Computer Algorithms, Galgotia Publishers, 1984.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Justify the choice of the appropriate data structure for an algorithm experimentally

CO2: Analyze algorithms experimentally

CS22004	Database Management System Laboratory B. Tech. (Computer Science and Engineering) **Fourth** Semester (Professional Core Laboratory)	L-T-P-C 0-0-3-1.5

Prerequisite:

E-R Model, Design a database using the E-R Model, Relational Model. Normalization, DDL commands, DML commands, Integrity constraints. SQL Querying, Triggers, Views, Functions, Stored Procedures, Indexes, Exception Handling, Transactions.

Books: Text / References

1 Abraham Silberschatz, Henry F. Korth, S. Sudarshan – Database System Concepts, McGraw-Hill
2 **N.** Shah**,** *Database Systems Using Oracle: A Simplified Guide to SQL and PL/SQL,* Pearson-Prentice Hall.
3 Ramez Elmasri & Shamkant Navathe – Fundamentals of Database Systems, Pearson

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Understand, appreciate and effectively explain the underlying concepts of database technologies.
CO2: Normalize a database, populate and query a database using SQL DML/DDL commands, and declare and enforce integrity constraints on a database using a state-of-the-art RDBMS.
CO3: Design, develop, and demonstrate a database application as a collaborative mini-project using a standard RDBMS.

CS22006	Artificial Intelligence Laboratory B. Tech. (Computer Science and Engineering) **Fourth** Semester (Professional Core Laboratory)	**L-T-P-C** 0-0-3-1.5

Prerequisites:

Study and implementation of Intelligent Agents and Environment types, Uninformed Search algorithms: BFS and DFS, Uniform Cost Search and Depth Limited Search, Informed Search algorithms: Best First Search and A* algorithm, AO* algorithm for problem solving, classic AI problems: 8-Puzzle / Tower of Hanoi / Tic-Tac-Toe, Propositional Logic and Predicate Logic inference, Minimax algorithm for game playing, Alpha-Beta Pruning for adversarial search, Machine Learning algorithms: k-NN and Naïve Bayes, Neural Network for classification.

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the basic concepts of AI.
2. Explain core AI concepts and intelligent agent models.
3. Apply search, reasoning, and learning techniques to solve problems.
4. Analyze AI applications and address ethical and societal issues.

Text Books/ Reference Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Fourth Edition, 2022, Pearson.
2. Kevin Night and Elaine Rich, Nair B., Artificial Intelligence, McGraw Hill, 2008.
3. Nils J. Nilsson, Artificial Intelligence: A New Synthesis MorganKaufmann, 1998.
4. Deepak Khemani, First Course In Artificial Intelligence, McGraw Hill, 2017.

CS22008	Applied Probability Theory Laboratory B. Tech. (Computer Science and Engineering) **Fourth** Semester (Professional Core Laboratory)	L-T-P-C 0-0-3-1.5

Prerequisite:

Basics of programming in R; Vectors, lists, matrices and data frames; Writing functions in R; Associative arrays/hashes; Handling missing data. Reading a file; Reading a file involving dates; Reading and writing both ASCII files and binary files; sending an R data object; Exporting and importing data; Reading .gz .bz2 files and URLs; directly reading Microsoft Excel files.

Plotting graphs; a grid of multiple pictures on one screen; histogram with tails; plotting two series on one graph.

Tables, joint and marginal distributions; "Moving window" standard deviation; Quartiles/deciles tables/graphs; Distribution of sample mean and sample median; MLE with custom likelihood function; Cauchy distribution; two CDFs and a two-sample Kolmogorov-Smirnoff test; simulation to measure size and power of a test.

Linear regression; OLS; Dummy variables in regression; Least squares dummy variable model; Nonlinear regression; Standard tests; use of orthogonal polynomials.

Books: Text / References

1 Garrett Grolemund and Hadley Wickham , R for Data Science, O'Reilly
2 Phil Spector , Data Manipulation with R, Springer
3 Paul Teetor, The R Cookbook, O'Reilly
4 Winston Chang, The R Graphics Cookbook,O'Reilly

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Use of open-source software for data handling.
CO2: Able to analyse, discover & display trends in data.
CO3: Able to use various statistical techniques.
CO4: Able to forecast trend based on data.

CS22010	Web Application Development Laboratory B. Tech. (Computer Science and Engineering) **Fourth** Semester (Professional Core Laboratory)	L-T-P-C 0-0-2-1

Prerequisite:

Internet and web fundamentals: web architecture, browser developer tools, client–server interaction, cookies, and basic security practices; HyperText Markup Language (HTML): semantic elements, headings, lists, tables, hyperlinks, images, forms, iframes, and multi-page website structuring with navigation; Cascading Style Sheets (CSS): selectors, class and ID usage, inline, internal and external stylesheets, text and font styling, backgrounds, borders, margins, and responsive layouts using Flexbox and Grid; Bootstrap framework for responsive web design; JavaScript: client-side scripting including variables, data types, operators, control structures, functions, event handling, DOM manipulation, arrays, objects, form validation, cookie handling, and development of interactive and dynamic web pages.

Books: Text / References

1 Thomas A. Powell, *HTML & XHTML: The Complete Reference*, 5th Edition, McGraw-Hill, 2003.

2 Eric T. Freeman, Elisabeth Robson**,** *Head First JavaScript Programming: A Brain-Friendly Guide*, O'Reilly, 2014.

3 Laura Lemay, Rafe Colburn, Jennifer Kyrnin, *Mastering HTML, CSS & Java Script Web Publishing*, BPB Publication, 2016.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

CO1: Design and develop structured web pages using HTML5 elements and semantic tags.

CO2: Apply CSS and responsive design techniques to create visually structured and user-friendly web interfaces.

CO3: Develop, secure, and deploy interactive web applications using JavaScript, client-side scripting techniques, frameworks, CMS tools, and local server configurations.

DEPT. OF ELECTRICAL ENGINEERING

Algebra and Calculus

	B. Tech (For ALL Branches)	**L-T-P-C**
MA11001	**First Semester (Professional Core)**	**3- 0-0- 3**

Pre-requisites: *Matrix and determinants, Limit, Continuity, Differentiability, Basic idea of integration*.

	Course Content	**Hours**
Unit-1	**Linear Algebra:** R^n as a vector space, Linear dependence and independence of vectors in R^n, Basis & Dimension; Rank and nullity of a matrix, Elementary transformations, Consistency of a System of linear equations & their solutions by Direct Methods: Gaussian Elimination method, Gauss-Jordan method; Eigenvalues & Eigenvectors, Hermitian, Skew-Hermitian & Unitary matrices, Cayley-Hamilton's theorem & its applications.	**8**
Unit-2	**Infinite Series:** Definition of Sequence & Infinite Series, Convergence & Divergence of real Sequence & Infinite Series, Tests of Convergence of positive term infinite series: Comparison Test, D' Alembert's Ratio Test, Raabe's Test, Cauchy's root Test, Integral Test, Alternating Series, Leibnitz's Test (all tests without proofs).	**8**
Unit-3	**Differential Calculus:** Successive Differentiation, Leibnitz's Theorem, Rolle's theorem, Lagrange's & Cauchy's Mean value theorems, Curvature, Radius & centre of curvature, Partial differentiation, Euler's theorem, Jacobian, Taylor's & Maclaurin's Theorems with Lagrange's form of remainder for functions of one and two variables, Expansions of functions of one and two variables, Extreme values for functions of two or more variables, Lagrange's method of undetermined multipliers.	**14**
Unit-4	**Integral Calculus:** Reduction Formulae. Application of integrals in Quadrature, Rectification, Volume and surface area of solids of revolution.	**6**
		Total: 36

Course Outcomes:

On completion of this Course,

1. The students will be able to apply the consistency concepts, eigenvalues, and eigenvectors concepts in engineering problems.

2. The students will be able to apply the concept of convergence of infinite series in mathematical & engineering problems.

3. The students will be capable of applying the knowledge of differentiation in the expansion of functions and optimizing functions appearing in engineering and daily life problems.

4. The students will be able to apply knowledge of integration in finding area, length of arc of curves, volume, and surface area appearing in engineering and real-life problems.

Course Objectives:

1. To make the students knowledgeable in the area of the system of linear equations, together with
   Solution techniques and applications in engineering problems.
2. To make the students knowledgeable in the area of infinite series and their convergence, so that they may be familiar with the limitations of series approximations of functions arising in Mathematical Modelling.
3. To make the students familiar with the area of application of differentiation, expansion of functions, and finding Extreme values of functions.
4. To enable the students to evaluate definite integrals and their application in finding area, length, volume, and surface area of solids of revolution.

Text Books:

1. Jr. Joel Hass, C. Heil & M.D. Weir, Thomas' Calculus, 14th Edition, Pearson Education, 2018.
2. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
3. S. C. Malik, S. Arora, Mathematical Analysis, 7th Edition, New Age Int. Publishers, 2005.

Reference Books:

1. B.C. Das & B.N. Mukherjee, Differential Calculus, U. N. Dhur & Sons Pvt. Ltd., 55th Edition, 1949.
2. B.C. Das, B.N. Mukherjee, Integral Calculus, U. N. Dhur & Sons Pvt. Ltd., 57th Edition, 1938.
3. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.
4. F. Ayres, Theory and Problems of Matrices, Schaum's Outline Series, 1st Edition, 1962.

CY11001	Applied Chemistry	L-T-P-C
	B.Tech (EE, ECE and EIE)	3-0-0-3
	First Semester	

Prerequisites: None

	Course Content	Hours
Unit-1	**Polymer & Composite materials:** Classification of polymers, methods of polymerization, thermosetting and thermoplastic polymers, conducting and biodegradable polymers, synthesis, properties and applications of polyethylene, chloropolyvinyl chloride (CPVC), Composite materials: Classification and basic requirement of composite materials, applications.	**6**
Unit-2	**Nanomaterials & Fuels**: Nanomaterials: Introduction; synthesis, characterization and applications of nanomaterials. Fuel: Introduction, classification of fuel, calorific value (HCV and LCV), determination of calorific value by bomb calorimetry, bio-fuels.	**6**
Unit-3	**Chemical Thermodynamics:** Introduction to chemical thermodynamics; second law of thermodynamics, Gibbs free energy, reaction spontaneity and equilibrium, fundamental equations, Maxwell's relations, Gibbs-Helmoltz equation, chemical potential.	**6**
Unit-4	**Electrochemistry & Corrosion:** Electrode potentials and its relevance to oxidation and reduction, types of electrodes, galvanic cell, measurement of EMF and application of EMF, types of reference electrodes (hydrogen, glass, quinhydrone electrodes), determination of pH. Dry Cells, lead acid cell and Fuel Cells: Construction, reaction, advantages and applications. Corrosion: Types of corrosion, factors affecting corrosion and corrosion control.	**6**
Unit-5	**Water & Its Treatment:** Sources of impurities in water; hardness in water and its disadvantages; boiler scale and its prevention; caustic embrittlement; boiler corrosion: treatment of water at industrial and domestic level; biological oxygen demand (BOD) and chemical oxygen demand (COD) and their significance.	**6**
Unit-6	**Spectroscopy:** Basics of spectroscopy, electromagnetic spectrum, Basic principles of IR, UV-Visible and NMR spectroscopy, Application of IR, UV-Visible and NMR spectroscopy in structure elucidation and material characterization.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the synthesis, properties, and applications of polymers, composites, and nanomaterials for engineering and industrial use.
2. Apply the principles of chemical thermodynamics and electrochemistry to solve engineering problems related to energy, fuel and electrochemical systems.
3. Identify different types of corrosion and propose appropriate control and prevention strategies for materials.
4. Evaluate water quality and treatment methods, and interpret spectroscopic data for material analysis.

Text Books/ Reference Books:

1. Jain, P.C., and Jain, M., Engineering Chemistry (2025), Dhanpat Rai Publishing Company
2. Chawla, S., Engineering Chemistry (2019), Dhanpat Rai Publishing Company
3. Glasstone, S., Physical Chemistry (1948), McMillan India
4. Dey, A. K., Environmental Chemistry (2003), New Age International
5. Rao, C. N. R., Müller, A., Cheetham, A. K. (Editor), The Chemistry of Nanomaterials Synthesis, Properties and Applications, Chemistry of Nanomaterials (2004), Wiley-VCH

ME11001	Engineering Mechanics	L-T-P-C
	B.Tech. (EE, ECE and EIE)	2-1-0-3
	First Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	Equivalent Force System, Equilibrium of Rigid Bodies, Law of Coulomb friction: Applications of dry friction in wedge and belt.	**9**
Unit-2	Equilibrium of simple plane trusses. Analysis of trusses by the method of joints and method of section. Principle of virtual work, Simple applications of Principle of virtual work for rigid bodies in static equilibrium.	**9**
Unit-3	Centroid of simple and composite plane figures. Pappus theorem and its applications. Area moment of inertia of simple and composite figures, Perpendicular axis theorem. Parallel axis theorem, Polar moment of inertia.	**6**
Unit-4	*Kinematics of particles:* Rectilinear motion of particles, plane curvilinear motion of particles in different coordinate systems, constrained motion of connected particles. *Plane kinematics of rigid bodies:* Translation of a rigid body in plane motion, rotation of rigid bodies about a fixed axis. *Kinetics of particles:* Applications of Newton's laws of motion, D'Alembert's principle, Principle of work-energy and Impulse-momentum in particle dynamics, Direct central impact and oblique central impact. *Plane kinetics of rigid bodies:* Equation of plane motion of a rigid body, Principle of work-energy in plane motion of a rigid body.	**12**
	Total	**36**

Course Outcomes (COs):

Upon the completion of this course, the students are expected

1. To build a fundamental understanding of static equilibrium in particles, rigid bodies, and friction, and apply it to solve related engineering problems.
2. To develop the ability to analyze simple plane trusses and apply the principle of virtual work to systems in static equilibrium.
3. To apply the theorem of Pappus. Parallel axis theorem and Perpendicular axis theorem.
4. To apply the concept of centroid and moment of inertia in analyzing the simple and composite figures.
5. To develop the ability to apply for solving the practical problems on kinematics and kinetics of motion of particles and rigid bodies.

Text Books:

1. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Statics, John Wiley & Sons, Inc; 3/e.
2. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Dynamics, John Wiley & Sons, Inc; 3/e.
3. F. P. Beer, Jr., E. R. Johnston, E. R. Eisenberg, P. J. Cornwell, D. Mazurek. Vector Mechanics for Engineers- Statics & Dynamics, McGraw-Hill Higher Education; 9/e.
4. 1. H. Shames, Engineering Mechanics - Statics and Dynamics, 4lh edition, Prentice-Hall of India.
5. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati. Engineering Mechanics, McGraw Hill Education; 5/e.

Reference Books:

1. S. Timoshenko, D.H. Young, Engineering Mechanics, 4th edition, McGraw- Hill.
2. R.C. Hibbeler. Engineering Mechanics - Statics & Dynamics, Pearson Education, 4/e.

Electrical and Electronics Technology

B.Tech. (ECE, EE and EIE)

EC11001 First Semester **L-T-P-C**

3-0-0-3

	Course Content	**Hours**
	Part – I: Electrical Engineering Dept portion	
Unit 1	Electrical safety: Definition, precautions D.C. Circuit & Networks: KVL and KCL, Superposition Theorem, Thevenin's and Norton's Theorems, Maximum power transfer theorem	**4**
Unit 2	A.C. Circuit: A.C. Fundamentals, phasor representation and algebra, Series R-L, R-C and R-L-C circuits, power calculations in A.C. circuit, phasor diagrams. Balanced Star-Delta connections, phase and line currents and voltages and their relations.	**6**
Unit 3	Measuring instruments: Ammeter, voltmeter, wattmeter, energy meter – types & connection, concepts of grounding and earthing.	**3**
Unit 4	Electrical Machines: D.C machine fundamentals and Transformer (Brief construction, types, working principle, voltage equation and application), 3-phase induction motor (Brief construction, principle, types, applications).	**5**
	Part – II: Electronics and Communication Engineering Dept portion	
Unit 1	Introduction to Electronic devices, Diode: Basic structure and operating principle, Diode Applications: rectifier circuits (half-wave and full-wave bridge rectifier), voltage regulator using Zener diode, clipper circuits, clamper circuits.	**5**
Unit 2	BJT structure and its applications: Basic structure, operation of transistor in active and saturation mode, DC analysis, MOSFET: Introduction to MOSFET, Operation and characteristics. Basic Amplifier Design.	**5**
Unit 3	System Design using Operational Amplifier (Op-Amp): Ideal op-amp, inverting amplifier, non-inverting configuration, transfer characteristics, op-amp applications like difference amplifier, summing amplifier, integrator, and differentiator.	**3**
Unit 4	Basic Digital Electronics: Logic gates, Boolean algebra, De-Morgan's theorem, K-Map, combinational circuits like adder, multiplexer, and de-multiplexer. Memory units: RAM, ROM.	**5**
		Total: 36

Course Outcomes (COs):

1. Understand the basic structure and operating principle of electronics devices and analyse DC and AC networks.
2. Measure different electrical quantities in simple 1-phase and 3-phase circuits.
3. Classify the electrical machines and the electronics devices; explain their working principles, characteristics and applications.
4. Design and implement simple analog and digital electronic circuits.

Text books:

1. J. B. Gupta, Basic Electrical Engineering, S K Kataria & Sons
2. Ashfaq Husain, Haroon Ashfaq, Basic Electrical Engineering, Dhanpat Rai & Co.
3. Louis Nashelsky and Robert Boylestad, Electronics Devices and Circuit Theory, 10th Edition, Pearson India.
4. Digital Design, M. Morris Mano, and Michael D Ciletti, Pearson.

EE11001	**Fundamentals of Electrical Engineering and Practices**	**L-T-P-C**
	B.Tech (Electrical Engg.)	3-0-0-3
	First Semester (Professional Core)	

Prerequisites: Nil

	Course Content	**Hours**
Unit-1	Electrical sources – dependent & independent. Network theorems using dependent AC & DC sources	**7**
Unit-2	Three Phase A.C. Circuits: Review of Single-phase circuit and impedance triangle concept, Complex power: active, reactive and apparent power, power triangle, Balanced Star-Delta connections, phase and line currents and voltages and their application of Balanced Star-Delta connections, Use of phase and line currents and voltages and their relations, unbalanced 3-phase circuits. Measurement of power in 1-phase and 3-phase circuits.	**8**
Unit-3	Electrochemical Energy conversion and Batteries – A brief review of storage systems and their use, Lead acid batteries, Li-ion batteries.	**5**
Unit-4	Electromechanical Energy conversion: Electromechanical laws: relation between electricity and magnetism, production of emfs (AC & DC), Faraday's law of electromagnetic induction, direction of induced emf, Lenz law, dynamically and statically induced emfs, self-inductances, mutual inductances and magnetic circuits.	**5**
Unit-5	Electrical Engineering Materials: Conductors, insulators, and dielectric materials – their properties, characteristics, and applications. Superconductors. Magnetic materials - types, losses and applications.	**5**
Unit-6	Illumination: Definition, Luminous Intensity, Concept of Flux & Laws. Understanding various terms regarding light: lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems.	**4**
Unit-7	Estimating & Costing: Design of a lighting scheme for a residential and commercial premise, flood lighting, electrical drawings- domestic wiring and service line connection, estimating and costing, I.E acts.	**6**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply the network theorems and AC fundamentals, and analyse complex circuits.
2. Apply the fundamentals of energy conversions to generate AC & DC emfs, and evaluate the requirement of energy storage systems.
3. Classify the electrical engineering materials and apply them in electrical engineering.
4. Demonstrate the illumination requirement of a room and design it using energy saving appliances.
5. Design and estimate electrical wiring of a residential building as per the Electricity Act, 2003.

Text Books/ Reference Books:

1 Del Toro, V., Electrical Engineering Fundamentals, Pearson Education.
2 Gupta, J. B., Basic Electrical Engineering, S. K. Kataria & Sons.
3 Dekker, A. J., Electrical Engineering Materials, Prentice Hall.
4 Raina, K. B., and Bhattacharya, S. K., Electrical Design Estimating and Costing, New Age International.
5 Theraja, B. L., and Theraja, A. K., A Textbook of Electrical Technology, S. Chand.
6 Uppal, S. L., and Garg, G. C., Electrical Wiring, Estimating & Costing, Khanna Publishers.
7 Hayt, W., Kemmerly, J., and Durbin, S. M., *Engineering Circuit Analysis*, McGraw Hill.

ME12001	Workshop Practice	L-T-P-C
	B.Tech. (EE, ECE and EIE)	0-0-3-1
	First Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	General safety precautions in workshop and introduction.	**3**
Unit-2	**Carpentry Shop:** Safety precaution, Kinds of wood and timber, Application of timber as per their classification, Carpentry hand tools and machines, Different types of carpentry joint, Demonstration of wood working machine like, band saw, circular saw, thickness planner, wood working lathe, surface planners, etc.	**6**
Unit-3	**Welding Shop:** Safety precaution in welding shop, Introduction to gas and arc welding, Soldering and brazing etc. Welding equipment and welding material.	**6**
Unit-4	**Fitting Shop:** Safety precaution, Introduction to fitting shop tools, equipment, Operation and their uses, Marking and measuring practice.	**6**
Unit-5	**Machine Shop:** Safety precautions, Demonstration and working principles of some of the general machines, like lathe, shaper, milling, drilling, grinding, slotting etc., General idea of cutting tools of the machines.	**6**
	Total	**27**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Know the importance of general safety precautions on different shop floors.
2. Identify the basics of tools and equipments used in fitting, carpentry, sheet metal, machine, welding and smithy.
3. Do fabrication of wooden joints and understand joining of metals.
4. Make metal joints and sheet metal work.
5. Understand the basics of removal of material from work piece surface to attain specific shape.
6. Familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.

Text Books/ Reference Books:

1. S K Hajra Choudhury, A K Hajra Choudhury, N. Roy. Workshop Technology Vol I & II, Media Promoters & Publishers Pvt. Ltd; 9/e.
2. H S Bawa. Workshop Practice, McGraw Hill Education; 2nd edition, 2/e.

EC12001	Electrical and Electronics Technology Laboratory	L-T-P
	B.Tech. (ECE, EE and EIE)	0-0-2
	First Semester	

Experiments

1. Verification of Thevenin's and Norton's Theorems in a DC circuit.
2. Verification of Superposition Theorem in DC circuits.
3. Measurement of power in single phase AC circuit using three ammeter method.
4. Measurement of three phase power in an AC circuit with star and delta connected variable loads.
5. Verification of Maximum Power Transfer Theorem in a DC circuit.
6. Familiarization with the components and instruments.
7. Design of a clipper and clamper circuits (both positive and negative)
8. Plot the VI characteristics of a PN junction diode and Zener diode and compare their difference.
9. Implement Boolean functions using logic gates.
10. Plot static characteristics of Common Emitter/ Common Base configuration of BJT.
11. Design of circuits using operational amplifier.

Course Outcomes (COs):

1. Develop practical skills using electrical and electronic components and measuring equipment.
2. Demonstrate and justify results of Network theorems in DC circuits.
3. Compute and verify power consumptions for single and three phase loads.
4. Understand the characteristics of various electronics devices.
5. Design and analyze simple analog and digital circuits.

CY12001	Chemistry Laboratory	L-T-P-C
	B.Tech (EE, ECE and EIE)	0-0-2-1
	First Semester	

Prerequisites: None

List of Experiments:

Experiment 1: To determine the total hardness of pond water/ supplied water using the standard EDTA solution
Experiment 2: Estimation of magnesium from the supplied solution using standard EDTA
Experiment 3: Estimation of calcium from the supplied solution using standard EDTA
Experiment 4: Determination of dissolved oxygen (DO) of lake water
Experiment 5: Determination of total alkalinity of supplied aqueous solution.
Experiment 6: To determine the strength of the $KMnO_4$ solution using a standard oxalic acid solution
Experiment 7: To determine the amount of Fe(II) present in the supplied solution using the standard $KMnO_4$ solution
Experiment 8: To determine the amount of Fe(III) present in the supplied solution using the standard $K_2Cr_2O_7$
Experiment 9: Quantitative determination of Copper (II) using standard HYPO ($Na_2S_2O_3$) solution
Experiment 10: Estimation of calcium in milk powder using standard EDTA solution
Experiment 11. Detection of special elements in supplied organic compounds.
Experiment 12: Determination of functional groups in the supplied organic compounds
Experiment 13: Preparation of Copper (II) glycinato complex
Experiment 14: Determination of the relative viscosity of the given organic compound by Ostwald Viscometer
Experiment 15: Determination of the surface tension of the given organic compound by the stalagmometer

Course Outcomes (COs): After completion of the course, students will be able to

1. Know about the methods for the determination of water quality parameters. They can assess the quality of water for drinking purposes, etc., by performing experiments such as determining total hardness, Ca^{2+}, Mg^{2+}, total alkalinity, and dissolved oxygen.
2. Determine presence of Fe^{3+}, Fe^{2+}, Cu^{2+} ions in water
3. Determine the physical properties of liquids by performing experiments, such as viscosity. They will also be able to determine the viscosity of the lubricating oil. The generated knowledge can be used for industrial product development, like detergent formulation.
4. Determine the surface tension of liquids
5. Synthesise coordination complexes of biologically important transition metal ions.
6. To perform the chemical reactions to find out different elements, functional groups or nonmetals present in the organic compounds. This will also help them to understand the role of different functional groups in chemical reactivity.

Text Books/ Reference Books:

1. Das, S. C., Advanced Practical Chemistry (2024), The World Press Private Limited
2. Laboratory Manual, Dept. of Chemistry, NIT Silchar

MA11004	Differential Equations and Mathematical Methods	L -T-P- C
	B. Tech. (For EE, ECE and EIE)	3- 0 - 0 - 3
	Second Semester (Professional Core)	

Pre-requisites: *Linear Algebra and Calculus.*

	Course Content	Hours
Unit-1	**Ordinary Differential Equation:** Exact differential equation of first order, integrating factors. Second & higher order linear differential equations with constant coefficients, Homogeneous (Cauchy's) linear differential equation, Method of variation of parameters.	**8**
Unit-2	**Partial Differential Equation:** Formation of partial differential equations (PDE), Solution of PDE by direct integration, Lagrange's linear equation & its solution, Non-linear PDE of first order, Charpit's method of solution, Homogeneous and Non-homogeneous linear equations with constant coefficients, Boundary and initial value problems (Dirichlet and Neumann type). Second-order PDE with constant coefficients and their classification to elliptic, parabolic, and hyperbolic type, solution by the method of separation of variables.	**10**
Unit-3	**Laplace and Z-Transform:** Basic idea of Integral Transform, Laplace and inverse Laplace transforms & their properties, Convolution Theorem, Solution of ODE by Laplace transform method. Z-transform and its properties, Solution of difference equations.	**9**
Unit-4	**Fourier Series and Fourier Transform:** Periodic functions, Fourier series representation of a function, half-range series, Fourier integral formula. Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting, and time shifting properties. Convolution theorem, Applications to boundary value problems.	**9**
		Total: 36

Course Outcomes:

On completion of this course

1. The students will be able to apply ordinary differential equations in engineering and real-life problems.
2. The students will be capable of applying partial differential equations in engineering and real-life problems.
3. The students will be able to apply Laplace/Z-transform in engineering problems.
4. The students will be able to apply the Fourier transform in engineering problems.

Course Objectives

1. To enable the students to understand the basic ideas of ordinary differential equations and their solutions, and also the application of series in solving ordinary linear differential equations.
2. To enable the students to understand the basic ideas of partial differential equations and their solutions, and also the applications in IVP & BVP.
3. To enable the students to solve ODE/Difference equations by using Laplace and Z-transform.
4. To enable students to clear the basic concepts on the Fourier series, the Fourier Transform, and to solve BVP.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.

Reference Books:

1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand & Company Ltd, 2020.
2. G.F. Simmons, Differential Equations, Tata McGraw-Hill, 2nd edition, 2017.
3. S. Sreenadh, Fourier Series and Integral Transforms, S. Chand Publication, 2014.

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PH11002	Wave Mechanics and Solid-State Physics	L-T-P-C
	B.Tech (EE, ECE and EIE)	3-0-0-3
	Second Semester (Common)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Waves and Oscillation:** Introduction to Vibrations and Oscillations, Review on Free Oscillations, Damped motions -under damping -Logarithmic decrement, relaxation time and Q-Factor, overdamping and critical damping, Forced oscillations with damping - Steady state solution and its frequency response, Power absorbed and dissipation in forced oscillator, Resonance- amplitude, velocity and power- sharpness of resonance.	**7**
	Coupled oscillations, introduction of normal modes and normal coordinate and their physical significance- general solutions, wave equation in one dimension, Characteristics and solution, superposition, travelling and standing waves, phase and group velocity.	**5**
Unit-2	**Electromagnetic Waves:** Vector Calculus : Scalar and Vector Fields – Differential calculus, Del operator, Gradient, Divergence and Curl, Product rules, Second Derivative with Del operator, Laplacian operator –Line, Surface and Volume Integrals (definition), Fundamental theorem of Integral calculus qualitatively (Gradient, Divergence and Curl)	**4**
	Electromagnetic theory: Maxwell's equations, Displacement current, Maxwell's equation in matter, Electromagnetic waves: The wave equation, Sinusoidal waves, Polarization EM waves in vacuum, Monochromatic plane waves, Energy in electromagnetic waves, EM waves in conductors, Conservation laws: continuity equation, Poynting's theorem, boundary conditions, reflection and transmission at normal incidence.	**6**
Unit-3	**Modern Physics and Quantum Mechanics:** Failure of classical physics, qualitative review of relevant experiments such as blackbody radiation, photo- electric effect, Compton scattering, de Broglie matter waves and Davison-Germer experiment, Uncertainty principle, Wave packet.	**3**
	Basic postulates of quantum mechanics, Wavefunction, normalization of wave function, quantum mechanical operators, probability density, expectation value, Development of Schrödinger equation (time dependent & time independent), particle on a 1D infinite potential well, potential barrier and quantum tunnelling.	**5**
Unit-4	**Solid State Physics:** Free electron theory, Fermi Dirac distribution, Fermi level, Density of states, Band theory of solids - conductors, semiconductors, insulators, Semiconductors - Intrinsic & Extrinsic, electron & hole concentration at thermal equilibrium. Hall Effect, Basics of Superconductivity- Zero resistance, perfect diamagnetism, critical field and Meissner effect.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the fundamental concepts of **classical and quantum wave mechanics**.
2. Interpret fundamental physical laws and principles for relevant engineering applications.
3. Apply principles of physics to solve numerical problems in **classical and quantum wave mechanics**.
4. Analyze various physical phenomena using appropriate concepts such as superposition, wave-particle duality, polarization, and quantization.
5. Evaluate the validity and limitations of theories in waves, electromagnetism, and quantum physics through comparison with experimental observations.

Text Books/ Reference Books:

1. Vibration and waves, A. P. French, CBS Publishers
2. Introduction to Electrodynamics, D. J. Griffiths, *Pearson*
3. *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*, Resnick and Eisberg, John Wiley & Sons
4. Quantum Mechanics, D. J. Griffiths, Cambridge University Press
5. Introduction to Solid State Physics, C. Kittel, Wiley India
6. The Physics of Solid, R Turton, Oxford University Press.

CS11002	Programming and Data Structure	L-T-P-C
	B.Tech (EE, ECE and EIE)	2-0-2-3
	Secound Semester (Professional Core)	

Prerequisites: Nil

		Hours
Unit-1	**Introduction:** Basic operations of digital computers, basic concepts of integer and floating point number representation, algorithm and efficiency.	**4**
Unit-2	**(Elements of C Programming)**: Data types, variables, operators, expression and assignment statements, conditional and branch statements, Loops and iteration statements, 1-d arrays, functions and parameter passing, recursions, Strings, pointers and structures, dynamic memory allocations.	**12**
Unit-3	**(Linear Data Structures): 2-d arrays, linked lists, stacks, and queues.**	**10**
Unit-4	**(Searching and Sorting):** Linear and binary search, bubble sort, insertion sort, merge sort, quick sort.	**8**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Learn the syntax and semantics of C programming language.
2. Test and execute the programs and correct syntax and logical errors.
3. Implement conditional branching, iteration and recursion.
4. Use basic data-structures (arrays, link lists, stacks, and queues) to formulate algorithms and programs.
5. Understand and analyse different searching sorting techniques.

Text Books/ Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
6. R. G. Dromey, How to Solve it by Computer, Prentice-Hall of India.

HS11001/11002	**English for Technical Communication** Ist / IInd Semester (Professional Core)	L-T-P-C 2-0-2-3

	Course Content	**Hour**
Unit 1	**Organizational Communication:** Introduction to the Course Importance and Relevance of the Course Why Communicative English? What is Communication? Barrier to Communication Non-verbal/Oral/(In)Formal Communication	6
Unit II	**Reading Comprehension** **Ignited mind** (Two Chapters) by APJ Abdul Kalam Essay: **Religion of the forest** by Rabindranath Tagore Essay: **Is Google Making Us Stupid?** by Nicholas Carr **The Story of My Sanskrit** (A chapter) by Kumud Pawde	**8**
Unit III	**Written Communication:** Letter Writing Cover Letter CV/Resume Writing Précis writing Essay Writing Report Writing Email Etiquettes Idioms and Phrases One Word Substitution Technical Communication Documentation and Minutes of Meeting Debate	**12**
Unit IV	**Oral Communication:**	**6**

Job interviews (Process, stages in job interviews, types of interviews, preparation, use of verbal and non-verbal cues, mock interview sessions)

Group Discussion (Features, uses-recruitment, selection, stages, positive and negative roles, organizational GD's (Brain Storming, Normal Group techniques, Delphi Technique))

Pictorial Essays.

Course Outcomes:

6. Students will recall the content and make inferences on organizational communication setup
7. Students will be able to read faster and comprehend better
8. Students will be able to express their ideas and thoughts clearly and systematically in the form of essays and reports
9. Students will be able to conduct short meetings with the skill to draft simple and short minutes of the meeting.
10. Students will demonstrate the ability to face the employment selection and answer interview questions, and they will be able to participate in group discussions confidently and assertively

Reference Books:

7. Barun K. Mitra & Basundhara Mitra*, Personality Development and Soft Skills.* Oxford University Press, 2024.

8. Meenakshi Raman & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press, 2015. https://d.docs.live.net/0af95281db477321/Desktop/question%20papers%20NITS/Technical%20Communication.pdf

9. Michael Swan. *Practical English Usage*. Oxford University Press, 2016.

10. Nilanjana Gupta. *English for All*. Macmillan Publishers India Ltd, 2011.

11. S. Miglani & S. Goyal. *English for Professionals- A Practical Book of Communication Skills in English*. Vayu Education of India, 2010.

12. Sanjay Kumar & Pushp Lata. *Communication Skills*. Oxford University Press, 2015.

EE11004	Electrical Measurement and Measuring Instruments	L-T-P-C
	B.Tech (Electrical Engg.)	3-0-0-3
	Second Semester (Professional Core)	

Prerequisites: Nil

	Course Content	Hours
Unit-1	**Introduction:** Introduction of signals, Measurement and instruments, Static and dynamic characteristics of instruments. Different types of instruments. Operating forces required for the working of indicating instruments. Different types of damping and control systems. Construction and working principles of PMMC, MI, Induction type, Electrodynamometer type, their applications, advantages and disadvantages.	**6**
Unit-2	**Calibration and Measurement Parameters:** Introduction to calibration, Significance of calibration, Precision and Accuracy, Measurement Errors. Importance of calibration in industry.	**4**
Unit-3	**Galvanometers and Dynamics:** Dynamic behaviour of a galvanometer - equation of motion for different damping conditions. Response of a galvanometer, operational constants, CDRX, relative damping, logarithmic decrement, sensitivity. Role of galvanometers in industrial measurement systems.	**4**
Unit-4	**Low, Medium and High Resistance Measurement:** Measurement of low resistance by Kelvin's double bridge, Wheatstone bridge for medium resistance and Megger or direct deflection for high resistance. Significance of the measurement of resistance in industries and households.	**4**
Unit-5	**Potentiometers (DC and AC):** Standardization, Principle of working and construction of Crompton (D.C.) potentiometer, Polar and Co-ordinate type of potentiometers. Use of potentiometers in industry.	**4**
Unit-6	**Impedance Measurement with AC Bridges:** Maxwell Bridge, Hay's Bridge, Schering Bridge, De Sauty Bridge. Use of AC bridge for precise measurement of electrical parameters, quality control and manufacturing with industrial examples.	**5**
Unit-7	**Measurement of Power, Power Factor and Energy:** Measurement of power and energy, use of a current transformer (CT) and a potential transformer (PT) with real-life examples, Electrodynamometer type wattmeter, Induction type energy meter, Indicating type frequency meter, Electrodynamometer type P.F. meter. Role of power, power factor and frequency in industrial operations.	**5**
Unit 8	**Measurement in Industry (with specific practical examples):** Temperature, Pressure, Flow rate, Liquid level, Physical dimensions, Chemical composition, Electrical parameters - voltage, current, resistance, and power, often measured using multi-meters, ammeters, and other specialized instruments, Mechanical Properties - hardness, strain, and torque, which are important for material characterization and quality control.	**8**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Tune various measuring instruments (including calibration) and measurement processes to measure electrical quantities accurately.
2. Perform experiments using a galvanometer, potentiometers, CTs & PTs, Kelvin’s double bridge, etc., to accurately measure various electrical parameters, following the electrical safety.
3. Design suitable DC and AC bridges for the measurement of resistance, inductance, capacitance, frequency, etc.
4. Identify various measuring instruments used in an industrial complex and apply different measurement techniques following the standards.

Text Books/ Reference Books:

1 Sawhney, A. K., *Electrical & Electronics Measurements and Instrumentation*, Dhanpat Rai and Co.
2 Golding, E. W., and Widdis, F. C., *Electrical Measurement and Measuring Instruments*, Reem Publications Pvt. Ltd.
3 Rajput, R. K., *Electrical Measurements and Measuring Instruments*, S. Chand.
4 Stout, Melville Bigham, *Basic Electrical Measurements*, Literary Licensing, LLC.

CE12002	**Computer Aided Drawing and Graphics**	**L-T-P-C**
	B.Tech (EE, ECE and EIE)	1-0-2-2
	Second Semester (Professional Core)	

Prerequisites: None

	Course Content	**Hours**
Unit-1	**Introduction to Engineering Drawing:** Importance and application in engineering, general instruction regarding instruments, dimensions and lettering, types of lines, concept of scales, geometrical constructions.	**9**
Unit-2	**Orthographic Projections:** Introduction to orthographic projections, elements and angles of projections, projection of points, projection of straight lines, projection of planes, conversion of pictorial views of objects into orthographic projections.	**6**
Unit-3	**Projections of Solids:** Orthographic projection of regular solids: Cubes, prisms, pyramids, cylinders, cones, tetrahedrons. Projections of frustum of solids.	**6**
Unit-4	**Isometric View:** Principles of isometric view, isometric view of simple objects, conversion of orthographic projections into isometric views.	**3**
Unit-5	**Introduction to CAD:** Introduction to CAD and advantage of CAD in engineering field, windows and system of AutoCAD, drawing area, command line, model space, layout space and work space. Drawing settings - Unit and limits, pan and zoom. Drafting settings - Grid, object snap, ortho on/off.	**3**
Unit-6	**Drafting Tools in CAD:** Tools and short commands for line, polyline, circle, polygon, arc, rectangle, ellipse, elliptical arc, hatch, spline, construction line, multiline, multiline style, point. Isometric drawing in AutoCAD.	**3**
Unit-7	**Modifying Tools in CAD:** Tools and short commands for move, rotate, trim, extend, copy, mirror, fillet, chamfer, erase, explode, offset, lengthen, edit polyline (fill on/off), edit hatch, edit array, edit multiline, align, break, point break and join. Object properties – Properties of windows, colour, linetype, linetype scale, line weight and match properties.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Produce geometric constructions with appropriate scale and dimension.
2. Apply the skill for preparing detail 2D drawing of engineering objects.
3. Visualize and develop the 3D view of engineering objects.
4. Create basic 2D drawings using AutoCAD software.

Text Books/Reference Books:

1. Bhatt, N. D., Engineering Drawing: Plane and Solid Geometry, 54th Edition, Charotar Publishing House Pvt. Limited, 2023.
2. Venugopal, K., and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, 6th Edition, New Age International, New Delhi, 2022.
3. Narayana, K. L., and Kannaiah, P., Text book on Engineering Drawing, 2nd Edition, Scitech Publishers, 2011.
4. Gopalakrishna, K. R., and Gopalakrishna, S., Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017.

PH12002	**Physics Laboratory**	**L-T-P-C**
	B.Tech (EE, ECE and EIE)	0-0-2-1
	Second Semester (Common)	

Prerequisites: None

List of Experiments

1. To calibrate an ammeter with the help of a potentiometer.
2. To study the twist in the thin rod by statical method using Barton's horizontal apparatus and thus to determine the modulus of rigidity of the material of the rod.
3. To study the bending of a beam supported at its ends and loaded at the middle and thus to determine the Young's modulus of the material of the beam.
4. To determine the refractive index of the material of a given prism using a spectrometer.
5. To determine frequency of a transverse waves and mass per unit length of given wire by using sonometer apparatus.
6. To study the charging and discharging of a capacitor and hence to determine it's time constant.
7. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
8. To determine the wavelength of sodium light using single slit diffraction.
9. Comparison of two low resistances by using Meter Bridge.

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply the various experimental procedures and techniques for physics related experiments.
2. Use the different measuring devices and setups to record the data with precision.
3. Apply the underlying physical concepts/theories to obtain quantitative results.
4. Evalute and analyze the error in the experiment with respect to the standard values of physical quanties.
5. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Text Books/ Reference Books:

1. University Practical Physics, D. C. Tayal, HPH Publisher
2. B.Sc. Practical Physics, Samir Kumar Ghosh, New Central Book Agency

MA21003

Mathematical Analysis and Probability Theory
B.Tech.(For EE,ECE,EIE)
Third Semester (Professional Core)

L -T-P- C
3- 0 - 0 - 3

Prerequisites: Ordinary & Partial differentiation, Elementary integration, Vector operations.

	Course Content	Hours
Unit-1	**Numerical Analysis:** Finite differences, Newtons forward and backward interpolation formulae, Numerical Integration: Trapezoidal and Simpsons 1/3rd rules. Solution of algebraic and transcendental equations - bisection, Newton-Raphson and regula-falsi methods. Numerical solutions of ODE and PDE, Euler's method, Taylor's method, Runge-Kutta method (4^{th} order).	**10**
Unit-2	**Vector Calculus:** Scalar & Vector Triple Product of vectors and their applications, Vector equations of lines & planes. Vector function of a single scalar variable, Limit, Continuity & differentiability. Geometrical and physical interpretation of derivatives and their applications. Scalar & Vector fields, Introduction to line, double and triple integrals, Applications of Green's theorem, Stokes' theorem and Gauss Divergence theorem.	**10**
Unit-3	**Complex Analysis:** Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integrals.	**9**
Unit-4	**Probability Theory:** Introduction to probability, Additive & multiplicative Laws of probability, Conditional probability, Independent events, Baye's theorem, Random variable, Probability mass function, Probability density function, Cumulative distribution function, Binomial, Poisson & Normal distributions.	**9**
	Total	**38**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply methods of Numerical Analysis to obtain approximate solutions of mathematical problems.
2. Solve multivariable and field-related problems using Vector Calculus concepts.
3. Analyze functions and evaluate integrals using techniques from Complex Analysis.
4. Apply principles of Probability and Statistics to model randomness and analyze data.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10^{th} Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44^{th} Edition, Khanna Publisher, 2017.
3. J. Ravichandran. Probability and Statistics for Engineers. Wiley India Pvt. Ltd., New Delhi, 2010.

Reference Books:

1. M.D. Raisinghania, Vector Analysis, S.Chand & Company Ltd, 2020.
2. S. Lipschutz and J. J. Schiller, Complex Variables, Schaum's Outline series, 2009.
3. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Method for Scientific and Engineering Computation, 2022.
4. S. Lipschutz and J. J. Schiller. Introduction to Probability and Statistics. Schaum's Outline Series, 2011.

CE21001/21002	Environmental Science	L-T-P-C
	3rd / 4th Semester (Professional Core)	2-0-0-2

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction and Natural Resources:** Environment, Definition, scope and importance, multidisciplinary nature of environmental studies, Forest Resources –use and over-exploitation of forests, deforestation, water, mineral, land, food resource and energy resources	**5**
Unit-2	**Ecosystem and Biodiversity:** Ecosystem-Concept of an ecosystem, structure and function of an ecosystem, Food chain, food webs and ecological pyramids, Energy flow in ecosystem producers and consumers Ecological Succession, Biodiversity and its Conservation – introduction, definition, genetic species and ecosystem diversity, value of biodiversity, hotspots of biodiversity, threats to biodiversity- habitat loss, poaching of wildlife conflicts, endangered and endemic species in India, conservation of biodiversity	**6**
Unit-3	**Environmental Pollution:** Causes, effects and control measures of air pollution, scales of defining pollutants, various air pollution control equipment, water pollution, wastewater management, primary, secondary and tertiary treatment techniques, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear radiation hazards, Solid waste management, sources of solid waste effects and control measures of urban industrial wastes, hierarchies of solid waste management techniques	**9**
Unit-4	**Environment and society:** Role of an individual prevention of pollution, consumerism and waste products, unsustainable to sustainable development, Environmental Laws, Environmental Impact Assessment, issue involved in enforcement of environmental legalizations, Environment and human health, epidemics, Women and child welfare, Role of information technology in environment and human health.	**4**
	Total	**24**

Course Outcomes (COs):

After completion of the course, students will be able to

9. Understand scope of environmental science and brief knowledge about natural resources
10. Realize the importance of ecosystem and biodiversity in growth of human civilization.
11. Understand the effects of environmental pollution and different strategies to mitigate it
12. Understand various environmental laws and societal issues related to the environment for the benefit of the community

Text Books/ Reference Books:

11. Henry J.G. and Heinke G.W. ***Environmental Science and Engineering.*** Prentice Hall of India. New Delhi.
12. Chandrasekhar M. ***Environmental Science.*** Hi-Tech Publishers.
13. Masters G.M. ***Environmental Engineering and Science.*** Prentice Hall of India, New Delhi.
14. Garg S.K. and Garg R. ***Ecological and Environmental Studies.*** Khanna Publishers, Delhi.
15. Chawla S. ***Environmental Studies.*** Tata McGraw-Hill Publishers, New Delhi.

EE21001	Circuit Theory	L-T-P-C
	B. Tech. (Electrical Engg.)	4-0-0-4
	Third Semester (Professional Core)	

Prerequisites:

	Course Content	Hours
Unit-1	**Two port Networks:** Significance of multi-port networks, Sign convention; Parametric models, significances and interconversions: admittance, impedance, transmission, and hybrid. Serial and parallel connection of two port networks, Conversion of impedances from star to delta and vice-versa using two port circuit analyses.	**8**
Unit-2	**Magnetically Coupled Circuit:** Dot convention and energy stored for magnetically coupled circuits, Analysis of magnetically coupled circuits	**3**
Unit-3	**Graph Theory**: Definition of node, branch, loop and mesh; Graph of a network, Tree, Co-tree, Incidence matrix, cut-set matrix, tie-set matrix and loop currents, Number of possible trees of a graph, Analysis of Networks, Network Equilibrium Equation, Duality.	**8**
Unit-4	**Applications of Laplace Transform and Fourier Analysis**: Waveform synthesis, Circuit response to arbitrary inputs using Laplace Transform, Application of Trigonometric and Exponential Fourier series analysis for the synthesis of non-sinusoidal periodic electrical functions.	**5**
Unit-5	**Frequency Response**: Concept of resonance – Series and parallel Resonance in electrical circuits, Q-factor, Selectivity, Bandwidth, and Half- power frequencies. Concept of driving point and transfer functions of a network and their significance.	**8**
Unit-6	**Filter Circuits**: Classification of filters, Ideal filter and T and π sectional representation of a filter circuit, Constant (k) type filters: low pass, high pass, band pass, band stop.	**6**
	Total	**38**

Course Outcomes (COs):

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

1. Analyze two port networks along with interconnections and applications.
2. Apply the knowledge of magnetically coupled coils and graph theory in finding circuit response.
3. Apply Laplace Transform and Fourier series to find electrical responses and synthesis of periodic signals
4. Demonstrate frequency response in AC circuits and its use in the design of passive filter networks.

Text Books/ Reference Books:

1. Hayt & Kemmerly. Engineering Circuit Analysis. Mc Graw Hill
2. Van Valkenburg. Network Analysis and Synthesis. Pearson 3rd Edition
3. Roy Choudhury. Network and Systems. New Age
4. Rajeswaran. Electric Circuit theory. Pearson
5. Wadhwa. Network Analysis and Synthesis. New Age
6. Soni & Gupta. A Course in Electrical Circuit Analysis. Dhanpat Rai & Sons.

EE21003	Electrical Machines-I	L-T-P-C
	B. Tech. (Electrical Engg.)	4-0-0-4
	Third Semester (Professional Core)	

Prerequisites:

	Course Content	Hours
Unit-1	**Basic Concept of Electrical Machines**: Classification, Armature and field winding structure of DC and Synchronous machines, Windings of transformer and induction machine, Winding factors, Concept of Different types of fields mmf for AC and DC machines. EMF and torque equations of AC and DC machines.	10
Unit-2	**DC Machines – Construction and Principle:** Constructional overview of DC machines, Armature winding types, Field systems and excitation methods, Armature reaction and commutation, Types of DC generators and motors,	4
Unit-3	**DC Generators – Performance and Characteristics:** Operating principle, separately excited, shunt, series, compound generators, Characteristics: O.C.C., internal, external characteristics, Voltage build-up and critical resistances.	4
Unit-4	**DC Motors – Performance and Control:** Operating principle, Types of DC motors and characteristics, starting methods and starters, Speed control techniques, Braking methods,	4
Unit-5	**Efficiency and Testing of DC machines:** Efficiency and losses of DC Machines, Testing methods, and Industrial applications.	3
Unit-6	**Transformers – Construction and Operation:** Transformer construction and operating principle and classification (3 phase and single phase), EMF equation of transformer, Ideal and practical transformer, Equivalent circuit and phasor diagrams (3 phase and single phase), Voltage regulation, Various types of transformer connections and their industrial applications.	8
Unit-7	**Transformer Performance and Testing:** Losses and efficiency, All-day efficiency, polarity test, Open-circuit and short-circuit tests, Sumpner's back-to-back test, Condition monitoring and cooling, Parallel operation.	4
Unit-8	**Advanced Topics and Applications:** Special transformers (autotransformers, instrument transformers, high frequency transformers), Magnetic Saturation in Transformer operation (Magnetostriction), Transformer in renewable energy systems, Introduction to smart machines and digital monitoring. Solid state transformers and applications.	3
	Total	**40**

Course Outcomes (COs):

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

1. Explain the concept (Construction and operation) of rotating electric machines and transformers.
2. Develop mathematical models and equivalent circuits of DC machines and transformers.
3. Interpret test results and operational constraints, and analyze performance characteristics and losses of DC machines and transformers.
4. Apply DC machines and transformers for industrial applications.

Text Books/ Reference Books:

1. P.S. Bimbhra, Electrical Machinery (7th ed.). Khanna Publishers, New Delhi, India
2. Nagrath & Kothari. Electric Machines (5th ed.). McGraw-Hill Education (India)
3. Dr. S.K. Sen. Electrical Machinery (4th ed.). Khanna Publishers, New Delhi, India\
4. MFitzgerald, A. E., Kingsley, C., & Umans, S. D. (2003). Electric Machinery (6th ed.). McGraw-Hill.
5. Chapman, Stephen J. (2012). Electric Machinery Fundamentals (5th ed.). McGraw-Hill

EE21005	Signals and Systems	L-T-P-C
	B.Tech (Electrical Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites:

	Course Content	Hours
Unit-1	**Introduction to Signals and Systems:** Introduction to standard continuous time (CT) and discrete time (DT) signals: impulse, step and ramp, sinusoid, exponential signals, their properties and importance, power signal, energy signals. Basic properties of systems: linearity, time-invariance, causality, stability, invertibility etc. with special emphasis on LTI system, mathematical model for systems, impulse response of a LTI system (CT and DT systems), Computation of convolution integral and convolution sum, block diagram representations of CT and DT systems.	**10**
Unit-2	**Application of Fourier Series and Fourier Transform:** Fourier Series Representation of periodic Signals, Fourier series, Waveform. Symmetries, Calculation of Fourier Coefficients, Frequency spectrum of aperiodic signals, Discrete time Fourier series/DFT. Basic properties of CT and FT Fourier series coefficient, Parseval's Theorem. Response of LTI systems (CT and DT) to complex exponentials, concept of Eigen functions, CT and DT Fourier transform (FT) of an a periodic signal, convergence of FT, properties of FT. Parseval's relation, Magnitude and phase response, introductory concepts of ideal and practical filters.	**8**
Unit-3	**Sampling and Reconstruction of Signals:** Concept of sampling, impulse sampling, Nyquist sampling theorem, zero order hold, reconstruction of signals from its samples.	**4**
Unit-4	**Application of Laplace and Z-Transform** Bilateral and unilateral Laplace transform (LT), Concept of poles and zeros, Region of Convergence (ROC), relation of system causality and stability with ROC, properties, inverse LT, applications. Bilateral and unilateral Z Transform (ZT), Concept of poles and zeros, relation of system causality.	**10**
	Total	**32**

Course Outcomes (COs)

At the end of the course the students will be able to

1. Define, represent and analyse various signals and system and their applications.
2. Apply Fourier series and transform to analyze the signals it in frequency domain.
3. Understand the Concept of sampling and reconstruction of signals from its samples.
4. Apply the knowledge of Laplace and Z-Transform to analyze the continuous and discrete time systems in frequency domain.

Text Books/ Reference Books:

1. A. V. Oppenheim, A. S. Willsky, and H. S. Nawab, Signals and Systems, 2nd edition. Pearson, 2015.
2. M. J. Roberts and G. Sharma, Fundamentals of Signals and Systems, 2nd edition. McGraw-Hill Education, 2017.
3. Tarun Kumar Rawat, Signals and Systems, Oxford University Press 2018.
4. :
5. B. P. Lathi, Signal Processing and Linear Systems. Oxford University Press, 2006.
6. R. F. Ziemer, W. H. Tranter, and D. R. Fannin, Signals and Systems - Continuous and Discrete, 4th edition. Pearson, 2014.
7. S. Haykin and B. V. Veen, Signals and Systems. Wiley, 2007.

EE21007	**Analog and Digital Electronics**	**L-T-P-C**
	B.Tech (Electrical Engg.)	4-0-0-4
	Third Semester (Professional Core)	

Prerequisites:

	Course Content	**Hours**
Unit-1	Physics of junction devices, BJT/FET as amplifiers and Oscillators; Multistage amplifiers, frequency response of basic and compound configurations.	8
Unit-2	Amplifiers, Feedback: Effect of negative and positive feedback, basic feedback topologies and their properties, analysis of practical feedback amplifiers; Sinusodial oscillators (RC, LC and crystal), multivibrators.	6
Unit-3	Power amplifiers: Class A, B, AB, C, D stages; IC output stages, operational amplifier circuits: Differential and Cascade amplifiers and applications, SE/NE 555 timer IC.	6
Unit-4	Active filters,- voltage controlled oscillators, A/D and D/A converters, sample and hold circuits	2
Unit-5	Logic Families: Different logic families, MOSFET as switch, TTL inverter – circuit description and operation, CMOS inverter – circuit description and operation, other TTL and CMOS gates, electrical behaviour of logic circuits.	4
Unit-6	Combinational logic modules, Decoders, encoders, multiplexers, de-multiplexers and their applications.	4
Unit-7	Three state devices, comparators, programmable logic devices, Sequential logic circuits: design and analysis of synchronous and asynchronous sequential circuits.	6
Unit-8	Memory: Read only memory (ROM), EPROM, Flash, static and dynamic random access memories.	4
Unit-9	Proposal of a Mini Project involving Analog and Digital Electronics and its possible applications.	4
	Total	**44**

Course Outcomes (COs)

At the end of the course the students will be able to

1. Analyse analog and digital electronic circuits.
2. Design of analog computational circuits using OP-AMP.
3. Design and analysis of active filters, oscillators and semiconductor memories.
4. Apply analog and digital circuits for industrial applications.

Text Books/ Reference Books:

1. Sedra & Smith, Microelectronic Circuits - 5th Edition
2. M. Morris Mano, Digital Logic and Computer Design, Pearson Education, 2016.
3. Boylestad & Nashelsky, Electronic Devices and Circuit Theory - 9th Edition
4. A.P. Malvino, Electronic Principles, Tata Mcgraw Hill Publications
5. William Kleitz, Digital Electronics, Prentice Hall International Inc
6. R. T. Howe and C. G. Sodini, Microelectronics: An Integrated Approach, Prentice Hall Inc. 1997.
7. Jacob Millman, and C.C. Halkias, “Electronic devices and circuits”, TMH Publications.
8. Ben G. Streetman, Solid State Electronic Devices, PHI, 5th Ed, 2001
9. Michael Shur, Introduction to Electronic Devices, John Wiley & Sons Inc., 2000.

EE22001	**Programming and Simulation Laboratory**	**L-T-P-C**
	B.Tech (Electrical Engg.)	1-0-2-1.5
	Third Semester (Professional Core)	

Prerequisites:

List of Experiments

Sl. No.	**Experiments**
1.	Basic computation of arithmetic, logarithm, trigonometric and exponential function using MATLAB.
2.	Simulation of different functions using MATLAB.
3.	Matrix operation and application of sorting using MATLAB.
4.	Solution of linear and differential equations using MATLAB.
5.	Simulation of different mathematical expressions using MATLAB simulation library (Simulink).
6.	Simulation of electrical and electronics circuits using MATLAB simulation library (Simulink) and creating Graphical User Interface (GUI) in MATLAB.
7.	Verification of Network Theorems Using PSpice.
8.	Transient response of RLC series & RLC parallel circuit by PSpice.
9.	Mini Project for the evaluation of the overall learning in the laboratory

Course Outcomes (COs):

After completion of the course, students will be able to

1. Solve electrical engineering problems using various numerical methods
2. Simulate and verify electrical and electronic circuits.
3. Design and analyse electrical circuits using PSPICE/MULTISIM or virtual laboratory.
4. Apply the programming and simulation skills for real life problems.

EE22003	**Measuring Instruments Laboratory**	**L-T-P-C**
	B.Tech (Electrical Engg.)	0-0-2-1
	Third Semester (Professional Core)	

Prerequisites:

List of Experiments

Sl. No.	**Experiments**
1.	To perform the calibration of a three-phase energy meter using a sub-standard energy meter as reference
2.	Experimental determination of power and power factors in a three-phase circuit.
3.	To study, determine, and evaluate the error of a single-phase energy meter using a sub-standard meter.
4.	To determine the value of medium resistance with the help of a Wheatstone bridge.
5.	Determination of different types of resistance by the substitution bridge method.
6.	Measurement of Peak and RMS voltages and Frequency of AC by using DSO.
7.	Experimental determination of unknown self-inductance of a coil using Anderson's A.C. bridge.
8.	To measure unknown self-inductance of high-quality factor of coil using Hay's Bridge.
9.	Open Ended Experiment 1 (Preferably Simulation Based)
10.	Open Ended Experiment 2 (Preferably Hardware Based)

Course Outcomes (COs):

After completion of the course, students will be able to

1. Calibrate and analyze single-phase and three-phase electrical energy and power measurements.
2. Measure electrical parameters using bridge methods and analyze accuracy and errors.
3. Perform and analyze open-ended electrical measurement experiments using modern instruments.

EE22005	**Circuit Laboratory**	**L-T-P-C**
	B.Tech (Electrical Engg.)	0-0-2-1
	Third Semester (Professional Core)	

Prerequisites:

Sl. No.	**Experiments**
1.	To determine the admittance (Y) parameters of an AC two-port network
2.	To determine the impedance (Z) parameters of an AC two-port network
3.	To determine the hybrid (h) parameters of an AC two-port network
4.	To determine the ABCD parameters of an AC two-port network
5.	To verify the Millman's Theorem on a DC circuit
6.	To determine the self-inductance of a coil in different core positions
7.	To measure the power and power factor of the load using three voltmeter method
8.	To analyse series resonance in an AC R-L-C circuit

Course Outcomes (COs):

After completion of the course, students will be able to

1. Demonstrate different types of modelling in AC networks and verify network theorems.
2. Compute frequency, impedance and voltage in resonating RLC series circuit.
3. Compute power, power factor and to analyse magnetization characteristic of core in in AC circuit

EE22007	**Analog and Digital Electronics Laboratory**	**L-T-P-C**
	B.Tech (Electrical Engg.)	0-0-2-1
	Third Semester (Professional Core)	

Prerequisites:

Sl. No.	Experiments
1.	Design and analyze inverting and non-inverting OP-AMP (IC 741) amplifiers.
2.	Implement and study OP-AMP (IC 741) based summing amplifier, Schmitt trigger, differentiator, and integrator circuits.
3.	Develop and verify low-pass and high-pass filters for a specified cut-off frequency.
4.	Construct and evaluate symmetrical and asymmetrical astable multivibrators using IC 555.
5.	Investigate the functionality of logic gates and the realization of adder and subtractor circuits.
6.	Formulate and implement digital code converter circuits.
7.	Construct and validate encoder and decoder circuits.
8.	Demonstrate the design and operation of a synchronous up–down counter.
9.	Examine the design and performance of shift register circuits.
10.	Open-ended laboratory experiment based on any additional Analog or Digital Electronics circuit. (Students may opt it based on available resources)

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply the principles of operational amplifiers to design, analyze, and verify linear and non-linear analog circuits such as amplifiers, filters, and waveform generators.
2. Implement and evaluate analog signal-processing circuits using OP-AMPs and timer ICs to achieve desired frequency response and waveform characteristics.
3. Design and realize fundamental combinational digital circuits including logic gates, adders, subtractors, code converters, encoders, and decoders.
4. Analyze and implement sequential digital circuits such as counters and shift registers, and interpret their timing and functional performance.

HS21001/21002	Engineering Economics	L-T-P-C
	IIIrd / IVth Semester (Professional Core)	3-0-0-3

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction:** Definition and scope of Economics; Engineering Economics and the role of engineers in economic decision-making; Theory of Consumer Behaviour: Cardinal and Ordinal Utility analysis.	**4**
Unit-2	**Demand Analysis:** Demand: meaning, law, determinants; Supply: meaning, law, determinants; Market equilibrium and price determination; Elasticity of demand; Demand Forecasting techniques.	**4**
Unit-3	**Theory of Cost and Production:** Meaning and classification of costs; Short-run cost concepts; Fixed cost; Variable cost; Total, average, and marginal cost; Long-run cost curves; Law of Variable Proportion and Returns to scale.	**3**
Unit 4:	**Theory of Product Pricing:** Market Structure: Perfect Competition-Characteristics; Price Determination; Monopoly- Characteristics, Price and Output Determination.	**6**
Unit 5	**National Income Determination**: Concepts and Measurement of National Income; Components of National Income; Methods of National Income Calculation; Problems in Measuring National Income.	**3**
Unit 6	**Macroeconomic issues and International Market:** Unemployment: Definition, types, and causes; Inflation: types, causes, and social costs of inflation; Business Cycle; Schumpeter theory of innovation.	**6**
Unit-7	**Project Evaluation and Management:** Meaning of Project Cycle, Project selection and planning; Project Appraisal; Means of financing and financial appraisal tools; Qualitative Methods for Project Evaluation, Social Cost Benefit Analysis; Externalities and environmental concerns.	**6**
	Total	**32**

Course Outcomes (COs):

After completion of the course, students will be able to

5. To introduce economic principles relevant to engineering decision-making
6. To analyse consumer behaviour, cost functions and producer behaviour for Engineering Decisions
7. To understand national income and macroeconomic issues
8. To apply project evaluation techniques and social and environmental cost-benefit analysis

Text Books/ Reference Books:

7. H. G. Thuesen, W. J. Fabrycky, and G. J. Thuesen (1993), Engineering Economy, Prentice Hall International.
8. F. C. Jelen (1970), Cost and Optimisation Engineering, McGraw-Hill Book Co., New York.
9. Hal R. Varian. Intermediate Microeconomics, 8th Edition, W. W. Norton and Company.
10. N. Gregory Mankiw. Principles of Microeconomics. Cengage Learning
11. N. Gregory Mankiw, Ronald D. Kneebone, Kenneth J McKenzie (2023). Principles of Macroeconomics, 9th Edition. Cengage Canada.
12. Salvatore, D. International Economics (11th ed.). John Wiley & Sons.

EE21002	Classical Control Systems	L-T-P-C
	B.Tech (Electrical Engg.)	4-0-0-4
	Fourth Semester (Professional Core)	

Prerequisites:

	Course Content	Hours
Unit-1	**Introduction:** Introduction of feedback control systems with motivational examples, Basic terminologies of feedback control systems. Case study (group assignments): Find an example of control techniques application in a practical system around you or in an industrial system. What is the role of the control technique? How to find the control techniques? Why do we need control system analysis and design?	**2**
Unit-2	**Mathematical modeling:** Mathematical modeling of electrical and mechanical systems with block diagrams. Transfer functions, Physical significance of poles and zeros, State-space modelling of dynamical systems. Block diagram reductions, Relevance of Routh array, Signal flow graph, Mason's gain formula. Classification of systems: SISO vs MIMO, Linear vs nonlinear, time-invariance vs time-varying, time-delay system or dead-time system with real-life examples.	**8**
Unit-3	**Time domain analysis:** Standard signals, Time response of First and Second order systems due to a unit step input, Time domain specifications, Location of poles of a second-order system with the variation of ω_n and ζ in s-plane, Concept of stability, BIBO stability and its measure, Stability and relative stability using Routh array, Static and Dynamic error coefficients, Steady state response, Standard performance indices. The root-locus technique, steps for obtaining a root-locus. The notion of controller design using root locus, Stability and transient performance using root locus.	**10**
Unit-4	**Frequency domain analysis:** Basic input-output relation, Bode plots, Polar plots, Nyquist plots, Nyquist stability criteria, frequency domain specifications and relative stability, The notion of controller design using frequency domain, Correlation between time and frequency domain specifications.	**8**
Unit-5	**Feedback Controller Design:** Basic idea of feedback control systems; P, PI, PD, PID controllers, Error analysis.	**4**
Unit-6	**Compensator & Controller Design:** Lead, lag and lag–lead compensators, introductory examples for each type of compensator design using root locus and Bode plot, Compensators vs PID controllers.	**6**
	Total	**38**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the fundamental concepts, terminologies, requirement and importance of feedback control systems.
2. Develop mathematical models using block diagrams and deduce transfer functions of electrical and mechanical systems using Block diagram reduction and Signal flow graph.
3. Analyze time-domain and frequency-domain behaviors and stability of control systems using various specifications, standard performance indices and Routh criterion.
4. Design and analyze P, PI, PD, and PID controllers to improve system performance
5. Design controllers and compensators; analyze stability by using root locus and frequency domain techniques.

Text Books/ Reference Books:

1. Franklin G.F., Powell J.D., Emami-Naeini A., Feedback Control of Dynamic Systems, Pearson, Upper Saddle River, New Jersey, 5th edition, 2006.
2. Ogata K., Modern Control Engineering, Prentice-Hall of India Pvt Ltd., New Delhi, 3rd edition, 2000.
3. Kuo B.C., Automatic Control Systems, Prentice-Hall of India Pvt Ltd., New Delhi, 6th edition, 1991.
4. N S Nise, Control Systems Engineering, Wiley
5. M. Gopal, Control Systems Principles and Design, Tata McGraw-Hill
6. J. Nagrath and M. Gopal, Control Systems Engineering, New Age International
7. Dorf and Bishop, Modern Control Systems, Addison Wesley

EE21004	Electrical Machines-II	L-T-P-C
	B. Tech. (Electrical Engg.)	4-0-0-4
	Fourth Semester (Professional Core)	

Prerequisites:

	Course Content	Hours
Unit-1	**Three-Phase Induction Machine– Construction and operating principle:** Construction of stator and rotor (squirrel cage, slip-ring), Classification, Principle of operation, Rotor frequency and slip, EMF and torque production	4
Unit-2	**Induction Machine Modeling and Performance:** Equivalent circuit of induction motor, Power flow diagram, Torque equation and maximum torque condition, Starting methods, Losses, efficiency, Performance under variable voltage and frequency, Speed control methods, Braking methods, Concept of doubly fed induction machine, and Industrial applications	8
Unit-3	**Synchronous Machine-Cylindrical Type:** Types and constructional features, EMF equation, Basic synchronous machine model, Concept of synchronous reactance and its determination, Open circuit and short circuit characteristics, Short circuit ratio, Operating characteristics, Phasor diagrams under various operating conditions, Nature of armature reaction, Power flow equations,	6
Unit-4	**Synchronous Machine-Salient Pole Type**: Introduction to two-reaction theory of salient pole type machine, concept of direct and quadrature axis reactance, Phasor diagram under various operating conditions both for motoring and generating mode, slip test, Damper winding, Synchronizing power, Determination of sequence impedance.	6
Unit-5	**Performance of Synchronous machine:** Synchronizing to infinite bus, Effect of excitation variations when connected to bus, Voltage regulation, Capability curve and Parallel operation, V-curve, Hunting, Methods of starting of synchronous motor and Application of synchronous motor as phase modifier, Swing equation under dynamic condition, Equal area criteria, Power-angle diagram & stability, Steady state and transient stability limits.	8
Unit-6	**Single-phase and Special AC Machines and Emerging Trend:** Single-phase Induction motors – Construction, Operating Principle, equivalent circuit, Stepper motors, Permanent magnet synchronous motors (PMSM), Brushless DC motors (BLDC), Switch Reluctance motors (SRM)– comparison with AC machines, Applications in EVs and renewable energy systems.	8
	Total	**40**

Course Outcomes (COs):

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

1. Explain the construction and operating principles of AC rotating machines.
2. Derive equivalent circuits and performance equations of synchronous and induction machines.
3. Analyse steady-state, dynamic characteristics and evaluate losses, efficiency, and stability of AC rotating machines.
4. Apply AC rotating machines in industrial and power system applications.

Text Books/ Reference Books:

1. P.S. Bimbhra, Electrical Machinery (7th ed.). Khanna Publishers, New Delhi, India
2. Nagrath & Kothari. Electric Machines (5th ed.). McGraw-Hill Education (India)
3. Dr. S.K. Sen. Electrical Machinery (4th ed.). Khanna Publishers, New Delhi, India\
4. MFitzgerald, A. E., Kingsley, C., & Umans, S. D. (2003). Electric Machinery (6th ed.). McGraw-Hill.
5. Chapman, Stephen J. (2012). Electric Machinery Fundamentals (5th ed.). McGraw-Hill

EE21006	Power Systems-I	L-T-P-C
	B.Tech (Electrical Engg.)	4-0-0-4
	Fourth Semester (Professional Core)	

Prerequisites:

	Course Content	Hours
Unit-1	**Introduction to various Power Plants:** Introduction to conventional sources and non-conventional sources of energy, their scopes for energy conversion. Overview of different conventional and non-conventional power generation plants. Per unit quantities, per unit values for steady state condition, single line diagram, problems.	6
Unit-2	**Economics of Power Systems:** Definitions of Load, connected load, Base load, Peak load, Demand, Demand intervals, Demand factor, Average load, Load factor, Diversity factors, Utilization factor, Capacity factor and Load curve. Economics of power factor improvement, tariff structures. Problems.	6
Unit-3	**Transmission Systems:** Introduction, transmission voltages, classification of transmission system, advantages of high voltage transmission, comparison of overhead and underground supply system. Comparison of AC and DC transmission system, economic choice of conductor size, Kelvin's law, problems.	6
Unit-4	**Overhead Transmission Line Constants:** Introduction, Conductors, Resistance of overhead line, inductance of solid cylindrical conductor, composite conductors, two conductor single phase line, three phase single circuit and double circuit lines with symmetrical and unsymmetrical spacing, transposed and un transposed line. Capacitance of two wire line, three phase symmetrical and unsymmetrical line, charging current, effect of earth on capacitance of transmission line. Skin and Proximity Effects. Corona in transmission line, critical disruptive and visual disruptive voltages, factors effecting corona, corona power loss, advantages and disadvantages of corona. Problems.	10
Unit-5	**Overhead Line Insulators and Underground Cables:** Overhead line insulators and its types, voltage grading of insulators, string efficiency, methods of improving string efficiency, grading. Sag in overhead line, calculation of sag, ice and wind loading, Stringing chart. Underground cables, general construction, classification of cables, capacitance of a single core cable, capacitance of three core cables, most economical size of conductor, grading of cables, types of grading, breakdown voltages. Problems.	6
Unit-6	**Distribution Systems (DS):** Introduction, classification of DS, feeders, distributors, service mains of a typical DS, primary AC DS - radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC DS - three phase four wire system and single phase two wire DS, methods of calculation of AC DS, current loading and voltage drop diagram. Problems	6
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the fundamentals of electric power generation and interpret per-unit quantities for the steady-state analysis.
2. Analyze power system economics and load characteristics.
3. Compute the electrical parameters for overhead and underground power lines.
4. Apply design principles to transmission and distribution systems.
5. Apply knowledge to solve operational problems in the power system.

Text Books/ Reference Books:

1. C.L. Wadhwa. Electrical Power systems. Wiley Eastern.
2. Ashfaq Hussain. Electrical Power System. CBS Publishers.

3. Soni, Gupta, Bhatnagar. Electric Power. Dhanpat Rai & Sons.
4. J.B.Gupta. A course in Power Systems. S. K. Katia & Sons.
5. O.I.Elgerd. Electric Energy system Theory – An Introduction. Tata McgrawHilll.
6. B.R.Gupta. Generation of Electrical Energy. S. Chand.
7. T.K. Nagsarkar and M.S. Sukhija. Power System Analysis. Oxford University Press.
8. I.J. Nagrath and D.P. Kothari. Power System Engineering. Tata McGraw-Hill.

EE21008	Microprocessor and Embedded Systems	L-T-P-C
	B.Tech (Electrical Engg.)	3-0-0-3
	Fourth Semester (Professional Core)	

Prerequisites:

	Course Content	Hours
Unit-1	**Fundamentals of Microprocessors**	**5**
	Evolution of microprocessors and embedded systems, microprocessor versus microcontroller, applications in electrical engineering systems, Harvard and Von-Neumann architectures, RISC and CISC processors, basic organization of a microprocessor system	
Unit-2	**8085 & 8086 Microprocessor Architecture**	**12**
	Functional block diagram of 8085, ALU, registers and timing control unit, data bus and address bus with multiplexing concept, instruction format and classification, addressing modes, instruction cycle, machine cycle and T-states, timing diagrams for instruction fetch and memory operations, memory organization and memory mapping, basic architecture of 8086 including EU and BIU, segment registers, pipelining concept and comparison with 8085	
Unit-3	**Programming and Interfacing**	**11**
	Data representation including binary, BCD, assembly language fundamentals, arithmetic, logical and branching instructions, looping, delay programs, subroutines and stack operations, introduction to interrupts, interfacing concepts, 8255 programmable peripheral interface, interfacing ADC, DMA, basics of serial communication	
Unit-4	**Embedded Controllers for Electrical Systems**	**8**
	Real-time control requirements in electrical engineering applications, overview of embedded system architecture, introduction to TI C2000 microcontrollers, special peripherals for control such as PWM modules, synchronized ADCs, timers and interrupts, development tools including IDE, compiler and debugger, basic embedded program structure, applications in electrical systems	
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain microprocessor fundamentals and architectures.
2. Analyze 8085/8086 architecture and operation.
3. Develop assembly programs and interface peripherals.
4. Apply embedded controllers in electrical applications.

Text Books/ Reference Books:

1. R. S. Gaonkar, Microprocessor Architecture, Programming and Applications, New Delhi, India: Wiley Eastern.
2. Texas Instruments, Hands-on Workshop on C2000 TMS320F28379D Microcontroller for Real-Time Control Applications, Training Material and Lab Guide
3. D. V. Hall, Microprocessors and Interfacing: Programming and Hardware, New York, NY, USA: McGraw-Hill, International Edition.
4. L. B. Das, The x86 Microprocessors, Noida, India: Pearson Education, 2010.

EE22002	**Power Electronic Devices and Fabrication Laboratory**	**L-T-P-C**
	B.Tech (Electrical Engg.)	1–0 -2-1.5
	Fourth Semester (Professional Core)	

Prerequisites:

Sl. No.	**Experiments**
1.	Identification of commonly used power electronic components, PCB fabrication tools, and laboratory instruments along with their functions, ratings, and safe handling procedures.
2.	Plot and analyze the V–I characteristics of a power diode.
3.	Design and assemble a PWM pulse generation circuit on a breadboard and verify its output waveform.
4.	Implement the PWM pulse generation circuit on a general-purpose PCB using proper soldering and desoldering techniques.
5.	Obtain and study the switching characteristics of a power BJT.
6.	Obtain and study the switching characteristics of a power MOSFET.
7.	Plot the switching characteristics of an IGBT and compare its performance with BJT and MOSFET.
8.	Assemble and test a single-phase diode rectifier circuit with and without capacitive filter and measure ripple reduction.
9.	Design and fabricate a single-layer PCB layout for diode rectifier with filter circuits using PCB design software.
10.	Study the characteristics of wide bandgap semiconductor devices and compare them with conventional silicon devices.

Course Outcomes (COs):

After completion of the course, students will be able to

1. Characterize power semiconductor devices.
2. Assemble, solder, and test power electronic circuits.
3. Design and fabricate single-layer PCBs and analyze circuit performance.

EE22004	**Electrical Machines-I Laboratory**	**L-T-P-C**
	B.Tech (Electrical Engg.)	0–0–2–1
	Fourth Semester (Professional Core)	

Prerequisites:

Sl. No.	Experiments
1	Ratio and polarity test of a single-phase transformer.
2	Direct loading test on single-phase transformer.
3	Open circuit and short circuit tests on a single-phase transformer.
4	Sumpner's (Back to Back) test on a single-phase transformer.
5	Parallel operation of two single-phase transformers
6	Three Phase to Two Phase Conversion (Scott Connection).
7	Three Phase to Six Phase Conversion.
8	Open circuit (Magnetization) characteristics of DC shunt generator.
9	Load characteristics of a DC shunt generator.
10	Load characteristics of D.C compound generator.
11	Load Characteristics of DC Series Motor.
12	Speed control of DC shunt motor.
13	Swinburne's test of a DC motor.
14	Hopkinson's (Back-to-Back) test on DC motor-generator set.
15	Speed reversal of 3-phase Induction Motor
16.	DC and AC Machine winding Design using FEM tools

Course Outcomes (COs):

After completion of the course, students will be able to

1. Demonstrate and execute different tests on single-phase Transformer to Analyse and Evaluate various performance parametes and characteristics.
2. Demonstrate and execute tests for different phase-conversion techniques using single-phase Transformers.
3. Demonstrate and execute different tests on different types of DC generator and Motors to Analyse and Evaluate various performance parametes and characteristics.
4. Design and simulate DC and AC machines windings to Analyse and Evaluate various performance features.

EE22006	**Microprocessor and Embedded Systems Laboratory**	**L-T-P-C**
	B.Tech (Electrical Engg.)	0–0–2–1
	Fourth Semester (Professional Core)	

Prerequisites:

Sl. No.	Experiments
1.	Write and execute programs for addition and subtraction of 8-bit and 16-bit numbers with carry/borrow.
2.	Write and execute a program for multiplication using shift/rotate method.
3.	Write and execute a program for division using repeated subtraction method.
4.	Write and execute a program to count number of 1's and 0's in a given byte.
5.	Write and execute a program to arrange numbers in ascending order.
6.	Write and execute a program for block data transfer.
7.	Write and execute a program for BCD to binary conversion and vice versa.
8.	Write and execute programs demonstrating stack operations using PUSH, POP, CALL, and RETURN instructions.
9.	Write and execute a program to compute square root or factorial of a number.
10.	Introduction to TI C2000 development board and study of architecture and peripherals.
11.	Generate PWM signal using a TI microcontroller and observe waveform using CRO/DSO.

Course Outcomes (COs):

After completion of the course, students will be able to

1. Develop and execute assembly programs for arithmetic, logical, data manipulation, and control operations.
2. Analyze program execution using registers, stack operations, and instruction flow concepts.
3. Apply microcontroller knowledge to study peripherals and generate PWM signals for real-time applications.

DEPT. OF ELECTRONICS & COMMUNICATION ENGINEERING

Algebra and Calculus

	B. Tech (For ALL Branches)	**L-T-P-C**
MA11001	**First Semester (Professional Core)**	**3- 0-0- 3**

Pre-requisites: *Matrix and determinants, Limit, Continuity, Differentiability, Basic idea of integration*.

	Course Content	**Hours**
Unit-1	**Linear Algebra:** R^n as a vector space, Linear dependence and independence of vectors in R^n, Basis & Dimension; Rank and nullity of a matrix, Elementary transformations, Consistency of a System of linear equations & their solutions by Direct Methods: Gaussian Elimination method, Gauss-Jordan method; Eigenvalues & Eigenvectors, Hermitian, Skew-Hermitian & Unitary matrices, Cayley-Hamilton's theorem & its applications.	**8**
Unit-2	**Infinite Series:** Definition of Sequence & Infinite Series, Convergence & Divergence of real Sequence & Infinite Series, Tests of Convergence of positive term infinite series: Comparison Test, D' Alembert's Ratio Test, Raabe's Test, Cauchy's root Test, Integral Test, Alternating Series, Leibnitz's Test (all tests without proofs).	**8**
Unit-3	**Differential Calculus:** Successive Differentiation, Leibnitz's Theorem, Rolle's theorem, Lagrange's & Cauchy's Mean value theorems, Curvature, Radius & centre of curvature, Partial differentiation, Euler's theorem, Jacobian, Taylor's & Maclaurin's Theorems with Lagrange's form of remainder for functions of one and two variables, Expansions of functions of one and two variables, Extreme values for functions of two or more variables, Lagrange's method of undetermined multipliers.	**14**
Unit-4	**Integral Calculus:** Reduction Formulae. Application of integrals in Quadrature, Rectification, Volume and surface area of solids of revolution.	**6**
		Total: 36

Course Outcomes:

On completion of this Course,

1. The students will be able to apply the consistency concepts, eigenvalues, and eigenvectors concepts in engineering problems.

2. The students will be able to apply the concept of convergence of infinite series in mathematical & engineering problems.

3. The students will be capable of applying the knowledge of differentiation in the expansion of functions and optimizing functions appearing in engineering and daily life problems.

4. The students will be able to apply knowledge of integration in finding area, length of arc of curves, volume, and surface area appearing in engineering and real-life problems.

Course Objectives:

1. To make the students knowledgeable in the area of the system of linear equations, together with
   Solution techniques and applications in engineering problems.
2. To make the students knowledgeable in the area of infinite series and their convergence, so that they may be familiar with the limitations of series approximations of functions arising in Mathematical Modelling.
3. To make the students familiar with the area of application of differentiation, expansion of functions, and finding Extreme values of functions.
4. To enable the students to evaluate definite integrals and their application in finding area, length, volume, and surface area of solids of revolution.

Text Books:

4. Jr. Joel Hass, C. Heil & M.D. Weir, Thomas' Calculus, 14th Edition, Pearson Education, 2018.
5. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
6. S. C. Malik, S. Arora, Mathematical Analysis, 7th Edition, New Age Int. Publishers, 2005.

Reference Books:

5. B.C. Das & B.N. Mukherjee, Differential Calculus, U. N. Dhur & Sons Pvt. Ltd., 55th Edition, 1949.
6. B.C. Das, B.N. Mukherjee, Integral Calculus, U. N. Dhur & Sons Pvt. Ltd., 57th Edition, 1938.
7. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.
8. F. Ayres, Theory and Problems of Matrices, Schaum's Outline Series, 1st Edition, 1962.

CY11001	Applied Chemistry	L-T-P-C
	B.Tech (EE, ECE and EIE)	3-0-0-3
	First Semester	

Prerequisites: None

	Course Content	Hours
Unit-1	**Polymer & Composite materials:** Classification of polymers, methods of polymerization, thermosetting and thermoplastic polymers, conducting and biodegradable polymers, synthesis, properties and applications of polyethylene, chloropolyvinyl chloride (CPVC), Composite materials: Classification and basic requirement of composite materials, applications.	**6**
Unit-2	**Nanomaterials & Fuels**: Nanomaterials: Introduction; synthesis, characterization and applications of nanomaterials. Fuel: Introduction, classification of fuel, calorific value (HCV and LCV), determination of calorific value by bomb calorimetry, bio-fuels.	**6**
Unit-3	**Chemical Thermodynamics:** Introduction to chemical thermodynamics; second law of thermodynamics, Gibbs free energy, reaction spontaneity and equilibrium, fundamental equations, Maxwell's relations, Gibbs-Helmoltz equation, chemical potential.	**6**
Unit-4	**Electrochemistry & Corrosion:** Electrode potentials and its relevance to oxidation and reduction, types of electrodes, galvanic cell, measurement of EMF and application of EMF, types of reference electrodes (hydrogen, glass, quinhydrone electrodes), determination of pH. Dry Cells, lead acid cell and Fuel Cells: Construction, reaction, advantages and applications. Corrosion: Types of corrosion, factors affecting corrosion and corrosion control.	**6**
Unit-5	**Water & Its Treatment:** Sources of impurities in water; hardness in water and its disadvantages; boiler scale and its prevention; caustic embrittlement; boiler corrosion: treatment of water at industrial and domestic level; biological oxygen demand (BOD) and chemical oxygen demand (COD) and their significance.	**6**
Unit-6	**Spectroscopy:** Basics of spectroscopy, electromagnetic spectrum, Basic principles of IR, UV-Visible and NMR spectroscopy, Application of IR, UV-Visible and NMR spectroscopy in structure elucidation and material characterization.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

5. Understand the synthesis, properties, and applications of polymers, composites, and nanomaterials for engineering and industrial use.
6. Apply the principles of chemical thermodynamics and electrochemistry to solve engineering problems related to energy, fuel and electrochemical systems.
7. Identify different types of corrosion and propose appropriate control and prevention strategies for materials.
8. Evaluate water quality and treatment methods, and interpret spectroscopic data for material analysis.

Text Books/ Reference Books:

6. Jain, P.C., and Jain, M., Engineering Chemistry (2025), Dhanpat Rai Publishing Company
7. Chawla, S., Engineering Chemistry (2019), Dhanpat Rai Publishing Company
8. Glasstone, S., Physical Chemistry (1948), McMillan India
9. Dey, A. K., Environmental Chemistry (2003), New Age International
10. Rao, C. N. R., Müller, A., Cheetham, A. K. (Editor), The Chemistry of Nanomaterials Synthesis, Properties and Applications, Chemistry of Nanomaterials (2004), Wiley-VCH

ME11001	Engineering Mechanics	L-T-P-C
	B.Tech. (EE, ECE and EIE)	2-1-0-3
	First Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	Equivalent Force System, Equilibrium of Rigid Bodies, Law of Coulomb friction: Applications of dry friction in wedge and belt.	**9**
Unit-2	Equilibrium of simple plane trusses. Analysis of trusses by the method of joints and method of section. Principle of virtual work, Simple applications of Principle of virtual work for rigid bodies in static equilibrium.	**9**
Unit-3	Centroid of simple and composite plane figures. Pappus theorem and its applications. Area moment of inertia of simple and composite figures, Perpendicular axis theorem. Parallel axis theorem, Polar moment of inertia.	**6**
Unit-4	*Kinematics of particles:* Rectilinear motion of particles, plane curvilinear motion of particles in different coordinate systems, constrained motion of connected particles. *Plane kinematics of rigid bodies:* Translation of a rigid body in plane motion, rotation of rigid bodies about a fixed axis. *Kinetics of particles:* Applications of Newton's laws of motion, D'Alembert's principle, Principle of work-energy and Impulse-momentum in particle dynamics, Direct central impact and oblique central impact. *Plane kinetics of rigid bodies:* Equation of plane motion of a rigid body, Principle of work-energy in plane motion of a rigid body.	**12**
	Total	**36**

Course Outcomes (COs):

Upon the completion of this course, the students are expected

6. To build a fundamental understanding of static equilibrium in particles, rigid bodies, and friction, and apply it to solve related engineering problems.
7. To develop the ability to analyze simple plane trusses and apply the principle of virtual work to systems in static equilibrium.
8. To apply the theorem of Pappus. Parallel axis theorem and Perpendicular axis theorem.
9. To apply the concept of centroid and moment of inertia in analyzing the simple and composite figures.
10. To develop the ability to apply for solving the practical problems on kinematics and kinetics of motion of particles and rigid bodies.

Text Books:

6. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Statics, John Wiley & Sons, Inc; 3/e.
7. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Dynamics, John Wiley & Sons, Inc; 3/e.
8. F. P. Beer, Jr., E. R. Johnston, E. R. Eisenberg, P. J. Cornwell, D. Mazurek. Vector Mechanics for Engineers- Statics & Dynamics, McGraw-Hill Higher Education; 9/e.
9. 1. H. Shames, Engineering Mechanics - Statics and Dynamics, 4lh edition, Prentice-Hall of India.
10. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati. Engineering Mechanics, McGraw Hill Education; 5/e.

Reference Books:

3. S. Timoshenko, D.H. Young, Engineering Mechanics, 4th edition, McGraw- Hill.
4. R.C. Hibbeler. Engineering Mechanics - Statics & Dynamics, Pearson Education, 4/e.

Electrical and Electronics Technology

B.Tech. (ECE, EE and EIE)

EC11001 First Semester **L-T-P-C**

3-0-0-3

	Course Content	**Hours**
	Part – I: Electrical Engineering Dept portion	
Unit 1	Electrical safety: Definition, precautions D.C. Circuit & Networks: KVL and KCL, Superposition Theorem, Thevenin's and Norton's Theorems, Maximum power transfer theorem	**4**
Unit 2	A.C. Circuit: A.C. Fundamentals, phasor representation and algebra, Series R-L, R-C and R-L-C circuits, power calculations in A.C. circuit, phasor diagrams. Balanced Star-Delta connections, phase and line currents and voltages and their relations.	**6**
Unit 3	Measuring instruments: Ammeter, voltmeter, wattmeter, energy meter – types & connection, concepts of grounding and earthing.	**3**
Unit 4	Electrical Machines: D.C machine fundamentals and Transformer (Brief construction, types, working principle, voltage equation and application), 3-phase induction motor (Brief construction, principle, types, applications).	**5**
	Part – II: Electronics and Communication Engineering Dept portion	
Unit 1	Introduction to Electronic devices, Diode: Basic structure and operating principle, Diode Applications: rectifier circuits (half-wave and full-wave bridge rectifier), voltage regulator using Zener diode, clipper circuits, clamper circuits.	**5**
Unit 2	BJT structure and its applications: Basic structure, operation of transistor in active and saturation mode, DC analysis, MOSFET: Introduction to MOSFET, Operation and characteristics. Basic Amplifier Design.	**5**
Unit 3	System Design using Operational Amplifier (Op-Amp): Ideal op-amp, inverting amplifier, non-inverting configuration, transfer characteristics, op-amp applications like difference amplifier, summing amplifier, integrator, and differentiator.	**3**
Unit 4	Basic Digital Electronics: Logic gates, Boolean algebra, De-Morgan's theorem, K-Map, combinational circuits like adder, multiplexer, and de-multiplexer. Memory units: RAM, ROM.	**5**
		Total: 36

Course Outcomes (COs):

1. Understand the basic structure and operating principle of electronics devices and analyse DC and AC networks.
2. Measure different electrical quantities in simple 1-phase and 3-phase circuits.
3. Classify the electrical machines and the electronics devices; explain their working principles, characteristics and applications.
4. Design and implement simple analog and digital electronic circuits.

Text books:

5. J. B. Gupta, Basic Electrical Engineering, S K Kataria & Sons
6. Ashfaq Husain, Haroon Ashfaq, Basic Electrical Engineering, Dhanpat Rai & Co.
7. Louis Nashelsky and Robert Boylestad, Electronics Devices and Circuit Theory, 10th Edition, Pearson India.
8. Digital Design, M. Morris Mano, and Michael D Ciletti, Pearson.

EC11002	Semiconductor Devices & Applications	L-T-P-C
	B.Tech. (ECE)	3-0-0-3
	First Semester (Professional Core I)	

	Course Content	Hours
Unit 1	Energy bands in semiconductors; charge carriers: electrons and holes, effective mass, doping, Carrier concentration: Fermi level, temperature dependence of carrier concentration, Density of states, Fermi-Dirac probability, Drift, and diffusion of carriers, recombination and lifetime of carriers.	**7**
Unit 2	**P-N Junction:** depletion region, forward and reverse- bias, depletion, and diffusion capacitances, switching characteristics; breakdown mechanisms, Metal-semiconductor junctions: rectifying and Ohmic contacts.	**6**
Unit 3	**Bipolar Junction Transistor:** BJT structure and principles of operation, I-V characteristics, equivalent circuit models, Transistor configurations: CB, CC, CE, Input, output and transfer characteristics of transistor, relation between α and β, small signal equivalent circuit, DC & AC load line and Q point Transistor biasing.	**8**
Unit 4	**Field Effect Transistor:**Introduction to FET, Difference between BJT and FET (bipolar vs unipolar, current vs voltage control, concept of electric field controlling current flow, high input impedance — significance in circuit design), Structure and working of JFET, basic structure of n-channel JFET, working principle, output and transfer characteristics. MOSFET structure, regions of operation, carrier transport, I-V characteristics, C-V characteristics, small-signal equivalent circuit. Introduction to FINFETs, GAA, transducers based on semiconductor devices.	**8**
Unit 5	**Optical Devices**: Optical absorption; conversion efficiency, light emitting diodes, solar cells, photodetectors.	**3**
		Total: 32

Course Outcomes (COs):

CO1: Describe the fundamental properties of semiconductors, including carrier generation, transport, and recombination mechanisms.

CO2: Analyse the electrical characteristics of P-N junctions, BJTs, and MOSFETs under different biasing conditions.

CO3: Apply device models to solve electronic circuit problems involving diodes, transistors (BJTs, FETs), and MOS devices.

CO4: Evaluate the performance of optical devices such as LEDs, photodetectors, and solar cells based on efficiency and response characteristics.

Text books:

1. S. M. Sze and M. K. Lee, Semiconductor Devices: Physics and Technology, 3rd Edition, 2013, Wiley.
2. A. K. Dutta, Semiconductor Devices and Circuits, Illustrated Edition, 2008, Oxford University Press.
3. J. Millman, C. C. Halkias and S. Jit, Electronics Devices and Circuits, 4th Edition, 2015, McGraw-Hill.
4. A. S. Sedra and K. C. Smith, Microelectronics Circuits, 5th Edition, 2005, Oxford University Press.
5. B. Streetman and S. Banerjee, Solid State Electronic Devices, 7th Edition, 2015, Pearson Education Limited.
6. D. A. Neamen, Semiconductor Physics and Devices, 4th Edition, 2011, McGraw-Hill

ME12001	Workshop Practice	L-T-P-C
	B.Tech. (EE, ECE and EIE)	0-0-3-1
	First Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	General safety precautions in workshop and introduction.	**3**
Unit-2	**Carpentry Shop:** Safety precaution, Kinds of wood and timber, Application of timber as per their classification, Carpentry hand tools and machines, Different types of carpentry joint, Demonstration of wood working machine like, band saw, circular saw, thickness planner, wood working lathe, surface planners, etc.	**6**
Unit-3	**Welding Shop:** Safety precaution in welding shop, Introduction to gas and arc welding, Soldering and brazing etc. Welding equipment and welding material.	**6**
Unit-4	**Fitting Shop:** Safety precaution, Introduction to fitting shop tools, equipment, Operation and their uses, Marking and measuring practice.	**6**
Unit-5	**Machine Shop:** Safety precautions, Demonstration and working principles of some of the general machines, like lathe, shaper, milling, drilling, grinding, slotting etc., General idea of cutting tools of the machines.	**6**
	Total	**27**

Course Outcomes (COs):

After completion of the course, students will be able to

7. Know the importance of general safety precautions on different shop floors.
8. Identify the basics of tools and equipments used in fitting, carpentry, sheet metal, machine, welding and smithy.
9. Do fabrication of wooden joints and understand joining of metals.
10. Make metal joints and sheet metal work.
11. Understand the basics of removal of material from work piece surface to attain specific shape.
12. Familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.

Text Books/ Reference Books:

3. S K Hajra Choudhury, A K Hajra Choudhury, N. Roy. Workshop Technology Vol I & II, Media Promoters & Publishers Pvt. Ltd; 9/e.
4. H S Bawa. Workshop Practice, McGraw Hill Education; 2nd edition, 2/e.

EC12001	Electrical and Electronics Technology Laboratory	L-T-P
	B.Tech. (ECE, EE and EIE)	0-0-2
	First Semester	

Experiments

12. Verification of Thevenin's and Norton's Theorems in a DC circuit.
13. Verification of Superposition Theorem in DC circuits.
14. Measurement of power in single phase AC circuit using three ammeter method.
15. Measurement of three phase power in an AC circuit with star and delta connected variable loads.
16. Verification of Maximum Power Transfer Theorem in a DC circuit.
17. Familiarization with the components and instruments.
18. Design of a clipper and clamper circuits (both positive and negative)
19. Plot the VI characteristics of a PN junction diode and Zener diode and compare their difference.
20. Implement Boolean functions using logic gates.
21. Plot static characteristics of Common Emitter/ Common Base configuration of BJT.
22. Design of circuits using operational amplifier.

Course Outcomes (COs):

1. Develop practical skills using electrical and electronic components and measuring equipment.
2. Demonstrate and justify results of Network theorems in DC circuits.
3. Compute and verify power consumptions for single and three phase loads.
4. Understand the characteristics of various electronics devices.
5. Design and analyze simple analog and digital circuits.

CY12001	Chemistry Laboratory	L-T-P-C
	B.Tech (EE, ECE and EIE)	0-0-2-1
	First Semester	

Prerequisites: None

List of Experiments:

Experiment 1: To determine the total hardness of pond water/ supplied water using the standard EDTA solution
Experiment 2: Estimation of magnesium from the supplied solution using standard EDTA
Experiment 3: Estimation of calcium from the supplied solution using standard EDTA
Experiment 4: Determination of dissolved oxygen (DO) of lake water
Experiment 5: Determination of total alkalinity of supplied aqueous solution.
Experiment 6: To determine the strength of the $KMnO_4$ solution using a standard oxalic acid solution
Experiment 7: To determine the amount of Fe(II) present in the supplied solution using the standard $KMnO_4$ solution
Experiment 8: To determine the amount of Fe(III) present in the supplied solution using the standard $K_2Cr_2O_7$
Experiment 9: Quantitative determination of Copper (II) using standard HYPO ($Na_2S_2O_3$) solution
Experiment 10: Estimation of calcium in milk powder using standard EDTA solution
Experiment 11. Detection of special elements in supplied organic compounds.
Experiment 12: Determination of functional groups in the supplied organic compounds
Experiment 13: Preparation of Copper (II) glycinato complex
Experiment 14: Determination of the relative viscosity of the given organic compound by Ostwald Viscometer
Experiment 15: Determination of the surface tension of the given organic compound by the stalagmometer

Course Outcomes (COs): After completion of the course, students will be able to

7. Know about the methods for the determination of water quality parameters. They can assess the quality of water for drinking purposes, etc., by performing experiments such as determining total hardness, Ca^{2+}, Mg^{2+}, total alkalinity, and dissolved oxygen.
8. Determine presence of Fe^{3+}, Fe^{2+}, Cu^{2+} ions in water
9. Determine the physical properties of liquids by performing experiments, such as viscosity. They will also be able to determine the viscosity of the lubricating oil. The generated knowledge can be used for industrial product development, like detergent formulation.
10. Determine the surface tension of liquids
11. Synthesise coordination complexes of biologically important transition metal ions.
12. To perform the chemical reactions to find out different elements, functional groups or nonmetals present in the organic compounds. This will also help them to understand the role of different functional groups in chemical reactivity.

Text Books/ Reference Books:

1. Das, S. C., Advanced Practical Chemistry (2024), The World Press Private Limited
2. Laboratory Manual, Dept. of Chemistry, NIT Silchar

MA11004	Differential Equations and Mathematical Methods	L -T-P- C
	B. Tech. (For EE, ECE and EIE)	3- 0 - 0 - 3
	Second Semester (Professional Core)	

Pre-requisites: *Linear Algebra and Calculus.*

	Course Content	Hours
Unit-1	**Ordinary Differential Equation:** Exact differential equation of first order, integrating factors. Second & higher order linear differential equations with constant coefficients, Homogeneous (Cauchy's) linear differential equation, Method of variation of parameters.	**8**
Unit-2	**Partial Differential Equation:** Formation of partial differential equations (PDE), Solution of PDE by direct integration, Lagrange's linear equation & its solution, Non-linear PDE of first order, Charpit's method of solution, Homogeneous and Non-homogeneous linear equations with constant coefficients, Boundary and initial value problems (Dirichlet and Neumann type). Second-order PDE with constant coefficients and their classification to elliptic, parabolic, and hyperbolic type, solution by the method of separation of variables.	**10**
Unit-3	**Laplace and Z-Transform:** Basic idea of Integral Transform, Laplace and inverse Laplace transforms & their properties, Convolution Theorem, Solution of ODE by Laplace transform method. Z-transform and its properties, Solution of difference equations.	**9**
Unit-4	**Fourier Series and Fourier Transform:** Periodic functions, Fourier series representation of a function, half-range series, Fourier integral formula. Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting, and time shifting properties. Convolution theorem, Applications to boundary value problems.	**9**
		Total: 36

Course Outcomes:

On completion of this course

1. The students will be able to apply ordinary differential equations in engineering and real-life problems.
2. The students will be capable of applying partial differential equations in engineering and real-life problems.
3. The students will be able to apply Laplace/Z-transform in engineering problems.
4. The students will be able to apply the Fourier transform in engineering problems.

Course Objectives

1. To enable the students to understand the basic ideas of ordinary differential equations and their solutions, and also the application of series in solving ordinary linear differential equations.
2. To enable the students to understand the basic ideas of partial differential equations and their solutions, and also the applications in IVP & BVP.
3. To enable the students to solve ODE/Difference equations by using Laplace and Z-transform.
4. To enable students to clear the basic concepts on the Fourier series, the Fourier Transform, and to solve BVP.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.

Reference Books:

1. M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand & Company Ltd, 2020.
2. G.F. Simmons, Differential Equations, Tata McGraw-Hill, 2nd edition, 2017.
3. S. Sreenadh, Fourier Series and Integral Transforms, S. Chand Publication, 2014.

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PH11002	Wave Mechanics and Solid-State Physics	L-T-P-C
	B.Tech (EE, ECE and EIE)	3-0-0-3
	Second Semester (Common)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Waves and Oscillation:** Introduction to Vibrations and Oscillations, Review on Free Oscillations, Damped motions -under damping -Logarithmic decrement, relaxation time and Q-Factor, overdamping and critical damping, Forced oscillations with damping - Steady state solution and its frequency response, Power absorbed and dissipation in forced oscillator, Resonance- amplitude, velocity and power- sharpness of resonance.	**7**
	Coupled oscillations, introduction of normal modes and normal coordinate and their physical significance- general solutions, wave equation in one dimension, Characteristics and solution, superposition, travelling and standing waves, phase and group velocity.	**5**
Unit-2	**Electromagnetic Waves:** Vector Calculus : Scalar and Vector Fields – Differential calculus, Del operator, Gradient, Divergence and Curl, Product rules, Second Derivative with Del operator, Laplacian operator –Line, Surface and Volume Integrals (definition), Fundamental theorem of Integral calculus qualitatively (Gradient, Divergence and Curl)	**4**
	Electromagnetic theory: Maxwell's equations, Displacement current, Maxwell's equation in matter, Electromagnetic waves: The wave equation, Sinusoidal waves, Polarization EM waves in vacuum, Monochromatic plane waves, Energy in electromagnetic waves, EM waves in conductors, Conservation laws: continuity equation, Poynting's theorem, boundary conditions, reflection and transmission at normal incidence.	**6**
Unit-3	**Modern Physics and Quantum Mechanics:** Failure of classical physics, qualitative review of relevant experiments such as blackbody radiation, photo- electric effect, Compton scattering, de Broglie matter waves and Davison-Germer experiment, Uncertainty principle, Wave packet.	**3**
	Basic postulates of quantum mechanics, Wavefunction, normalization of wave function, quantum mechanical operators, probability density, expectation value, Development of Schrödinger equation (time dependent & time independent), particle on a 1D infinite potential well, potential barrier and quantum tunnelling.	**5**
Unit-4	**Solid State Physics:** Free electron theory, Fermi Dirac distribution, Fermi level, Density of states, Band theory of solids - conductors, semiconductors, insulators, Semiconductors - Intrinsic & Extrinsic, electron & hole concentration at thermal equilibrium. Hall Effect, Basics of Superconductivity- Zero resistance, perfect diamagnetism, critical field and Meissner effect.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

6. Explain the fundamental concepts of **classical and quantum wave mechanics**.
7. Interpret fundamental physical laws and principles for relevant engineering applications.
8. Apply principles of physics to solve numerical problems in **classical and quantum wave mechanics**.
9. Analyze various physical phenomena using appropriate concepts such as superposition, wave-particle duality, polarization, and quantization.
10. Evaluate the validity and limitations of theories in waves, electromagnetism, and quantum physics through comparison with experimental observations.

Text Books/ Reference Books:

7. Vibration and waves, A. P. French, CBS Publishers
8. Introduction to Electrodynamics, D. J. Griffiths, *Pearson*
9. *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*, Resnick and Eisberg, John Wiley & Sons
10. Quantum Mechanics, D. J. Griffiths, Cambridge University Press
11. Introduction to Solid State Physics, C. Kittel, Wiley India
12. The Physics of Solid, R Turton, Oxford University Press.

CS11002	Programming and Data Structure	L-T-P-C
	B.Tech (EE, ECE and EIE)	2-0-2-3
	Secound Semester (Professional Core)	

Prerequisites: Nil

		Hours
Unit-1	**Introduction:** Basic operations of digital computers, basic concepts of integer and floating point number representation, algorithm and efficiency.	**4**
Unit-2	**(Elements of C Programming)**: Data types, variables, operators, expression and assignment statements, conditional and branch statements, Loops and iteration statements, 1-d arrays, functions and parameter passing, recursions, Strings, pointers and structures, dynamic memory allocations.	**12**
Unit-3	**(Linear Data Structures): 2-d arrays, linked lists, stacks, and queues.**	**10**
Unit-4	**(Searching and Sorting):** Linear and binary search, bubble sort, insertion sort, merge sort, quick sort.	**8**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Learn the syntax and semantics of C programming language.
2. Test and execute the programs and correct syntax and logical errors.
3. Implement conditional branching, iteration and recursion.
4. Use basic data-structures (arrays, link lists, stacks, and queues) to formulate algorithms and programs.
5. Understand and analyse different searching sorting techniques.

Text Books/ Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
6. R. G. Dromey, How to Solve it by Computer, Prentice-Hall of India.

HS11001/11002	**English for Technical Communication** Ist / IInd Semester (Professional Core)	L-T-P-C 2-0-2-3

	Course Content	**Hour**
Unit 1	**Organizational Communication:** Introduction to the Course Importance and Relevance of the Course Why Communicative English? What is Communication? Barrier to Communication Non-verbal/Oral/(In)Formal Communication	6
Unit II	**Reading Comprehension** **Ignited mind** (Two Chapters) by APJ Abdul Kalam Essay: **Religion of the forest** by Rabindranath Tagore Essay: **Is Google Making Us Stupid?** by Nicholas Carr **The Story of My Sanskrit** (A chapter) by Kumud Pawde	**8**
Unit III	**Written Communication:** Letter Writing Cover Letter CV/Resume Writing Précis writing Essay Writing Report Writing Email Etiquettes Idioms and Phrases One Word Substitution Technical Communication Documentation and Minutes of Meeting Debate	**12**
Unit IV	**Oral Communication:**	**6**

Job interviews (Process, stages in job interviews, types of interviews, preparation, use of verbal and non-verbal cues, mock interview sessions)

Group Discussion (Features, uses-recruitment, selection, stages, positive and negative roles, organizational GD's (Brain Storming, Normal Group techniques, Delphi Technique))

Pictorial Essays.

Course Outcomes:

11. Students will recall the content and make inferences on organizational communication setup
12. Students will be able to read faster and comprehend better
13. Students will be able to express their ideas and thoughts clearly and systematically in the form of essays and reports
14. Students will be able to conduct short meetings with the skill to draft simple and short minutes of the meeting.
15. Students will demonstrate the ability to face the employment selection and answer interview questions, and they will be able to participate in group discussions confidently and assertively

Reference Books:

13. Barun K. Mitra & Basundhara Mitra*, Personality Development and Soft Skills.* Oxford University Press, 2024.

14. Meenakshi Raman & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press, 2015. https://d.docs.live.net/0af95281db477321/Desktop/question%20papers%20NITS/Technical%20Communication.pdf

15. Michael Swan. *Practical English Usage*. Oxford University Press, 2016.

16. Nilanjana Gupta. *English for All*. Macmillan Publishers India Ltd, 2011.

17. S. Miglani & S. Goyal. *English for Professionals- A Practical Book of Communication Skills in English*. Vayu Education of India, 2010.

18. Sanjay Kumar & Pushp Lata. *Communication Skills*. Oxford University Press, 2015.

EC11004	Fundamentals of Analog and Digital Circuits	L-T-P-C
	B.Tech. (ECE)	3-0-0-3
	Second Semester (Professional Core II)	

	Course Content	Hours
Unit 1	BJT and MOSFET-based Amplifiers: Biasing schemes of BJT and MOSFET, Introduction to small signal analysis, Single-stage BJT and MOSFET amplifier configurations using hybrid π-model, Multistage BJT and MOSFET amplifiers.	**6**
Unit 2	Operational amplifiers and their applications: Basics of Op-Amp, Op-amp applications like current-to-voltage converter, voltage-to-current converter, difference amplifier, instrumentation amplifier, Schmitt trigger circuits, Astable and mono-stable multivibrator circuits	**6**
Unit 3	Number Systems and Boolean Algebra: Decimal, binary, octal, hexadecimal number system and conversion, binary weighted codes, signed numbers, 1's and 2's complement codes, Binary arithmetic, De-Morgans theorems, canonical logic forms, sum of product & product of sums, Karnaugh maps, two, three and four variable Karnaugh maps.	**8**
Unit 4	Analysis & design of Combinational Logic: Introduction to combinational circuits, code conversions, decoder, encoder, priority encoder, multiplexers as function generators, binary adder, subtractor, BCD adder, Binary comparator, arithmetic logic units.	**8**
Unit 5	Sequential Logic: Sequential circuits, flip-flops, clocked and edge-triggered flip-flops, timing specifications, asynchronous and synchronous counters, counter design with state equations, Registers, serial in serial out shift registers.	**5**
		Total: 33

Course Outcomes (COs):

1. Design BJT and MOSFET based circuits.
2. Design and analyse circuits using operational amplifiers.
3. Understand the basic concepts of data and binary systems.
4. Understand and Illustrate combinational circuits.
5. Demonstrate the memory, Flip flops and registers.

Text books:

9. S. Smith, *Microelectronics Circuits*, 5th Ed., Oxford, 2005
10. P. Gray, P. Hurst, S. Lewis, and R. Meyer, *Analysis & Design of Analog Integrated Circuits*, 4th Ed., Wiley, 2001.
11. B. Razavi, *Design of Analog CMOS Integrated Circuits*, McGraw Hill 2001.
12. Digital Design, M. Morris Mano, and Michael D Ciletti, Pearson
13. Modern Digital Electronics, R.P.Jain, McGraw-Hill

CE12002	**Computer Aided Drawing and Graphics**	**L-T-P-C**
	B.Tech (EE, ECE and EIE)	1-0-2-2
	Second Semester (Professional Core)	

Prerequisites: None

	Course Content	**Hours**
Unit-1	**Introduction to Engineering Drawing:** Importance and application in engineering, general instruction regarding instruments, dimensions and lettering, types of lines, concept of scales, geometrical constructions.	**9**
Unit-2	**Orthographic Projections:** Introduction to orthographic projections, elements and angles of projections, projection of points, projection of straight lines, projection of planes, conversion of pictorial views of objects into orthographic projections.	**6**
Unit-3	**Projections of Solids:** Orthographic projection of regular solids: Cubes, prisms, pyramids, cylinders, cones, tetrahedrons. Projections of frustum of solids.	**6**
Unit-4	**Isometric View:** Principles of isometric view, isometric view of simple objects, conversion of orthographic projections into isometric views.	**3**
Unit-5	**Introduction to CAD:** Introduction to CAD and advantage of CAD in engineering field, windows and system of AutoCAD, drawing area, command line, model space, layout space and work space. Drawing settings - Unit and limits, pan and zoom. Drafting settings - Grid, object snap, ortho on/off.	**3**
Unit-6	**Drafting Tools in CAD:** Tools and short commands for line, polyline, circle, polygon, arc, rectangle, ellipse, elliptical arc, hatch, spline, construction line, multiline, multiline style, point. Isometric drawing in AutoCAD.	**3**
Unit-7	**Modifying Tools in CAD:** Tools and short commands for move, rotate, trim, extend, copy, mirror, fillet, chamfer, erase, explode, offset, lengthen, edit polyline (fill on/off), edit hatch, edit array, edit multiline, align, break, point break and join. Object properties – Properties of windows, colour, linetype, linetype scale, line weight and match properties.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

5. Produce geometric constructions with appropriate scale and dimension.
6. Apply the skill for preparing detail 2D drawing of engineering objects.
7. Visualize and develop the 3D view of engineering objects.
8. Create basic 2D drawings using AutoCAD software.

Text Books/Reference Books:

5. Bhatt, N. D., Engineering Drawing: Plane and Solid Geometry, 54th Edition, Charotar Publishing House Pvt. Limited, 2023.
6. Venugopal, K., and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, 6th Edition, New Age International, New Delhi, 2022.
7. Narayana, K. L., and Kannaiah, P., Text book on Engineering Drawing, 2nd Edition, Scitech Publishers, 2011.
8. Gopalakrishna, K. R., and Gopalakrishna, S., Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017.

PH12002	Physics Laboratory	L-T-P-C
	B.Tech (EE, ECE and EIE)	0-0-2-1
	Second Semester (Common)	

Prerequisites: None

List of Experiments

10. To calibrate an ammeter with the help of a potentiometer.
11. To study the twist in the thin rod by statical method using Barton's horizontal apparatus and thus to determine the modulus of rigidity of the material of the rod.
12. To study the bending of a beam supported at its ends and loaded at the middle and thus to determine the Young's modulus of the material of the beam.
13. To determine the refractive index of the material of a given prism using a spectrometer.
14. To determine frequency of a transverse waves and mass per unit length of given wire by using sonometer apparatus.
15. To study the charging and discharging of a capacitor and hence to determine it's time constant.
16. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
17. To determine the wavelength of sodium light using single slit diffraction.
18. Comparison of two low resistances by using Meter Bridge.

Course Outcomes (COs):

After completion of the course, students will be able to

6. Apply the various experimental procedures and techniques for physics related experiments.
7. Use the different measuring devices and setups to record the data with precision.
8. Apply the underlying physical concepts/theories to obtain quantitative results.
9. Evalute and analyze the error in the experiment with respect to the standard values of physical quanties.
10. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Text Books/ Reference Books:

1. University Practical Physics, D. C. Tayal, HPH Publisher
2. B.Sc. Practical Physics, Samir Kumar Ghosh, New Central Book Agency

MA21003

Mathematical Analysis and Probability Theory
B.Tech.(For EE,ECE,EIE)
Third Semester (Professional Core)

L -T-P- C
3- 0 - 0 - 3

Prerequisites: Ordinary & Partial differentiation, Elementary integration, Vector operations.

	Course Content	Hours
Unit-1	**Numerical Analysis:** Finite differences, Newtons forward and backward interpolation formulae, Numerical Integration: Trapezoidal and Simpsons 1/3rd rules. Solution of algebraic and transcendental equations - bisection, Newton-Raphson and regula-falsi methods. Numerical solutions of ODE and PDE, Euler's method, Taylor's method, Runge-Kutta method (4^{th} order).	**10**
Unit-2	**Vector Calculus:** Scalar & Vector Triple Product of vectors and their applications, Vector equations of lines & planes. Vector function of a single scalar variable, Limit, Continuity & differentiability. Geometrical and physical interpretation of derivatives and their applications. Scalar & Vector fields, Introduction to line, double and triple integrals, Applications of Green's theorem, Stokes' theorem and Gauss Divergence theorem.	**10**
Unit-3	**Complex Analysis:** Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integrals.	**9**
Unit-4	**Probability Theory:** Introduction to probability, Additive & multiplicative Laws of probability, Conditional probability, Independent events, Baye's theorem, Random variable, Probability mass function, Probability density function, Cumulative distribution function, Binomial, Poisson & Normal distributions.	**9**
	Total	**38**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply methods of Numerical Analysis to obtain approximate solutions of mathematical problems.
2. Solve multivariable and field-related problems using Vector Calculus concepts.
3. Analyze functions and evaluate integrals using techniques from Complex Analysis.
4. Apply principles of Probability and Statistics to model randomness and analyze data.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10^{th} Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44^{th} Edition, Khanna Publisher, 2017.
3. J. Ravichandran. Probability and Statistics for Engineers. Wiley India Pvt. Ltd., New Delhi, 2010.

Reference Books:

1. M.D. Raisinghania, Vector Analysis, S.Chand & Company Ltd, 2020.
2. S. Lipschutz and J. J. Schiller, Complex Variables, Schaum's Outline series, 2009.
3. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Method for Scientific and Engineering Computation, 2022.
4. S. Lipschutz and J. J. Schiller. Introduction to Probability and Statistics. Schaum's Outline Series, 2011.

CE21001/21002	Environmental Science	L-T-P-C
	3rd / 4th Semester (Professional Core)	2-0-0-2

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction and Natural Resources:** Environment, Definition, scope and importance, multidisciplinary nature of environmental studies, Forest Resources –use and over-exploitation of forests, deforestation, water, mineral, land, food resource and energy resources	**5**
Unit-2	**Ecosystem and Biodiversity:** Ecosystem-Concept of an ecosystem, structure and function of an ecosystem, Food chain, food webs and ecological pyramids, Energy flow in ecosystem producers and consumers Ecological Succession, Biodiversity and its Conservation – introduction, definition, genetic species and ecosystem diversity, value of biodiversity, hotspots of biodiversity, threats to biodiversity- habitat loss, poaching of wildlife conflicts, endangered and endemic species in India, conservation of biodiversity	**6**
Unit-3	**Environmental Pollution:** Causes, effects and control measures of air pollution, scales of defining pollutants, various air pollution control equipment, water pollution, wastewater management, primary, secondary and tertiary treatment techniques, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear radiation hazards, Solid waste management, sources of solid waste effects and control measures of urban industrial wastes, hierarchies of solid waste management techniques	**9**
Unit-4	**Environment and society:** Role of an individual prevention of pollution, consumerism and waste products, unsustainable to sustainable development, Environmental Laws, Environmental Impact Assessment, issue involved in enforcement of environmental legalizations, Environment and human health, epidemics, Women and child welfare, Role of information technology in environment and human health.	**4**
	Total	**24**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand scope of environmental science and brief knowledge about natural resources
2. Realize the importance of ecosystem and biodiversity in growth of human civilization.
3. Understand the effects of environmental pollution and different strategies to mitigate it
4. Understand various environmental laws and societal issues related to the environment for the benefit of the community

Text Books/ Reference Books:

1. Henry J.G. and Heinke G.W. ***Environmental Science and Engineering.*** Prentice Hall of India. New Delhi.
2. Chandrasekhar M. ***Environmental Science.*** Hi-Tech Publishers.
3. Masters G.M. ***Environmental Engineering and Science.*** Prentice Hall of India, New Delhi.
4. Garg S.K. and Garg R. ***Ecological and Environmental Studies.*** Khanna Publishers, Delhi.
5. Chawla S. ***Environmental Studies.*** Tata McGraw-Hill Publishers, New Delhi.

EC21001	Digital System Design	L-T-P-C
	B.Tech (Electronics and Communication Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites: Nil

	Course Content	Hours
Unit-1	Number systems: Binary, Octal, Decimal, Hexadecimal, Signed number representation (1's complement, 2's complement), Binary arithmetic, Boolean algebra and theorems, Logic gates and universal gates, Canonical forms (SOP, POS), Logic minimization using Karnaugh Maps.	**8**
Unit-2	Design procedure for combinational circuits, Adders, Subtractors, BCD Adder, Magnitude comparator, Code converters, Multiplexers and Demultiplexers, Encoders and Decoders, Implementation using MSI devices, Introduction to PLDs (PAL, PLA, PROM).	**9**
Unit-3	Latches and Flip-Flops (SR, JK, D, T), Triggering methods and timing parameters, Registers and Shift Registers, Counters (Asynchronous and Synchronous), Finite State Machines (Moore and Mealy models), State reduction and state assignment, Sequence detector design	**9**
Unit-4	Propagation delay and timing analysis, Setup time, Hold time, Hazards and glitches, Clocking methodology, Metastability, Introduction to synchronous system design	**7**
Unit-5	Introduction to HDL (Verilog preferred), Data types and operators, Behavioral and structural modelling, Combinational and sequential circuit modelling, Testbench basics, Introduction to FPGA architecture.	**7**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

5. Apply Boolean algebra to simplify digital circuits.
6. Design combinational logic circuits using standard methods.
7. Design and analyze sequential circuits and FSMs.
8. Model digital systems using Verilog HDL.
9. Implement digital designs on FPGA platforms..

Text Books/ Reference Books:

11. Digital Design, M. Morris Mano and Michael Ciletti, Pearson / PHI
12. Digital Fundamentals, Thomas L. Floyd, Pearson / Pearson India
13. Verilog HDL – Samir Palnitkar, Prentice Hall / India Edition

EC21003	Electronic Materials and Devices	L-T-P-C
	B.Tech (Electronics and Communication Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites: Nil

	Course Content	Hours
Unit-1	**Introduction to materials science and Crystal structure**: Important properties of engineering materials and materials structures. Types of Solids, Space Lattices, The Diamond Structure, Atomic Bonding, crystal structure, crystal symmetry, lattice planes and directions, miller indices and interplanar spacing. Structural determination by X-ray diffraction: Bragg's law of X-ray diffraction. Crystal imperfection, Types of imperfection: point, line, surface and grain boundary defects, Frank-Read source**.**	**6**
Unit-2	**The Quantum Concept**:, Extensions of the Wave Theory, to Atoms, Allowed and Forbidden Energy Bands, Electrical Conduction in Solids, Density of States Function, Statistical Mechanics).	**4**
Unit-3	**Energy Band Theory:** Preliminary Considerations, The Bloch Theorem, Approximate One-Dimensional Analysis, Kronig-Penney Model, Mathematical Solution, Energy Bands and Brillouin Zones, Particle Motion and Effective Mass Carriers and Current, Extrapolation of Concepts to Three Dimensions, Brillouin Zones, E-k Diagrams, Constant-Energy Surfaces, density of state, effective Mass, Molecular orbital theory and band formation, Band Gap Energy	**8**
Unit-4	**Optical properties of materials:** interaction of light with solids. Atomic and electronic interactions; optical properties of metal and non-metals. Photoelectric effects and its characteristics. Einstein photoelectric emission, PV cells and their applications.	**6**
Unit-5	**Fundamental properties of 2D materials**: Chemical bonding, crystal structure, electronic band structure doping, Electronic transport in devices with 2D material channels.	**4**
Unit-6	**MOS Capacitor**: Band Bending in the MOS Capacitor, Depletion Approximation, Flat-band, Threshold Voltage, Capacitance-Voltage (CV) Plot of the ideal MOS Capacitor, Small-signal Capacitance and Equivalent Circuit	**6**
Unit-7	**Electronic devices**: Planar and Non-Planar MOSFETs, I-V Characteristics and operation	**6**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the fundamentals of crystal geometry, crystal structures, and defects in crystal
2. Understand the fundamentals of quantum mechanics associated with crystal structure.
3. Analyse the mechanism of bond and band formation in solids and their electrical properties.
4. Analyse the optical interaction of the electronic materials
5. Understand the fundamentals of 2-D materials and planar and non-planar MOS Devices

Text Books/ Reference Books:

1. Principles of Electronic Materials and Devices, Safa Kasap, McGraw Hill
2. Advanced Semiconductor Fundamentals, Robert F. Pierret, Pearson
3. Electrical Engineering Materials, A.J. Dekker, Prentice Hall India Learning Private Limited
4. 2D Materials for Nanoelectronics, Michel Houssa, CRC Press
5. Fundamentals of Modern VLSI Devices, Taur & Ning, Cambridge Publications

Online Resources:

1. **EE 784 – 2D Materials and Devices** https://www.ee.iitb.ac.in/web/course_lists/ee-784-2d-materials-and-devices/

2. **MT21107-INTRODUCTION TO ENGINEERING MATERIALS**
   https://erp.iitkgp.ac.in/ERPWebServices/curricula/commonFileDownloader.jsp

EC21005	Signals and Systems	L-T-P-C
	B.Tech (Electronics and Communication Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites: Nil

	Course Content	Hours
Unit-1	**Classification of Signals and Systems:** Continuous time signals (CT signals)- Discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential - classification of CT and DT signals – periodic and a periodic signal, odd & even signals, Energy & Power signals - CT systems and DT systems, Operations on signals- time scaling, time reversal, time shifting, signal addition, subtraction, multiplication. Classification of systems.	**10**
Unit-2	**Analysis of Continuous Time Signals:** Drichlet's conditions for Fourier series representation, Fourier series analysis and properties. Spectrum of Continuous Time (CT) signals- Fourier Transform, analysis and synthesis, properties, Laplace transform: definition, properties, Region of Convergence (basic concept), relation with Fourier transform.	**12**
Unit-3	**Linear Time Invariant–Continuous Time Systems:** LTI systems, differential equations, Impulse response, Convolution integrals, Fourier and Laplace transforms in Analysis, ROC, Pole-zero plot of 1st and 2nd order systems, causality and stability.	**6**
Unit-4	**Analysis of Discrete Time Signals:** Baseband Sampling of CT signals- Aliasing, Nyquist criteria (basic mathematical and intuitive understanding), Reconstruction of CT signal from DT signal, DTFT (frequency analysis) and properties, Z-transform- properties, ROC, Pole-zero plot on z-plane.	**6**
Unit-5	**Linear Time Invariant –Discrete Time Systems:** Difference Equations-Block diagram representation-Impulse response-Convolution sum-DTFT and Z Transform analysis of Recursive and Non-Recursive systems, System causality and stability.	**2**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Identify different types of continuous and discrete time signals and systems.
2. Study various signals using Fourier and Laplace analysis techniques.
3. Analyze continuous-time LTI systems using differential equations, convolution integral, transfer function, pole-zero plots, and determine system causality and stability.
4. Explain the sampling theorem and analyze discrete-time signals using DTFT and Z-transform including Region of Convergence and pole-zero representation.
5. Analyze discrete-time LTI systems using difference equations, convolution sum, frequency response, and transform techniques, and determine system causality and stability.

Text Books/ Reference Books:

1. Allan V. Oppenheim, S. Wilsky and S.H. Nawab, ―Signals and Systems‖, Pearson, Indian Reprint, 2007
2. B. P. Lathi, Principles of Linear Systems and Signals‖, Oxford, Second Edition, 2009
3. H P Hsu, Signals and Systems‖, Schaum's Outlines, Tata McGraw Hill, 2006
4. S. Haykin and B. Van Veen, "Signals and Systems", Second Edition, Wiley, 2003.
5. P. Ramakrishna Rao, Signals and Systems , Tata Mc Graw Hill Publications, 2008.
6. Edward W. Kamen, Bonnie S. Heck, Fundamentals of Signals and Systems Using the Web and MATLAB, Pearson, Indian Reprint, 2007
7. John Alan Stuller, An Introduction to Signals and Systems‖, Thomson, 2007

EC21007	**Analog Integrated Circuit Design**	**L-T-P-C**
	B.Tech (Electronics and Communication Engg.)	3-1-0-4
	Third Semester (Professional Core)	

Prerequisites: Nil

	Course Content	**Hours**
Unit-1	Difference between discrete circuits and integrated circuits, IC biasing of MOS amplifier configurations-current source, current mirror, and current steering; High Frequency response, Common source amplifier with Active load, Common Gate amplifier with Active load, MOS Cascode amplifier, Wilson current mirror.	**10**
Unit-2	Basics of MOS differential amplifier, Large and small signal operation of MOS differential amplifier, common mode gain, differential mode gain and CMRR using π model; Nonideal characteristics of Differential amplifier, Differential amplifier with active load, Two stage CMOS Op-Amp, Calculation of common mode gain, differential mode gain and CMRR of two stage CMOS Op-Amp using π model.	**12**
Unit-3	Importance of negative feedback, Basic Feedback topologies-Series-Shunt, Series-Series, Shunt-Series, Shunt-Shunt; Effect of Feedback on Amplifier poles, Stability analysis using Bode-plot.	**6**
Unit-4	Non ideal effects in Op-Amp: Practical Op-Amp Parameters, Finite Open-Loop Gain, Offset Voltage, Input Bias Current, Finite Slew rate, Additional Non ideal Effects.	**6**
Unit-5	Introduction to Switch Capacitor, MOSFET as switch, Speed and Precision Consideration, Switched capacitor Amplifiers, Switched capacitor Integrator, Switched capacitor common mode feedback.	**6**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Analyze importance of integrated circuits in day-to-day applications.
2. Understand the significance of different biasing techniques and apply them to different integrated circuits.
3. Design and analysis of MOS amplifiers, current mirrors, differential amplifiers, and switched capacitor.
4. Understand the concept of feedback and frequency response of different single stage MOS amplifiers.
5. Understand the basic concepts and apply in design of integrated circuits for VLSI applications.

Text Books/ Reference Books:

1. Microelectronic Circuits, Adel S. Sedra and Kenneth C. Smith, Oxford University Press (7th edition)
2. Design of Analog CMOS Integrated Circuits, Behzad Razavi, Tata McGraw Hill
3. Microelectronics: Circuit Analysis and Design, Donald A Neamen, McGraw-Hill Education(4th edition)
4. Analog Electronics with Op-Amps, A.J. Peyton and V. Walsh, Cambridge University Press
5. Analysis and Design of Analog ICs, Gray and Meyer, Wiley India Pvt Ltd

EC22001	**Analog Integrated Circuit Design Laboratory**	**L-T-P-C**
	B.Tech (Electronics and Communication Engg.)	0-0-3-2.5
	Third Semester (Professional Core Lab)	

List of Experiments:

1. To find 3dB frequency & gain for different values of load & W/L ratio in case of common source stage with resistive load using N-MOSFET.
2. To find 3 dB frequency & gain for different values of load & W/L ratio for common source stage with resistive load using P-MOSFET.
3. Simulation & analysis of diode connected load common source amplifier. Find edge of triode region & gm1, gm2, gain & 3 dB frequencies.
4. DC analysis of source follower using resistive & current source load.
5. AC analysis of common gate amplifiers and calculate input and output impedance.
6. AC analysis of cascade stage amplifier.
7. AC analysis differential amplifier & calculate CMRR.
8. Simulation of basic current mirrors using resistive load using N-MOSFET and P MOSFET.
9. Simulation of cascade current mirrors using resistive load using N-MOSFET and N-MOSFET and P-MOSFET.
10. Simulation of Wilson Current mirror circuit.
11. Mini project

Course Outcomes (COs):

1. Design and verify gain vs. frequency plot for common source amplifier.
2. Implement and verify the AC performance of common gate and differential amplifiers.
3. Design and evaluate the characteristic of current mirror circuit.
4. mplement mini project using various integrated circuit**.**

EC22003	**Digital System Design Laboratory**	**L-T-P-C**
	B.Tech (Electronics and Communication Engg.)	0-0-2-2

Third Semester (Professional Core Lab)

Pre-Requisites: Electrical and Electronic Sciences Lab (EE-12001)

List of Experiments:

1. Study and verification of AND, OR, and NOT gates.
2. Study and verification of NAND and NOR gates.
3. Implementation of basic gates using NAND gate only and NOR gate only.
4. Verification of De Morgan's Theorem.
5. Realization of simple Boolean expressions using logic gates.
6. Implementation of Half and Full Adder .
7. Implementation of Half and Full Subtractor.
8. Implementation of 4:1 Multiplexer.
9. Verification of 3-to-8 Decoder.
10. Implementation of Binary to Gray code converter.
11. Implementation of Magnitude Comparator.
12. Verification of SR Latch.
13. Verification of JK and D Flip-Flops.
14. Design of 4-bit Shift Register.
15. Design of Ripple Counter.

Course Outcomes (COs):

1. Apply the principles of logic gates and Boolean algebra to realize combinational circuits.
2. Analyze the performance and output characteristics of combinational and sequential circuits.
3. Design different combinational and sequential circuits.
4. Implement and verify digital circuits using appropriate hardware components.

EC22005	**Signals and Systems Laboratory**	**L-T-P-C**
	B.Tech (Electronics and Communication Engg.)	0-0-2-2
	Third Semester (Professional Core Lab)	

List of Experiments:

1. Basic operations such as time scaling, time reversal, time shifting, signal addition, subtraction, and multiplication of signals.
2. Fourier series Analysis of Periodic Signals. Study the effect of increasing and decreasing of number of frequency components while synthesizing a signal.
3. Compute and plot DFT. Study the basic properties such as time shift, frequency shift, etc.
4. Plot and verify the frequency response of 1st and 2nd order RC circuit.
5. Sampling of signals. Reconstruction with basic averaging filter. Study the effect of various sampling rates in frequency domain.
6. Reconstruction of sampled signals with basic 1st and 2nd order RC filters. Study the difference in reconstruction.
7. Implement convolution. Experiment with basic signals input to LTI systems with different impulse responses. Study the convolution property of DFT
8. Implement circular convolution. Compare linear convolution with circular convolution.
9. Implement Z-transform and study pole zero plots on z-plane..

Course Outcomes (COs):

1. Apply fundamental operations on continuous-time and discrete-time signals.
2. Analyse periodic and discrete-time signals, and discrete systems using Fourier series and DFT, and Z-transform.
3. Demonstrate the sampling process and investigate aliasing effects through time-domain and frequency-domain analysis.
4. Design, implement, and experimentally verify the frequency response of first and second order RC circuits.
5. Implement linear and circular convolution, and verify the convolution theorem

HS21001/21002	Engineering Economics	L-T-P-C
	IIIrd / IVth Semester (Professional Core)	3-0-0-3

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction:** Definition and scope of Economics; Engineering Economics and the role of engineers in economic decision-making; Theory of Consumer Behaviour: Cardinal and Ordinal Utility analysis.	**4**
Unit-2	**Demand Analysis:** Demand: meaning, law, determinants; Supply: meaning, law, determinants; Market equilibrium and price determination; Elasticity of demand; Demand Forecasting techniques.	**4**
Unit-3	**Theory of Cost and Production:** Meaning and classification of costs; Short-run cost concepts; Fixed cost; Variable cost; Total, average, and marginal cost; Long-run cost curves; Law of Variable Proportion and Returns to scale.	**3**
Unit 4:	**Theory of Product Pricing:** Market Structure: Perfect Competition-Characteristics; Price Determination; Monopoly- Characteristics, Price and Output Determination.	**6**
Unit 5	**National Income Determination**: Concepts and Measurement of National Income; Components of National Income; Methods of National Income Calculation; Problems in Measuring National Income.	**3**
Unit 6	**Macroeconomic issues and International Market:** Unemployment: Definition, types, and causes; Inflation: types, causes, and social costs of inflation; Business Cycle; Schumpeter theory of innovation.	**6**
Unit-7	**Project Evaluation and Management:** Meaning of Project Cycle, Project selection and planning; Project Appraisal; Means of financing and financial appraisal tools; Qualitative Methods for Project Evaluation, Social Cost Benefit Analysis; Externalities and environmental concerns.	**6**
	Total	**32**

Course Outcomes (COs):

After completion of the course, students will be able to

9. To introduce economic principles relevant to engineering decision-making
10. To analyse consumer behaviour, cost functions and producer behaviour for Engineering Decisions
11. To understand national income and macroeconomic issues
12. To apply project evaluation techniques and social and environmental cost-benefit analysis

Text Books/ Reference Books:

13. H. G. Thuesen, W. J. Fabrycky, and G. J. Thuesen (1993), Engineering Economy, Prentice Hall International.
14. F. C. Jelen (1970), Cost and Optimisation Engineering, McGraw-Hill Book Co., New York.
15. Hal R. Varian. Intermediate Microeconomics, 8th Edition, W. W. Norton and Company.
16. N. Gregory Mankiw. Principles of Microeconomics. Cengage Learning
17. N. Gregory Mankiw, Ronald D. Kneebone, Kenneth J McKenzie (2023). Principles of Macroeconomics, 9th Edition. Cengage Canada.
18. Salvatore, D. International Economics (11th ed.). John Wiley & Sons.

EC21002	**Electromagnetic Theory and Wave Propagation**	**L-T-P-C**
	B.Tech (Electronics and Communication Engg.)	3-0-0-3
	Fourth Semester (Professional Core)	

Prerequisites: MA11001, MA11002, PH11001

	Course Content	**Hours**
Unit-1	Fundamental Concepts of Static and Time-Varying Fields: Physical interpretation of gradient, divergence and curl; Coordinate systems; Review of static fields; Biot Savart Law; Ampere's circuital law; Faraday's law; Current continuity equation; Displacement current, Laplace's equation, Boundary conditions	**10**
Unit-2	Maxwell's Equations and Plane Waves: Maxwell's equations in static & time varying fields, Maxwell's equation in phasor form Wave equation in an isotropic homogeneous medium and its solution, polarization of waves, Poynting vector.	**8**
Unit-3	Reflection of Electromagnetic Waves: Reflection and refraction of plane waves at plane boundaries, Normal incidence, standing waves, laws of reflection, reflection of obliquely incident waves, Brewster's angle.	**7**
Unit-4	Transmission lines: Circuit model for transmission lines, loss less and lossy lines, field analysis of transmission lines, Smith chart, impedance matching.	**8**
Unit-5	Wave Propagation: Ground Wave Propagation – Space and Surface Waves, Wave Tilt. Field Strength Variation with Distance and Height, Super Refraction, Duct Propagation, Scattering Phenomena, Tropospheric Propagation. Sky Wave Propagation–Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Critical Frequency, MUF, LUF, OF, Multihop Propagation.	**7**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Calculate electric and magnetic fields in different coordinates for various charge and current configurations.
2. Demonstrate different aspects of plane wave in dielectric and conducting media using Maxwell's equations.
3. Analyse the reflection of Electromagnetic Waves and its properties.
4. Realize the analogy of wave with transmission line and calculate the transmission line performance.
5. To have knowledge different wave propagation and their applications.

Text Books/ Reference Books:

1. Electromagnetic Waves and Radiating Systems, E. C. Jordan & K. G. Balman, PHI
2. Microwave Devices and Circuits, S. Y. Liao, Pearson
3. Engineering Electromagnetics, W. H. Hayt & J. A. Buck, TMH
4. Elements of Electromagnetics, M. N. O. Sadiku, Oxford Uni. Press
5. Antennas and Wave Propagation, J. D. Kraus, R. J. Marhefka and Ahmad S. Khan, TMH.

EC21004	**Microprocessor and Microcontroller**	**L-T-P-C**
	B.Tech (Electronics and Communication Engg.)	3-0-0-3
	Fourth Semester (Professional Core)	

Prerequisites: Nil

	Course Content	**Hours**
Unit-1	Introduction to microprocessor, computer and its organization, Programming system; Address bus, data bus and control bus, Tristate bus; clock generation; Connecting Microprocessor to I/O devices; Data transfer schemes; Architectural advancements of microprocessors. Introductory System design using microprocessors; 8085 & 8086 – Hardware Architecture; External memory addressing; Bus cycles; some important Companion Chips; Maximum mode bus cycle; 8086 system configuration; Memory Interfacing; Minimum mode system configuration, Interrupt processing.	**8**
Unit-2	Programmer's model of 8086; operand types, operand addressing; assembler directives, instruction Set-Data transfer group, Arithmetic group, Logical group.	**8**
Unit-3	ARM Cortex-M0/M3/M4: Architecture, pipeline, Thumb-2 instruction set. STM32 / LPC series: Register map, clock configuration, startup sequence. GPIO, NVIC, SysTick, DMA configuration. Embedded C programming with CMSIS and HAL/LL drivers. Low-power modes and power management techniques.	**8**
Unit-4	Introduction; Generation of I/O ports; Programmable Peripheral Interface (PPI)- Intel 8255; Sample-and-Hold Circuit and Multiplexer; Keyboard and Display Interface; Keyboard and Display Controller (8279). Direct memory access, Interfacing of D-to-A converter, A-to-D converter, Display Terminal Interface, Printer Interface.	**10**
Unit-5	Introduction to 8051 Micro-Controllers, Architecture; Memory Organization; Special Function register; Port Operation; Memory Interfacing, I/O Interfacing; Programming 8051 resources, interrupts; Programmer's model of 8051; Operand types, Operand addressing; Data transfer instructions, Arithmetic instructions, Logic instructions, Control transfer instructions; Programming	**6**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the internal architecture of 8-bit, and 16-bit processors.
2. Write and debug assembly and embedded C programs for microprocessors and microcontrollers.
3. Understand the ARM Cortex-M Architecture.
4. Interface sensors, actuators, displays, and communication peripherals.
5. Design and implement 8051 microcontroller based systems.

Text Books/ Reference Books:

1. Microprocessor Architecture, Programming and application with 8085, R.S. Gaonkar, PRI Penram International publishing PVT. Ltd., 5th Edition
2. Microprocessors and Interfacing, Programming and Hardware, Douglas V Hall, TMH Publication
3. The Definitive Guide to ARM CORTEX - M3 and CORTEX M4 Processors - 3rd-Ed., by Joseph Yiu
4. The 8051 Microcontroller Architecture, Programming and Application by Kenneth J. Ayala
5. Designing Embedded System Applications on ARM Cortex-M by Ariel Lutenberg, et al.
6. The 8051 Microcontroller and Embedded Systems using Assembly and C by Muhammad Ali Mazidi

EC21006	COMMUNICATION ENGINEERING	L-T-P-C
	B.Tech (Electronics and Communication Engg.)	3-0-0-3
	Fourth Semester (Professional Core	

Prerequisites: : Signal & Systems, Probability and Stochastic Process

	Course Content	Hours
Unit-1	**Introduction:** Introduction of communication system, Block diagram, type of communication, modes of communication, signal bandwidth,channel bandwidth, frequency spectrum, Signal classification (continuous time signal, discrete time), Energy and power signal, thermal noise, signal-to-noise ratio (SNR), and Shannon capacity theorem	**10**
Unit-2	**Analog Communication**: Overview of Communication System; Need of Modulation and its Benefits, definition of amplitude modulation, demodulation, modulation index, efficiency, bandwidth requirement, advantage of angle modulation over amplitude modulation, Bandwidth comparison between amplitude and angle modulation. DSB-LC, DSB-SC, power distribution analysis, and Carson's Rule for FM **Pulse modulation**: Introduction, sampling process, pulse amplitude modulation (PAM), PPM, PWM, PDM, TDM, bandwidth-noise trade-off, Nyquist sampling theorem.	**10**
Unit-3	**Digital Communication:** Introduction of digital communication, advantage of digital communication over analog, Modulation Techniques: Amplitude Shift Keying (ASK), Phase Shift Keying (PSK),Frequency Shift Keying. Line coding (NRZ, RZ, Manchester), Inter-Symbol Interference (ISI), Nyquist criterion (conceptual), QPSK, and qualitative BER comparison.	**10**
Unit-4	**Communication system:** Introduction to optical communication systems, Advantage of optical communication, Signal propagation in optical fibre, TIR, refractive index, numerical aperture, relative refractive index, skew rays, classification of fibres, Propagation of EM signals in wireless channel –Reflection, diffraction and Scattering, Signal fading, Scattering, Friss transmission equation, attenuation mechanisms and basic dispersion concepts.	**10**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. To understand the basics of communication system, transmitter/receiver block diagram, definition of basic terms related to communication.
2. To explain and discuss the need of modulation, understand the concept of analog communication including amplitude and angle
3. modulation and to calculate the value of modulation index and pulse modulation.
4. To understand the fundamentals of digital communication, Introduction to digital modulation techniques, distinguish between analog and digital
5. communication.
6. To understand the basic concepts of optical communication systems, defining various terms, evaluating losses and other parameters of fibre

Text Books/ Reference Books:

1. Title Wireless Communications principle and practice, Author Rappaport, Publisher Pearson,Edition 2nd ed. (2010)
2. Title Optical Fibre Communications Author G. Keiser Publisher 3rd Edition Tata McGraw Hill, 2000
3. Title Modern Digital and Analog Communication Systems Author B. P. Lathi and Z. Ding Publisher 4th edition, OXFORD
4. Title Analog and digital communication Author Simon Haykin, 2nd edition, Publisher JOHN WILEY & SONS, INC

EC21008 **CONTROL SYSTEMS** **L-T-P-C**

B.Tech (Electronics and Communication Engg.) 3-0-0-3

Fourth Semester (Professional Core/)

Prerequisites: Nil

	Course Content	Hours
Unit-1	Introduction to control system, Basic control system components; block diagrammatic description, Reduction of block diagrams. Open loop and closed loop (feedback) systems, Examples of automatic control system, Basic elements of servo machines models of physical systems, differential equations. Principles of feedback; transfer function; block diagrams; steady-state errors, Stability of a system, sensitivity, characteristic equation,	**8**
Unit-2	Signal flow graphs and their use in determining transfer functions of systems; Mason's Gain formula, standard test signals, Order of systems, concept of time constant, dynamic characteristics of a system, transient and steady state analysis of LTI control systems, Definition and significance of Frequency response.	**10**
Unit-3	Tools and techniques for LTI control system analysis: Relative stability issues, root loci, Routh-Hurwitz criterion, Characterization of plants: Asymptotic and BIBO stability; Significance of poles and eigenvalues; Routh-Hurwitz test. Bode and Nyquist plots. Pole placement Design	**8**
Unit-4	Control system compensators: Design of phase lead and lag compensators, Proportional-Integral-Derivative (PID) control.	**8**
Unit-5	State variable representation and solution of state equation of LTI control systems, state transition matrix, controllability, observability.	**6**
	Total	**40**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form.
2. Demonstrate different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
3. Apply time domain techniques to predict and diagnose transient performance parameters of the system for standard input functions.
4. Demonstrate different types of techniques in frequency domain to examine the stability and sensitivity of the system.
5. Design different types of controllers and compensator to ascertain the required dynamic response from the system.

Text Books/ Reference Books:

1. A Text Book of Control system, K. Ogata, PHI
2. Control System and Design, Nagrath and Gopal , TMH
3. Automatic Control System , B.C Kuo, PHI

EC22002	MICROPROCESSOR AND MICROCONTROLLER Laboratory	L-T-P-C
	B.Tech (Electronics and Communication Engg.)	0-0-3-2.5

Fourth Semester (Professional Core Lab)

List of Experiments:

1. Induction to 8085 Microprocessor
2. Addition of 2 – 8 bit numbers (b) Addition of 2 – 16 bit numbers (c) Addition of 2 – decimal numbers (d) Addition of 8 bit number (neglecting the carry)
3. Subtraction of 2 – 16 bit numbers
4. (a) Multiplication of 2 – 16 bit numbers (b) Multiplication of two 8bit numbers (bit rotation) (c) Multiply two 8-bit numbers by repetitive addition
5. (a) Division of 2 – 16 bit number (b) Division of 2 – 8 bit numbers (c) Factorial of 8 bit number
6. (a) Separation of hexadecimal number into two digits (b) Check the parity of hex numbers
7. Speed control of stepper motor
8. (a) 1‟s complement of an 8 bit number (b) 2‟s complement of an 8 bit number
9. (a)Generation of square wave (b) Generation of triangular wave (c) Generation of sawtooth wave
10. (a) Addition of 2 – 8 bit numbers using microcontroller 8051 (b) Subtraction of 2 – 8 bit numbers using microcontroller 8051 (c) Multiplication of 2 – 8 bit numbers using microcontroller 8051 (d) Division of 2 – 8 bit numbers using microcontroller 8051
11. Interfacing experiments : Interfacing of A/D and D/A..

Course Outcomes (COs):

After completion of the course, students will be able to

1. To familiarize with the assembly level programming
2. To gain knowledge in microprocessor architecture, programming and its various applications
3. Design circuits for various applications using microcontrollers
4. An in-depth knowledge of applying the concepts on real- time applications

EC22004	CONTROL SYSTEMS Laboratory	L-T-P-C
	B.Tech (Electronics and Communication Engg.)	0-0-2-2
	Fourth Semester (Professional Core Lab)	

List of Experiments:

1. To plot Root Locus, Nyquist plot and Bode plot and identify stability of a system using MATLAB.
2. To study and report on Linear System Simulator.
3. To observe the transient and steady-state responses of linear time-invariant (LTI) systems using the Linear System Simulator.
4. To design, implement and study the effects of different cascade compensation networks for a given system.
5. To identify the transfer functions of both the AC servomotor and the DC motor.
6. To obtain the time response from state model of a system.
7. To implement the control action for temperature control system.
8. To design Proportional-Integral-Derivative (PID) controller using MATLAB.
9. To implement the PID Controller for DC Motor using active-circuit realization.
10. To design and implement PID controller using Arduino.

Course Outcomes (COs):

1. Understand the transient, steady state response and stability analysis of LTI system for different input signals.
2. Identify the transfer functions of both the AC servomotor and the DC motor and define their dynamic behaviours
3. Understand the PID controller, how it works, how to use it for various applications, use of PID controller to improve system performance.
4. Apply the various theoretical concepts of control system to control the temperature.
5. Use Arduino board to implement PID controller to control a DC motor.

EC22006	COMMUNICATION ENGINEERING Laboratory	L-T-P-C
	B.Tech (Electronics and Communication Engg.)	0-0-2-2
	Fourth Semester (Professional Core Lab)	

List of Experiments:

1. DSBSC and AM Transmitter & the corresponding Receiver
2. FM Transmitter & Receiver
3. Analog signal sampling & Reconstruction
4. Frequency Division Multiplexing and Demultiplexing
5. Time Division Multiplexing and Demultiplexing
6. Generation & Detection of PAM/PWM/PPM
7. Generation & Detection of PCM
8. Generation & Detection of DM/SIGMA DELTA/ADM
9. Baseband digital data transmission
10. Generation & Detection of BPSK/DPSK/DEPSK
11. Generation & Detection of PWM
12. Simulation of digital modulation schemes

Course Outcomes (COs):

1. To understand the basics of communication system, transmitter/receiver block diagram, definition of basic terms related to communication.
2. To explain and discuss the need of modulation, understand the concept of analog communication including amplitude and angle modulation and to calculate the value of modulation index and pulse modulation.
3. To understand the fundamentals of digital communication, Introduction to digital modulation techniques, distinguish between analog and digital communication.
4. To understand the basic concepts of optical communication systems, defining various terms, evaluating losses and other parameters of fibre

DEPT. OF ELECTRONICS & INSTRUMENTATION ENGINEERING

Algebra and Calculus

	B. Tech (For ALL Branches)	**L-T-P-C**
MA11001	**First Semester (Professional Core)**	**3- 0-0- 3**

Pre-requisites: *Matrix and determinants, Limit, Continuity, Differentiability, Basic idea of integration*.

	Course Content	**Hours**
Unit-1	**Linear Algebra:** R^n as a vector space, Linear dependence and independence of vectors in R^n, Basis & Dimension; Rank and nullity of a matrix, Elementary transformations, Consistency of a System of linear equations & their solutions by Direct Methods: Gaussian Elimination method, Gauss-Jordan method; Eigenvalues & Eigenvectors, Hermitian, Skew-Hermitian & Unitary matrices, Cayley-Hamilton's theorem & its applications.	**8**
Unit-2	**Infinite Series:** Definition of Sequence & Infinite Series, Convergence & Divergence of real Sequence & Infinite Series, Tests of Convergence of positive term infinite series: Comparison Test, D' Alembert's Ratio Test, Raabe's Test, Cauchy's root Test, Integral Test, Alternating Series, Leibnitz's Test (all tests without proofs).	**8**
Unit-3	**Differential Calculus:** Successive Differentiation, Leibnitz's Theorem, Rolle's theorem, Lagrange's & Cauchy's Mean value theorems, Curvature, Radius & centre of curvature, Partial differentiation, Euler's theorem, Jacobian, Taylor's & Maclaurin's Theorems with Lagrange's form of remainder for functions of one and two variables, Expansions of functions of one and two variables, Extreme values for functions of two or more variables, Lagrange's method of undetermined multipliers.	**14**
Unit-4	**Integral Calculus:** Reduction Formulae. Application of integrals in Quadrature, Rectification, Volume and surface area of solids of revolution.	**6**
		Total: 36

Course Outcomes:

On completion of this Course,

1. The students will be able to apply the consistency concepts, eigenvalues, and eigenvectors concepts in engineering problems.

2. The students will be able to apply the concept of convergence of infinite series in mathematical & engineering problems.

3. The students will be capable of applying the knowledge of differentiation in the expansion of functions and optimizing functions appearing in engineering and daily life problems.

4. The students will be able to apply knowledge of integration in finding area, length of arc of curves, volume, and surface area appearing in engineering and real-life problems.

Course Objectives:

1. To make the students knowledgeable in the area of the system of linear equations, together with
   Solution techniques and applications in engineering problems.
2. To make the students knowledgeable in the area of infinite series and their convergence, so that they may be familiar with the limitations of series approximations of functions arising in Mathematical Modelling.
3. To make the students familiar with the area of application of differentiation, expansion of functions, and finding Extreme values of functions.
4. To enable the students to evaluate definite integrals and their application in finding area, length, volume, and surface area of solids of revolution.

Text Books:

7. Jr. Joel Hass, C. Heil & M.D. Weir, Thomas' Calculus, 14th Edition, Pearson Education, 2018.
8. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
9. S. C. Malik, S. Arora, Mathematical Analysis, 7th Edition, New Age Int. Publishers, 2005.

Reference Books:

9. B.C. Das & B.N. Mukherjee, Differential Calculus, U. N. Dhur & Sons Pvt. Ltd., 55th Edition, 1949.
10. B.C. Das, B.N. Mukherjee, Integral Calculus, U. N. Dhur & Sons Pvt. Ltd., 57th Edition, 1938.
11. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.
12. F. Ayres, Theory and Problems of Matrices, Schaum's Outline Series, 1st Edition, 1962.

CY11001	Applied Chemistry	L-T-P-C
	B.Tech (EE, ECE and EIE)	3-0-0-3
	First Semester	

Prerequisites: None

	Course Content	Hours
Unit-1	**Polymer & Composite materials:** Classification of polymers, methods of polymerization, thermosetting and thermoplastic polymers, conducting and biodegradable polymers, synthesis, properties and applications of polyethylene, chloropolyvinyl chloride (CPVC), Composite materials: Classification and basic requirement of composite materials, applications.	**6**
Unit-2	**Nanomaterials & Fuels**: Nanomaterials: Introduction; synthesis, characterization and applications of nanomaterials. Fuel: Introduction, classification of fuel, calorific value (HCV and LCV), determination of calorific value by bomb calorimetry, bio-fuels.	**6**
Unit-3	**Chemical Thermodynamics:** Introduction to chemical thermodynamics; second law of thermodynamics, Gibbs free energy, reaction spontaneity and equilibrium, fundamental equations, Maxwell's relations, Gibbs-Helmoltz equation, chemical potential.	**6**
Unit-4	**Electrochemistry & Corrosion:** Electrode potentials and its relevance to oxidation and reduction, types of electrodes, galvanic cell, measurement of EMF and application of EMF, types of reference electrodes (hydrogen, glass, quinhydrone electrodes), determination of pH. Dry Cells, lead acid cell and Fuel Cells: Construction, reaction, advantages and applications. Corrosion: Types of corrosion, factors affecting corrosion and corrosion control.	**6**
Unit-5	**Water & Its Treatment:** Sources of impurities in water; hardness in water and its disadvantages; boiler scale and its prevention; caustic embrittlement; boiler corrosion: treatment of water at industrial and domestic level; biological oxygen demand (BOD) and chemical oxygen demand (COD) and their significance.	**6**
Unit-6	**Spectroscopy:** Basics of spectroscopy, electromagnetic spectrum, Basic principles of IR, UV-Visible and NMR spectroscopy, Application of IR, UV-Visible and NMR spectroscopy in structure elucidation and material characterization.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

9. Understand the synthesis, properties, and applications of polymers, composites, and nanomaterials for engineering and industrial use.
10. Apply the principles of chemical thermodynamics and electrochemistry to solve engineering problems related to energy, fuel and electrochemical systems.
11. Identify different types of corrosion and propose appropriate control and prevention strategies for materials.
12. Evaluate water quality and treatment methods, and interpret spectroscopic data for material analysis.

Text Books/ Reference Books:

14. Jain, P.C., and Jain, M., Engineering Chemistry (2025), Dhanpat Rai Publishing Company
15. Chawla, S., Engineering Chemistry (2019), Dhanpat Rai Publishing Company
16. Glasstone, S., Physical Chemistry (1948), McMillan India
17. Dey, A. K., Environmental Chemistry (2003), New Age International
18. Rao, C. N. R., Müller, A., Cheetham, A. K. (Editor), The Chemistry of Nanomaterials Synthesis, Properties and Applications, Chemistry of Nanomaterials (2004), Wiley-VCH

ME11001	Engineering Mechanics	L-T-P-C
	B.Tech. (EE, ECE and EIE)	2-1-0-3
	First Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	Equivalent Force System, Equilibrium of Rigid Bodies, Law of Coulomb friction: Applications of dry friction in wedge and belt.	**9**
Unit-2	Equilibrium of simple plane trusses. Analysis of trusses by the method of joints and method of section. Principle of virtual work, Simple applications of Principle of virtual work for rigid bodies in static equilibrium.	**9**
Unit-3	Centroid of simple and composite plane figures. Pappus theorem and its applications. Area moment of inertia of simple and composite figures, Perpendicular axis theorem. Parallel axis theorem, Polar moment of inertia.	**6**
Unit-4	*Kinematics of particles:* Rectilinear motion of particles, plane curvilinear motion of particles in different coordinate systems, constrained motion of connected particles. *Plane kinematics of rigid bodies:* Translation of a rigid body in plane motion, rotation of rigid bodies about a fixed axis. *Kinetics of particles:* Applications of Newton's laws of motion, D'Alembert's principle, Principle of work-energy and Impulse-momentum in particle dynamics, Direct central impact and oblique central impact. *Plane kinetics of rigid bodies:* Equation of plane motion of a rigid body, Principle of work-energy in plane motion of a rigid body.	**12**
	Total	**36**

Course Outcomes (COs):

Upon the completion of this course, the students are expected

11. To build a fundamental understanding of static equilibrium in particles, rigid bodies, and friction, and apply it to solve related engineering problems.
12. To develop the ability to analyze simple plane trusses and apply the principle of virtual work to systems in static equilibrium.
13. To apply the theorem of Pappus. Parallel axis theorem and Perpendicular axis theorem.
14. To apply the concept of centroid and moment of inertia in analyzing the simple and composite figures.
15. To develop the ability to apply for solving the practical problems on kinematics and kinetics of motion of particles and rigid bodies.

Text Books:

11. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Statics, John Wiley & Sons, Inc; 3/e.
12. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Dynamics, John Wiley & Sons, Inc; 3/e.
13. F. P. Beer, Jr., E. R. Johnston, E. R. Eisenberg, P. J. Cornwell, D. Mazurek. Vector Mechanics for Engineers- Statics & Dynamics, McGraw-Hill Higher Education; 9/e.
14. 1. H. Shames, Engineering Mechanics - Statics and Dynamics, 4lh edition, Prentice-Hall of India.
15. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati. Engineering Mechanics, McGraw Hill Education; 5/e.

Reference Books:

5. S. Timoshenko, D.H. Young, Engineering Mechanics, 4th edition, McGraw- Hill.
6. R.C. Hibbeler. Engineering Mechanics - Statics & Dynamics, Pearson Education, 4/e.

Electrical and Electronics Technology

B.Tech. (ECE, EE and EIE)

EC11001 First Semester **L-T-P-C**

3-0-0-3

	Course Content	**Hours**
	Part – I: Electrical Engineering Dept portion	
Unit 1	Electrical safety: Definition, precautions D.C. Circuit & Networks: KVL and KCL, Superposition Theorem, Thevenin's and Norton's Theorems, Maximum power transfer theorem	**4**
Unit 2	A.C. Circuit: A.C. Fundamentals, phasor representation and algebra, Series R-L, R-C and R-L-C circuits, power calculations in A.C. circuit, phasor diagrams. Balanced Star-Delta connections, phase and line currents and voltages and their relations.	**6**
Unit 3	Measuring instruments: Ammeter, voltmeter, wattmeter, energy meter – types & connection, concepts of grounding and earthing.	**3**
Unit 4	Electrical Machines: D.C machine fundamentals and Transformer (Brief construction, types, working principle, voltage equation and application), 3-phase induction motor (Brief construction, principle, types, applications).	**5**
	Part – II: Electronics and Communication Engineering Dept portion	
Unit 1	Introduction to Electronic devices, Diode: Basic structure and operating principle, Diode Applications: rectifier circuits (half-wave and full-wave bridge rectifier), voltage regulator using Zener diode, clipper circuits, clamper circuits.	**5**
Unit 2	BJT structure and its applications: Basic structure, operation of transistor in active and saturation mode, DC analysis, MOSFET: Introduction to MOSFET, Operation and characteristics. Basic Amplifier Design.	**5**
Unit 3	System Design using Operational Amplifier (Op-Amp): Ideal op-amp, inverting amplifier, non-inverting configuration, transfer characteristics, op-amp applications like difference amplifier, summing amplifier, integrator, and differentiator.	**3**
Unit 4	Basic Digital Electronics: Logic gates, Boolean algebra, De-Morgan's theorem, K-Map, combinational circuits like adder, multiplexer, and de-multiplexer. Memory units: RAM, ROM.	**5**
		Total: 36

Course Outcomes (COs):

1. Understand the basic structure and operating principle of electronics devices and analyse DC and AC networks.
2. Measure different electrical quantities in simple 1-phase and 3-phase circuits.
3. Classify the electrical machines and the electronics devices; explain their working principles, characteristics and applications.
4. Design and implement simple analog and digital electronic circuits.

Text books:

14. J. B. Gupta, Basic Electrical Engineering, S K Kataria & Sons
15. Ashfaq Husain, Haroon Ashfaq, Basic Electrical Engineering, Dhanpat Rai & Co.
16. Louis Nashelsky and Robert Boylestad, Electronics Devices and Circuit Theory, 10th Edition, Pearson India.
17. Digital Design, M. Morris Mano, and Michael D Ciletti, Pearson.

EI 11001	**Measurement I**	**L-T-P-C**
	B.Tech Electronics & Instrumentation Engineering	3-0-0-3
	First Semester Professional Core	

Prerequisites: Nil

	Course Content	**Hours**
Unit-1	**Measurement:** Introduction, Definition, significance of measurement, Measurement characteristics, Static & dynamic characteristics, Introduction to Modern industrial instruments.	**6**
Unit-2	**Errors:** Types of errors, Systematic and Random Errors in Measurements, expression of uncertainty-accuracy and precision index, propagation of errors, Probability of errors, Statistical analysis and Limiting error with examples.	**7**
Unit-3	**Electrical Measuring instruments:** Classification of instruments, Principle and working of PMMC, Moving iron, Dynamo Meter type instruments, Extension of range of instruments- shunts & multipliers	**6**
Unit-4	Galvanometer, different types of galvanometer and their applications, Overview of Ammeter, Voltmeter & Multimeter, True rms meters, Voltage and current Scaling, DC Potentiometers, AC potentiometers.	**6**
Unit-5	**Measurement of power and energy:** Definitions of power, types, Measurement of power, different methods, construction and working of Electrodynamometer type of Wattmeter. Errors in power measurements. Energy, Induction type energy meter, Indicating type Frequency meter, Electrodynamometer type P.F. meter- construction and working principle, advantages, disadvantages, Overview of Instrument Transformers.	**7**
	Total	**32**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the significance of measurement and types of errors in measurement.
2. Interpret the characteristics of measuring instruments and possible causes of errors.
3. Choose the appropriate instruments to measure a given set of parameters.
4. Understand the concepts of electrical measuring quantities like voltage and currents.
5. Understand the principle of power and energy measurement.

Text Books/ Reference Books:

1. Sawhney Ashok K. A course in Electrical and Electronic Measurements and Instrumentation. Dhanpat Rai & Co, New Delhi.
2. Helfrick Albert D. and Cooper William D. Modern Electronic Instrumentation and Measurement Techniques. Pearson Education India.
3. H S Kalsi, Electronic Instrumentation and Measurements, McGraw Hill Education (India) Private Limited.
4. Gupta Jitendra B. Electronics Measurement & Instrumentation. Katson Books.
5. H S Kalsi, Electronic Instrumentation and Measurements, McGraw Hill Education (India) Private Limited.
6. Madan Gopal. Control Systems Principles and Design. Tata McGrow Hill, New Delhi.

ME12001	Workshop Practice	L-T-P-C
	B.Tech. (EE, ECE and EIE)	0-0-3-1
	First Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	General safety precautions in workshop and introduction.	**3**
Unit-2	**Carpentry Shop:** Safety precaution, Kinds of wood and timber, Application of timber as per their classification, Carpentry hand tools and machines, Different types of carpentry joint, Demonstration of wood working machine like, band saw, circular saw, thickness planner, wood working lathe, surface planners, etc.	**6**
Unit-3	**Welding Shop:** Safety precaution in welding shop, Introduction to gas and arc welding, Soldering and brazing etc. Welding equipment and welding material.	**6**
Unit-4	**Fitting Shop:** Safety precaution, Introduction to fitting shop tools, equipment, Operation and their uses, Marking and measuring practice.	**6**
Unit-5	**Machine Shop:** Safety precautions, Demonstration and working principles of some of the general machines, like lathe, shaper, milling, drilling, grinding, slotting etc., General idea of cutting tools of the machines.	**6**
	Total	**27**

Course Outcomes (COs):

After completion of the course, students will be able to

13. Know the importance of general safety precautions on different shop floors.
14. Identify the basics of tools and equipments used in fitting, carpentry, sheet metal, machine, welding and smithy.
15. Do fabrication of wooden joints and understand joining of metals.
16. Make metal joints and sheet metal work.
17. Understand the basics of removal of material from work piece surface to attain specific shape.
18. Familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.

Text Books/ Reference Books:

5. S K Hajra Choudhury, A K Hajra Choudhury, N. Roy. Workshop Technology Vol I & II, Media Promoters & Publishers Pvt. Ltd; 9/e.
6. H S Bawa. Workshop Practice, McGraw Hill Education; 2nd edition, 2/e.

EC12001	Electrical and Electronics Technology Laboratory	L-T-P
	B.Tech. (ECE, EE and EIE)	0-0-2
	First Semester	

Experiments

1. Verification of Thevenin's and Norton's Theorems in a DC circuit.
2. Verification of Superposition Theorem in DC circuits.
3. Measurement of power in single phase AC circuit using three ammeter method.
4. Measurement of three phase power in an AC circuit with star and delta connected variable loads.
5. Verification of Maximum Power Transfer Theorem in a DC circuit.
6. Familiarization with the components and instruments.
7. Design of a clipper and clamper circuits (both positive and negative)
8. Plot the VI characteristics of a PN junction diode and Zener diode and compare their difference.
9. Implement Boolean functions using logic gates.
10. Plot static characteristics of Common Emitter/ Common Base configuration of BJT.
11. Design of circuits using operational amplifier.

Course Outcomes (COs):

1. Develop practical skills using electrical and electronic components and measuring equipment.
2. Demonstrate and justify results of Network theorems in DC circuits.
3. Compute and verify power consumptions for single and three phase loads.
4. Understand the characteristics of various electronics devices.
5. Design and analyze simple analog and digital circuits.

CY12001	Chemistry Laboratory	L-T-P-C
	B.Tech (EE, ECE and EIE)	0-0-2-1
	First Semester	

Prerequisites: None

List of Experiments:

Experiment 1: To determine the total hardness of pond water/ supplied water using the standard EDTA solution
Experiment 2: Estimation of magnesium from the supplied solution using standard EDTA
Experiment 3: Estimation of calcium from the supplied solution using standard EDTA
Experiment 4: Determination of dissolved oxygen (DO) of lake water
Experiment 5: Determination of total alkalinity of supplied aqueous solution.
Experiment 6: To determine the strength of the $KMnO_4$ solution using a standard oxalic acid solution
Experiment 7: To determine the amount of Fe(II) present in the supplied solution using the standard $KMnO_4$ solution
Experiment 8: To determine the amount of Fe(III) present in the supplied solution using the standard $K_2Cr_2O_7$
Experiment 9: Quantitative determination of Copper (II) using standard HYPO ($Na_2S_2O_3$) solution
Experiment 10: Estimation of calcium in milk powder using standard EDTA solution
Experiment 11. Detection of special elements in supplied organic compounds.
Experiment 12: Determination of functional groups in the supplied organic compounds
Experiment 13: Preparation of Copper (II) glycinato complex
Experiment 14: Determination of the relative viscosity of the given organic compound by Ostwald Viscometer
Experiment 15: Determination of the surface tension of the given organic compound by the stalagmometer

Course Outcomes (COs): After completion of the course, students will be able to

13. Know about the methods for the determination of water quality parameters. They can assess the quality of water for drinking purposes, etc., by performing experiments such as determining total hardness, Ca^{2+}, Mg^{2+}, total alkalinity, and dissolved oxygen.
14. Determine presence of Fe^{3+}, Fe^{2+}, Cu^{2+} ions in water
15. Determine the physical properties of liquids by performing experiments, such as viscosity. They will also be able to determine the viscosity of the lubricating oil. The generated knowledge can be used for industrial product development, like detergent formulation.
16. Determine the surface tension of liquids
17. Synthesise coordination complexes of biologically important transition metal ions.
18. To perform the chemical reactions to find out different elements, functional groups or nonmetals present in the organic compounds. This will also help them to understand the role of different functional groups in chemical reactivity.

Text Books/ Reference Books:

1. Das, S. C., Advanced Practical Chemistry (2024), The World Press Private Limited
2. Laboratory Manual, Dept. of Chemistry, NIT Silchar

MA11004	Differential Equations and Mathematical Methods	L -T-P- C
	B. Tech. (For EE, ECE and EIE)	3- 0 - 0 - 3
	Second Semester (Professional Core)	

Pre-requisites: *Linear Algebra and Calculus.*

	Course Content	Hours
Unit-1	**Ordinary Differential Equation:** Exact differential equation of first order, integrating factors. Second & higher order linear differential equations with constant coefficients, Homogeneous (Cauchy's) linear differential equation, Method of variation of parameters.	**8**
Unit-2	**Partial Differential Equation:** Formation of partial differential equations (PDE), Solution of PDE by direct integration, Lagrange's linear equation & its solution, Non-linear PDE of first order, Charpit's method of solution, Homogeneous and Non-homogeneous linear equations with constant coefficients, Boundary and initial value problems (Dirichlet and Neumann type). Second-order PDE with constant coefficients and their classification to elliptic, parabolic, and hyperbolic type, solution by the method of separation of variables.	**10**
Unit-3	**Laplace and Z-Transform:** Basic idea of Integral Transform, Laplace and inverse Laplace transforms & their properties, Convolution Theorem, Solution of ODE by Laplace transform method. Z-transform and its properties, Solution of difference equations.	**9**
Unit-4	**Fourier Series and Fourier Transform:** Periodic functions, Fourier series representation of a function, half-range series, Fourier integral formula. Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting, and time shifting properties. Convolution theorem, Applications to boundary value problems.	**9**
		Total: 36

Course Outcomes:

On completion of this course

5. The students will be able to apply ordinary differential equations in engineering and real-life problems.
6. The students will be capable of applying partial differential equations in engineering and real-life problems.
7. The students will be able to apply Laplace/Z-transform in engineering problems.
8. The students will be able to apply the Fourier transform in engineering problems.

Course Objectives

5. To enable the students to understand the basic ideas of ordinary differential equations and their solutions, and also the application of series in solving ordinary linear differential equations.
6. To enable the students to understand the basic ideas of partial differential equations and their solutions, and also the applications in IVP & BVP.
7. To enable the students to solve ODE/Difference equations by using Laplace and Z-transform.
8. To enable students to clear the basic concepts on the Fourier series, the Fourier Transform, and to solve BVP.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017.

Reference Books:

4. M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand & Company Ltd, 2020.
5. G.F. Simmons, Differential Equations, Tata McGraw-Hill, 2nd edition, 2017.
6. S. Sreenadh, Fourier Series and Integral Transforms, S. Chand Publication, 2014.

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PH11002	Wave Mechanics and Solid-State Physics	L-T-P-C
	B.Tech (EE, ECE and EIE)	3-0-0-3
	Second Semester (Common)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Waves and Oscillation:** Introduction to Vibrations and Oscillations, Review on Free Oscillations, Damped motions -under damping -Logarithmic decrement, relaxation time and Q-Factor, overdamping and critical damping, Forced oscillations with damping - Steady state solution and its frequency response, Power absorbed and dissipation in forced oscillator, Resonance- amplitude, velocity and power- sharpness of resonance.	**7**
	Coupled oscillations, introduction of normal modes and normal coordinate and their physical significance- general solutions, wave equation in one dimension, Characteristics and solution, superposition, travelling and standing waves, phase and group velocity.	**5**
Unit-2	**Electromagnetic Waves:** Vector Calculus : Scalar and Vector Fields – Differential calculus, Del operator, Gradient, Divergence and Curl, Product rules, Second Derivative with Del operator, Laplacian operator –Line, Surface and Volume Integrals (definition), Fundamental theorem of Integral calculus qualitatively (Gradient, Divergence and Curl)	**4**
	Electromagnetic theory: Maxwell's equations, Displacement current, Maxwell's equation in matter, Electromagnetic waves: The wave equation, Sinusoidal waves, Polarization EM waves in vacuum, Monochromatic plane waves, Energy in electromagnetic waves, EM waves in conductors, Conservation laws: continuity equation, Poynting's theorem, boundary conditions, reflection and transmission at normal incidence.	**6**
Unit-3	**Modern Physics and Quantum Mechanics:** Failure of classical physics, qualitative review of relevant experiments such as blackbody radiation, photo- electric effect, Compton scattering, de Broglie matter waves and Davison-Germer experiment, Uncertainty principle, Wave packet.	**3**
	Basic postulates of quantum mechanics, Wavefunction, normalization of wave function, quantum mechanical operators, probability density, expectation value, Development of Schrödinger equation (time dependent & time independent), particle on a 1D infinite potential well, potential barrier and quantum tunnelling.	**5**
Unit-4	**Solid State Physics:** Free electron theory, Fermi Dirac distribution, Fermi level, Density of states, Band theory of solids - conductors, semiconductors, insulators, Semiconductors - Intrinsic & Extrinsic, electron & hole concentration at thermal equilibrium. Hall Effect, Basics of Superconductivity- Zero resistance, perfect diamagnetism, critical field and Meissner effect.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the fundamental concepts of **classical and quantum wave mechanics**.
2. Interpret fundamental physical laws and principles for relevant engineering applications.
3. Apply principles of physics to solve numerical problems in **classical and quantum wave mechanics**.
4. Analyze various physical phenomena using appropriate concepts such as superposition, wave-particle duality, polarization, and quantization.
5. Evaluate the validity and limitations of theories in waves, electromagnetism, and quantum physics through comparison with experimental observations.

Text Books/ Reference Books:

1. Vibration and waves, A. P. French, CBS Publishers
2. Introduction to Electrodynamics, D. J. Griffiths, *Pearson*
3. *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*, Resnick and Eisberg, John Wiley & Sons
4. Quantum Mechanics, D. J. Griffiths, Cambridge University Press
5. Introduction to Solid State Physics, C. Kittel, Wiley India
6. The Physics of Solid, R Turton, Oxford University Press.

CS11002	Programming and Data Structure	L-T-P-C
	B.Tech (EE, ECE and EIE)	2-0-2-3
	Secound Semester (Professional Core)	

Prerequisites: Nil

		Hours
Unit-1	**Introduction:** Basic operations of digital computers, basic concepts of integer and floating point number representation, algorithm and efficiency.	**4**
Unit-2	**(Elements of C Programming)**: Data types, variables, operators, expression and assignment statements, conditional and branch statements, Loops and iteration statements, 1-d arrays, functions and parameter passing, recursions, Strings, pointers and structures, dynamic memory allocations.	**12**
Unit-3	**(Linear Data Structures): 2-d arrays, linked lists, stacks, and queues.**	**10**
Unit-4	**(Searching and Sorting):** Linear and binary search, bubble sort, insertion sort, merge sort, quick sort.	**8**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Learn the syntax and semantics of C programming language.
2. Test and execute the programs and correct syntax and logical errors.
3. Implement conditional branching, iteration and recursion.
4. Use basic data-structures (arrays, link lists, stacks, and queues) to formulate algorithms and programs.
5. Understand and analyse different searching sorting techniques.

Text Books/ Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
6. R. G. Dromey, How to Solve it by Computer, Prentice-Hall of India.

HS11001/11002	**English for Technical Communication** Ist / IInd Semester (Professional Core)	L-T-P-C 2-0-2-3

	Course Content	**Hour**
Unit 1	**Organizational Communication:** Introduction to the Course Importance and Relevance of the Course Why Communicative English? What is Communication? Barrier to Communication Non-verbal/Oral/(In)Formal Communication	6
Unit II	**Reading Comprehension** **Ignited mind** (Two Chapters) by APJ Abdul Kalam Essay: **Religion of the forest** by Rabindranath Tagore Essay: **Is Google Making Us Stupid?** by Nicholas Carr **The Story of My Sanskrit** (A chapter) by Kumud Pawde	**8**
Unit III	**Written Communication:** Letter Writing Cover Letter CV/Resume Writing Précis writing Essay Writing Report Writing Email Etiquettes Idioms and Phrases One Word Substitution Technical Communication Documentation and Minutes of Meeting Debate	**12**
Unit IV	**Oral Communication:**	**6**

Job interviews (Process, stages in job interviews, types of interviews, preparation, use of verbal and non-verbal cues, mock interview sessions)

Group Discussion (Features, uses-recruitment, selection, stages, positive and negative roles, organizational GD's (Brain Storming, Normal Group techniques, Delphi Technique))

Pictorial Essays.

Course Outcomes:

16. Students will recall the content and make inferences on organizational communication setup
17. Students will be able to read faster and comprehend better
18. Students will be able to express their ideas and thoughts clearly and systematically in the form of essays and reports
19. Students will be able to conduct short meetings with the skill to draft simple and short minutes of the meeting.
20. Students will demonstrate the ability to face the employment selection and answer interview questions, and they will be able to participate in group discussions confidently and assertively

Reference Books:

19. Barun K. Mitra & Basundhara Mitra*, Personality Development and Soft Skills.* Oxford University Press, 2024.

20. Meenakshi Raman & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press, 2015. https://d.docs.live.net/0af95281db477321/Desktop/question%20papers%20NITS/Technical%20Communication.pdf

21. Michael Swan. *Practical English Usage*. Oxford University Press, 2016.

22. Nilanjana Gupta. *English for All*. Macmillan Publishers India Ltd, 2011.

23. S. Miglani & S. Goyal. *English for Professionals- A Practical Book of Communication Skills in English*. Vayu Education of India, 2010.

24. Sanjay Kumar & Pushp Lata. *Communication Skills*. Oxford University Press, 2015.

EI 11002	**Measurement II** B.Tech Electronics & Instrumentation Engineering Second Semester Professional Core	**L-T-P-C** 3-0-0-3

Prerequisites: Nil

	Course Content	**Hours**
Unit-1	**Review of Measurement:** Functional Elements of measurement, Accuracy, Precision, resolution, reliability, repeatability, Classification of Instruments, Calibration of instruments, Introduction to Transducer, Classification of Transducers, Resistive Transducer	**4**
Unit-2	**D. C Bridges:** General equation for bridge balance, Bridges for measurement of R, L and C, D.C. bridges, Wheatstone bridge, Kelvin's double bridge,	**6**
Unit-3	**A. C Bridges:** General form of an A.C. bridge, Maxwell's inductance –capacitance bridge, Hay's bridge, Anderson's bridge, Schering bridge, Wien's bridge, Sources of errors in bridge measurement.	**7**
Unit-4	**Electronic measuring Instruments:** Measurement of quality factor (Q), Q-meter, Digital Voltmeter (DVM)-Ramp type, Integrating type, ADC, Digital frequency meter, Timer/Counter.	**7**
Unit-5	**Oscilloscopes and Probes:** Oscilloscopes-CRO, Construction, Time based circuit, Measurement of time, phase and frequency, with CRO, Basics of DSO and applications. AC and DC current probes, CRO probes, Probe loading effects, Function generators.	**8**
	Total	**32**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the fundamentals of measurement in electronics.
2. Understand the use of various measuring techniques for measurement of different physical parameters using different classes of transducers.
3. Familiarize students with electronic instruments and their principles of operation.
4. Develop an ability to use AC and DC bridges for Electronics measurements.
5. Analyze the concepts of sinusoidal, triangular and square waveforms.

Text Books/ Reference Books:

1. Sawhney Ashok K. A course in Electrical and Electronic Measurements and Instrumentation. Dhanpat Rai & Co, New Delhi.
2. Helfrick Albert D. and Cooper William D. Modern Electronic Instrumentation and Measurement Techniques. Pearson Education India.
3. H. S. Kalsi, Electronic Instrumentation and Measurements, McGraw Hill Education (India) Private Limited.
4. Gupta Jitendra B. Electronics Measurement & Instrumentation. Katson Books.
5. Madan Gopal. Control Systems Principles and Design. Tata McGrow Hill, New Delhi.

CE12002	**Computer Aided Drawing and Graphics**	**L-T-P-C**
	B.Tech (EE, ECE and EIE)	1-0-2-2
	Second Semester (Professional Core)	

Prerequisites: None

	Course Content	**Hours**
Unit-1	**Introduction to Engineering Drawing:** Importance and application in engineering, general instruction regarding instruments, dimensions and lettering, types of lines, concept of scales, geometrical constructions.	**9**
Unit-2	**Orthographic Projections:** Introduction to orthographic projections, elements and angles of projections, projection of points, projection of straight lines, projection of planes, conversion of pictorial views of objects into orthographic projections.	**6**
Unit-3	**Projections of Solids:** Orthographic projection of regular solids: Cubes, prisms, pyramids, cylinders, cones, tetrahedrons. Projections of frustum of solids.	**6**
Unit-4	**Isometric View:** Principles of isometric view, isometric view of simple objects, conversion of orthographic projections into isometric views.	**3**
Unit-5	**Introduction to CAD:** Introduction to CAD and advantage of CAD in engineering field, windows and system of AutoCAD, drawing area, command line, model space, layout space and work space. Drawing settings - Unit and limits, pan and zoom. Drafting settings - Grid, object snap, ortho on/off.	**3**
Unit-6	**Drafting Tools in CAD:** Tools and short commands for line, polyline, circle, polygon, arc, rectangle, ellipse, elliptical arc, hatch, spline, construction line, multiline, multiline style, point. Isometric drawing in AutoCAD.	**3**
Unit-7	**Modifying Tools in CAD:** Tools and short commands for move, rotate, trim, extend, copy, mirror, fillet, chamfer, erase, explode, offset, lengthen, edit polyline (fill on/off), edit hatch, edit array, edit multiline, align, break, point break and join. Object properties – Properties of windows, colour, linetype, linetype scale, line weight and match properties.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

9. Produce geometric constructions with appropriate scale and dimension.
10. Apply the skill for preparing detail 2D drawing of engineering objects.
11. Visualize and develop the 3D view of engineering objects.
12. Create basic 2D drawings using AutoCAD software.

Text Books/Reference Books:

9. Bhatt, N. D., Engineering Drawing: Plane and Solid Geometry, 54th Edition, Charotar Publishing House Pvt. Limited, 2023.
10. Venugopal, K., and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, 6th Edition, New Age International, New Delhi, 2022.
11. Narayana, K. L., and Kannaiah, P., Text book on Engineering Drawing, 2nd Edition, Scitech Publishers, 2011.
12. Gopalakrishna, K. R., and Gopalakrishna, S., Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017.

PH12002	**Physics Laboratory**	**L-T-P-C**
	B.Tech (EE, ECE and EIE)	0-0-2-1
	Second Semester (Common)	

Prerequisites: None

List of Experiments

1. To calibrate an ammeter with the help of a potentiometer.
2. To study the twist in the thin rod by statical method using Barton's horizontal apparatus and thus to determine the modulus of rigidity of the material of the rod.
3. To study the bending of a beam supported at its ends and loaded at the middle and thus to determine the Young's modulus of the material of the beam.
4. To determine the refractive index of the material of a given prism using a spectrometer.
5. To determine frequency of a transverse waves and mass per unit length of given wire by using sonometer apparatus.
6. To study the charging and discharging of a capacitor and hence to determine it's time constant.
7. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
8. To determine the wavelength of sodium light using single slit diffraction.
9. Comparison of two low resistances by using Meter Bridge.

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply the various experimental procedures and techniques for physics related experiments.
2. Use the different measuring devices and setups to record the data with precision.
3. Apply the underlying physical concepts/theories to obtain quantitative results.
4. Evalute and analyze the error in the experiment with respect to the standard values of physical quanties.
5. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Text Books/ Reference Books:

1. University Practical Physics, D. C. Tayal, HPH Publisher
2. B.Sc. Practical Physics, Samir Kumar Ghosh, New Central Book Agency

MA21003

Mathematical Analysis and Probability Theory
B.Tech.(For EE,ECE,EIE)
Third Semester (Professional Core)

L -T-P- C
3- 0 - 0 - 3

Prerequisites: Ordinary & Partial differentiation, Elementary integration, Vector operations.

	Course Content	Hours
Unit-1	**Numerical Analysis:** Finite differences, Newtons forward and backward interpolation formulae, Numerical Integration: Trapezoidal and Simpsons 1/3rd rules. Solution of algebraic and transcendental equations - bisection, Newton-Raphson and regula-falsi methods. Numerical solutions of ODE and PDE, Euler's method, Taylor's method, Runge-Kutta method (4^{th} order).	**10**
Unit-2	**Vector Calculus:** Scalar & Vector Triple Product of vectors and their applications, Vector equations of lines & planes. Vector function of a single scalar variable, Limit, Continuity & differentiability. Geometrical and physical interpretation of derivatives and their applications. Scalar & Vector fields, Introduction to line, double and triple integrals, Applications of Green's theorem, Stokes' theorem and Gauss Divergence theorem.	**10**
Unit-3	**Complex Analysis:** Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integrals.	**9**
Unit-4	**Probability Theory:** Introduction to probability, Additive & multiplicative Laws of probability, Conditional probability, Independent events, Baye's theorem, Random variable, Probability mass function, Probability density function, Cumulative distribution function, Binomial, Poisson & Normal distributions.	**9**
	Total	**38**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply methods of Numerical Analysis to obtain approximate solutions of mathematical problems.
2. Solve multivariable and field-related problems using Vector Calculus concepts.
3. Analyze functions and evaluate integrals using techniques from Complex Analysis.
4. Apply principles of Probability and Statistics to model randomness and analyze data.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10^{th} Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44^{th} Edition, Khanna Publisher, 2017.
3. J. Ravichandran. Probability and Statistics for Engineers. Wiley India Pvt. Ltd., New Delhi, 2010.

Reference Books:

1. M.D. Raisinghania, Vector Analysis, S.Chand & Company Ltd, 2020.
2. S. Lipschutz and J. J. Schiller, Complex Variables, Schaum's Outline series, 2009.
3. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Method for Scientific and Engineering Computation, 2022.
4. S. Lipschutz and J. J. Schiller. Introduction to Probability and Statistics. Schaum's Outline Series, 2011.

CE21001/21002	Environmental Science	L-T-P-C
	3rd / 4th Semester (Professional Core)	2-0-0-2

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction and Natural Resources:** Environment, Definition, scope and importance, multidisciplinary nature of environmental studies, Forest Resources –use and over-exploitation of forests, deforestation, water, mineral, land, food resource and energy resources	**5**
Unit-2	**Ecosystem and Biodiversity:** Ecosystem-Concept of an ecosystem, structure and function of an ecosystem, Food chain, food webs and ecological pyramids, Energy flow in ecosystem producers and consumers Ecological Succession, Biodiversity and its Conservation – introduction, definition, genetic species and ecosystem diversity, value of biodiversity, hotspots of biodiversity, threats to biodiversity- habitat loss, poaching of wildlife conflicts, endangered and endemic species in India, conservation of biodiversity	**6**
Unit-3	**Environmental Pollution:** Causes, effects and control measures of air pollution, scales of defining pollutants, various air pollution control equipment, water pollution, wastewater management, primary, secondary and tertiary treatment techniques, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear radiation hazards, Solid waste management, sources of solid waste effects and control measures of urban industrial wastes, hierarchies of solid waste management techniques	**9**
Unit-4	**Environment and society:** Role of an individual prevention of pollution, consumerism and waste products, unsustainable to sustainable development, Environmental Laws, Environmental Impact Assessment, issue involved in enforcement of environmental legalizations, Environment and human health, epidemics, Women and child welfare, Role of information technology in environment and human health.	**4**
	Total	**24**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand scope of environmental science and brief knowledge about natural resources
2. Realize the importance of ecosystem and biodiversity in growth of human civilization.
3. Understand the effects of environmental pollution and different strategies to mitigate it
4. Understand various environmental laws and societal issues related to the environment for the benefit of the community

Text Books/ Reference Books:

1. Henry J.G. and Heinke G.W. ***Environmental Science and Engineering.*** Prentice Hall of India. New Delhi.
2. Chandrasekhar M. ***Environmental Science.*** Hi-Tech Publishers.
3. Masters G.M. ***Environmental Engineering and Science.*** Prentice Hall of India, New Delhi.
4. Garg S.K. and Garg R. ***Ecological and Environmental Studies.*** Khanna Publishers, Delhi.
5. Chawla S. ***Environmental Studies.*** Tata McGraw-Hill Publishers, New Delhi.

EI21001	Analog Electronics B.Tech. (Electronics & Instrumentation Engineering) Third Semester (Professional Core Theory)	L-T-P-C 3-0-0-3

Prerequisites: Nil

Unit	Course Content	Hours
Unit-1	**Introduction**: Example of an electronic system. active electronic circuit components and their low frequency models. Amplifier models, voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistanced amplifier.	8
Unit-2	**Transistors**: Small Signal BJT amplifiers, AC equivalent circuit, hybrid model and their use in amplifier design. Analysis of single stage transistor amplifier using h-parameters: voltage gain, current gain, Input impedance and Output impedance. Comparison of transistor configurations. Differential and multistage amplifiers	6
Unit-3	**JFET and MOSFET**: JFET operation and characteristics, Biasing and small signal model of JFET, Small signal operation and models of MOSFET, Nonlinear one-port and two-port circuits, large signal and small signal analysis of MOSFET, Internal capacitance of MOSFET: Gate capacitive effect and junction capacitance, Single stage MOS amplifiers, Comparison of Transistors.	8
Unit-4	**Introduction to Active Filters**: First and second order Low-Pass Butterworth filter; filter Design, Frequency Scaling, First and Second-Order High-Pass Butterworth filters, Band-Pass and Band-Stop Filters; Wide Band-Pass, Bandreject and Narrow Band-Pass, Band Reject filters, All-Pass Filters.	8
Unit-5	**Feedback topologies** and analysis for discrete transistor amplifiers; stability of feedback circuits using Barkhausen criteria, Oscillators; Oscillator Principles, Oscillator Types, Frequency Stability, Phase shift oscillator, Wien Bridge Oscillator, Quadrature Oscillator, Square-Wave generator, Triangular-wave Generator, Saw tooth-wave generator, Voltage controlled Oscillator, timer 555, Multivibrators and Phase locked loop.	6
	Total Hours	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain fundamental terminologies and concepts of amplifiers, filters and oscillators..
2. Perform the analysis of any analog electronics circuit consisting BJT, FET and OPAMP..
3. Design amplifier circuits using BJT, FET & OPAMP and observe the amplitude & frequency responses.
4. Analyze feedback topologies, active filters, BJT/FET/Operational Amplifiers.

Text Books/ Reference Books:

1. Boylestad Robert L. and Nashelsky Louis. Electronic Devices and Circuits theory. Pearson Education, New Delhi (2009).
2. Sedra Adel S. and Smith Kenneth C. Microelectronic Circuits Theory and Application. Oxford University Press, New Delhi (2017).
3. Cathey Jimmie J. and Singh Ajay K. Electronic Devices and Circuits. Tata McGraw Hill Publishing Company Ltd., New Delhi (2006).
4. Neamen Donald A. Electronics Circuits Analysis and Design. Tata McGraw Hill Publishing Company Ltd., New Delhi (2006).
5. Millman Jacob, Halkias Christos C. and Jit Satyabrata. Milliman's Electronics Devices and Circuits. Tata McGraw Hill Publishing Company Ltd., New Delhi (2015).

6. Millman Jacob and Halkias Christos C. Integrated Electronics: Analog and Digital Circuits and Systems. Tata McGraw Hill Publishing Company Ltd., New Delhi (2015).

EI21003	Digital Electronics B.Tech. (Electronics & Instrumentation Engineering) Third Semester (Professional Core Theory)	L-T-P-C 3-0-0-3

Prerequisites: Nil

Unit	Course Content	Hours
Unit-1	Numbers systems & Codes: Decimal, binary, octal, hexadecimal and general number representation, interconversion between any two number systems, arithmetic operation using n's and (n-1)'s complements. Codes: BCD codes, weighted & non-weighted codes, error detecting and correcting codes (Parity bit code, hamming code), alphanumeric codes (ASCII, EBCDIC).	**7**
Unit-2	Minimization techniques: K-Map for three, four and five variables, don't care combinations, mapping for non-standard functions, Quine-McCluskey method for SOP and POS functions without and with don't care conditions.	**7**
Unit-3	Combinational circuit design: Design of adders & subtractors (half and full), Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Code converters (Binary-gray-BCD-XS3), magnitude comparators, decoders, BCD-to-seven segment decoders, encoders, priority encoders, multiplexers, demultiplexer.	**7**
Unit-4	Sequential circuit fundamentals: Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, characteristic equations, conversion of flip-flops. Registers: Buffer register, controlled buffer register, data transfer in shift registers (SISO, SIPO, PISO, PIPO), bidirectional, universal shift registers, applications of shift registers	**8**
Unit-5	Counter design: Introduction, design procedure of asynchronous modulo counters for up, down, using positive and negative edge triggered flip-flops, design of synchronous modulo counters under constraints, shift register counters (ring, twisted ring type), pulse train generators (direct and indirect logic).	**7**
	Total Hours	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand fundamentals of any number system and binary codes.
2. Understand and apply minimization techniques to simplify switching functions.
3. Analyze and design various combinational circuits
4. Comprehensive understanding of flip-flops and registers.
5. Analyze and design various types of digital counter circuits.

Text Books/ Reference Books:

1. A. Anand Kumar, Fundamentals of Digital Circuits., Fourth edition, Prentice Hall India Learning Pvt. Ltd., New Delhi (2023).
2. M. Morris Mano, Digital design, sixth edition, pearson, (2022).

EI21005	Sensors & Transducers B.Tech. (Electronics & Instrumentation Engineering) Third Semester (Professional Core Theory)	L-T-P-C 3-0-0-3

Prerequisites: Nil

Unit	Course Content	Hours
Unit-1	**Introduction:** General concepts and terminology of measurement systems, generalized measurement system, Review of performance characteristics of a measurement system, Statistical analysis of measurement data. Transducers and sensors, classification, emerging fields of sensor technologies.	6
Unit-2	**Resistive transducers:** Potentiometers, metal and semiconductor strain gauges and their signal conditioning circuits, strain gauge applications, Instrumentation amplifier-circuits and applications.	8
Unit-3	**Inductive transducers:** Transformer types (LVDT) and associated signal conditioning circuits, Capacitive transducers, capacitive microphone, Digital Transducers.	9
Unit-4	**Piezoelectric transducers:** Charge amplifier and signal conditioning of PE transducers; photoelectric transducers, Hall effect sensors	5
Unit-5	**Transducers for Industrial Instrumentation:** Thermocouples: Thermoelectric effects, laws of thermocouple, cold junction compensation techniques, thermocouple types, construction, measuring circuits, Resistance temperature detector (RTD), principle and types, construction requirements for industry, measuring circuits, 3/4 wire RTD. Thermistors, principle and sensor types, measuring circuits, linearization methods and applications.	8
	Total Hours	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Define the terminology, standards and characteristics of measurement systems.
2. Identify the transducers and sensors used in various applications.
3. Utilize the basic principles and techniques of various sensors and transducers in real applications.
4. Design various circuits using sensors and transducers.
5. Apply knowledge of Sensors and Transducers for practical implementations in engineering applications.

Text Books/ Reference Books:

1. Murthy D. V. S. Transducers and Instrumentation. Prentice Hall India Learning Pvt. Ltd., New Delhi (2008).
2. Patranabis, Sensors and Transducers. Prentice Hall India Learning Pvt. Ltd., New Delhi (2003).
3. Doebelin Ernest O. Measurement Systems - Application and Design. Tata McGraw-Hill, New York (2003).
4. Neubert Hermann K. P. Instrument Transducers - An Introduction to their Performance and Design. 2nd Edition, Oxford University Press, Cambridge (1999).
5. Waldemar Nawrocki. Measurement Systems and Sensors. Artech House (2005).
6. Sze Simon M. Semiconductor sensors. John Wiley & Sons Inc., Singapore (1994).
7. Nakra Bahadur C. and Chaudhry Krishan k. Instrumentation Measurement and Analysis. TATA McGraw-Hill, New Delhi (2004).

EI21007	Signals & Systems B.Tech. (Electronics & Instrumentation Engineering) Third Semester (Professional Core Theory)	L-T-P-C 3-0-0-3

Prerequisites: Nil

Unit	Course Content	Hours
Unit-1	Classification of Signals and Systems: Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Causal and Non-causal signal, Deterministic & Random signals, Energy & Power signals – Classification of systems- CT systems and DT systems – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.	**6**
Unit-2	Analysis of Continuous Time Signals: Fourier series for periodic signals, Fourier Transform & properties, Laplace Transforms and properties.	**8**
Unit-3	Linear Time Invariant Continuous Time Systems: Impulse response, Transfer function, convolution integrals, correlation, Differential Equations, Fourier and Laplace transforms in Analysis of CT systems, Systems connected in series / parallel, Frequency response of first order and second order LTI systems.	**8**
Unit-4	Analysis of Discrete Time Signals: Nyquist sampling theorem & Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT – Z Transform & Properties.	**7**
Unit-5	Linear Time Invariant Discrete Time Systems: Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.	**7**
	Total Hours	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand the classification of a given signal and/or system.
2. Develop an ability to find if a system is LTI or not.
3. Apply various transforms to understand and analyze signals and/or systems.
4. Understand the relation between time domain and frequency domain, and analyze LTI systems.
5. Understand the sampling theorem, & apply to analyze signal transmission through a LTI system.

Text Books/ Reference Books:

1. Papoulis Athanasios.Circuits and Systems: A Modern Approach. Holt, Rinehart, and Winston Publishers, New York (1980)
2. Lathi Bhagawandas P. Signal Processing and Linear Systems. Oxford University Press (1998)
3. Simon Haykin and Barry van Veen. Signals and Systems.John Wiley and Sons (Asia) Private Limited (1998)

EI22001	Measurement Laboratory B.Tech. (Electronics & Instrumentation Engineering) Third Semester (Professional Core Laboratory)	L-T-P-C 0-0-3-1.5

List of Experiments

1. Measurement of an unknown medium resistance using Wheatstone bridge.
2. Measurement of an unknown low resistance using Kelvin's double bridge.
3. Measurement of an unknown self-inductance using Maxwell's inductance capacitance bridge.
4. Determination of critical damping resistance of a D'Arsonval galvanometer
5. Calibration of Ammeter, Voltmeter and Wattmeter using Potentiometer.
6. a) Design, construction and calibration of series and shunt type Ohmmeters; b) Measurement of insulation resistance of cable by Megger or Insulation tester
7. Calibration of wattmeter at different Power Factors.
8. Testing of CT & PT; Measurement of power of HV circuit using CT & PT.
9. Measurement of unknown parameter using LCR meter (Q-meter).
10. Measurement of unknown Frequency using Frequency Counter Trainer.
11. Measurement of three-phase power by two wattmeter methods.
12. Measurement of Phase & Frequency with CRO.
13. Magnetic measurement using Ballistic Galvanometer.
14. Measurement of R, L and C by using RLC bridge instrument.
15. Measurement of resistance by using: (i) Wheatstone bridge, (ii) Kelvin's double bridge.
16. Study of various types of multimeters and measurement of different AC, DC parameters.
17. Demonstration of MC, MI, Induction type and dynamometer type instruments.
18. Measurement of self-inductance, mutual inductance and coupling coefficient of transformer windings & Air cored Coils
19. Extension of range of Ammeter, Voltmeter and Wattmeter using Shunt Series resistance and instrumentation Transformers.
20. Calibration of Single Phase energy meter by: (i) Direct Loading; (ii) Phantom Loading at various points
21. Calibration of 3 Phase energy meter using standard watt meter.
22. a) Measurement of Capacitance using Schering Bridge; b) Measurement of Frequency using Wien's bridge

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. Measure unknown electrical parameters (R, L, C, frequency, power, energy) using bridge methods, LCR meters, frequency counters, and standard measurement instruments.
2. Calibrate electrical measuring instruments such as ammeters, voltmeters, wattmeters, and energy meters using standard techniques including potentiometer, direct loading, and phantom loading methods.
3. Analyze the performance and characteristics of measurement devices including galvanometers, CTs, PTs, multimeters, and magnetic measurement instruments, and evaluate measurement accuracy and errors.
4. Design and implement appropriate measurement setups for single-phase and three-phase systems, extend instrument ranges using shunts and instrument transformers, and interpret experimental results with respect to precision and reliability.

EI22003	Analog Electronics Laboratory B.Tech. (Electronics & Instrumentation Engineering) Third Semester (Professional Core Laboratory)	L-T-P-C 0-0-3-1.5

List of Experiments

1. Design and test an Inverting & Non- Inverting Amplifier using an OP-AMP
2. Design and test a Comparator using an OP-AMP
3. Design and test Schmitt Trigger using an OPAMP
4. Design and test an Adder & Subtractor circuit using an OPAMP
5. Design and test an Integrator & Differentiator circuit using an OPAMP
6. Design and test V-I characteristic of a NPN transistor in CE configuration
7. Construct fixed biased method & Voltage divider biasing method using BJT
8. Study the Monostable multivibrator using IC 555 timer.
9. Study the astable multivibrator using IC 555 timer.
10. Implement the Operational Amplifier as a Schmitt Trigger.
11. Active Filter Applications – LPF, HPF (first order).
12. Study different VI using NI Basic Electronics modules.
13. Implement a voltage regulatory circuit using Zener Diode
14. Design of RC phase shift oscillators using BJT/ FET.
15. Design of Colpitts oscillators using BJT, Design of Hartley oscillators using BJT

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. Acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier.
2. Develop the ability to analyze and design analog electronic circuits using discrete components.
3. Observe the amplitude & frequency responses of common amplification circuits.
4. Design, construct & take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis
5. Analyze & interface different VI using NI basic electronics modules.

EI22005	Digital Electronics Laboratory B.Tech. (Electronics & Instrumentation Engineering) Third Semester (Professional Core Laboratory)	L-T-P-C 0-0-3-1.5

List of Experiments

1. To Verify a K-map simplified boolean expression.
2. To Verify the operation of adders.
3. To Verify the operation of subtractors.
4. To Verify the operation of code converter circuits like a) BCD to XS-3 b) Binary to gray.
5. Design 4-bit Decoder and Encoder using basic logic gates.
6. Implement a given boolean expression using decoder and or gates.
7. To study a BCD to 7 Segment LED display.
8. To verify the operation of multiplexers & demultiplexers.
9. Implement a given boolean expression using multiplexers.
10. Implement & verify the operation of a higher order multiplexer using multiple lower order multiplexers.
11. To (a) study S-R, J-K, D & T Flip-flops, (b) conversions of one Flip-Flop to another.
12. To study and verify the operation of master slave flip-flops.
13. To study and verify modulo synchronous counters.
14. To implement a 3-bit (a) up counter, (b) down counter, (c) up-down counter, (d) decade counter with count sequence 0 to 9.
15. Small hobby projects and experiments related to digital circuits.

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. Analyze and Design simple combinational circuits.
2. Realize and verify the truth table of unknown functions.
3. Study and verify the operation of simple sequential circuits.
4. Implement utility based and innovative digital circuits.

EI22007	Sensors & Transducers Laboratory B.Tech. (Electronics & Instrumentation Engineering) Third Semester (Professional Core Laboratory)	L-T-P-C 0-0-3-1.5

List of Experiments

1. To study the characteristics of a strain gauge and determine the relationship between applied strain and change in resistance.
2. To study the characteristics of a load cell and perform weight measurement using strain gauge-based load cells.
3. To study the construction and working of LVDT and to measure displacement and thickness using LVDT.
4. To study flow measurement using a differential pressure type transducer and analyze its performance characteristics.
5. To study the characteristics and working principles of LDR, thermostat and thermocouple.
6. To study the testing and calibration of T, J, K, R and S type thermocouples.
7. To study the voltage–intensity characteristics of a phototransistor.
8. To study the ramp response characteristics of a filled-in system thermometer.
9. To study and compare the step response characteristics of RTD and thermocouple sensors.
10. To study the working and characteristics of force and torque transducers and electrical pressure probes.
11. To study the characteristics and operation of a photoelectric tachometer for speed measurement.
12. To study the working principle and characteristics of a Hall Effect transducer.
13. To study the characteristics and working of an accelerometer model for vibration measurement.
14. To study the characteristics of an angular potentiometer transducer model.
15. To measure parameters such as temperature and depth using optical fibre sensors and study their characteristics.
16. To study the characteristics and working principle of piezoelectric sensors.

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. Demonstrate the working principles and operating characteristics of various sensors and transducers used for measuring displacement, force, torque, pressure, temperature, flow, speed, vibration, and light intensity.
2. Experimentally determine and analyze static and dynamic characteristics of sensors, including sensitivity, linearity, hysteresis, accuracy, repeatability, and response time.
3. Perform calibration and testing of temperature sensors (RTD and thermocouples of types T, J, K, R, and S) and evaluate their performance under different operating conditions.
4. Select and implement appropriate transducers for specific measurement applications, acquire experimental data, and interpret results to assess measurement accuracy and system performance.

EI22009	Computational and Simulation Laboratory	L-T-P-C
	B.Tech. (Electronics & Instrumentation Engineering)	0-0-3-1.5
	Third Semester (Professional Core Laboratory)	

List of Experiments

1. Plotting and visualization of mathematical functions and datasets using computational tools.
2. Study of the effect of parameters on polynomial, exponential, logarithmic, and trigonometric functions through graphical analysis.
3. Computational solution of systems of linear algebraic equations using matrix-based methods.
4. Determination of eigenvalues and eigenvectors of matrices and their interpretation.
5. Polynomial operations and numerical determination of roots of polynomials.
6. Symbolic computation of derivatives, integrals, and algebraic equations.
7. Numerical differentiation and numerical integration using standard approximation techniques.
8. Numerical solution of ordinary differential equations using Euler and Runge–Kutta methods.
9. Optimization of single-variable functions using numerical techniques.
10. Optimization of multivariable functions using gradient-based methods and contour plots.

Additional Experiments (Assignment):

11. Monte Carlo simulation for estimation of numerical values and uncertainty analysis.
12. Transient response analysis of first-order electrical circuits (RC) using computational methods.
13. Transient response analysis of second-order electrical circuits (RLC) using computational methods.
14. Computational modeling and simulation of the Lotka–Volterra prey–predator equations.
15. Random signal generation and statistical characterization using computational tools.

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. Apply computational tools to visualize mathematical functions, analyze datasets, and interpret graphical results.
2. Implement numerical and symbolic methods to solve problems involving linear algebra, polynomials, calculus, and ordinary differential equations.
3. Formulate and solve optimization and stochastic problems using numerical techniques, including Monte Carlo simulation and statistical analysis.
4. Model and simulate simple dynamical systems, including electrical circuits and nonlinear systems, and analyze their transient and steady-state behavior.

HS21001/21002	Engineering Economics	L-T-P-C
	IIIrd / IVth Semester (Professional Core)	3-0-0-3

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction:** Definition and scope of Economics; Engineering Economics and the role of engineers in economic decision-making; Theory of Consumer Behaviour: Cardinal and Ordinal Utility analysis.	**4**
Unit-2	**Demand Analysis:** Demand: meaning, law, determinants; Supply: meaning, law, determinants; Market equilibrium and price determination; Elasticity of demand; Demand Forecasting techniques.	**4**
Unit-3	**Theory of Cost and Production:** Meaning and classification of costs; Short-run cost concepts; Fixed cost; Variable cost; Total, average, and marginal cost; Long-run cost curves; Law of Variable Proportion and Returns to scale.	**3**
Unit 4:	**Theory of Product Pricing:** Market Structure: Perfect Competition-Characteristics; Price Determination; Monopoly- Characteristics, Price and Output Determination.	**6**
Unit 5	**National Income Determination**: Concepts and Measurement of National Income; Components of National Income; Methods of National Income Calculation; Problems in Measuring National Income.	**3**
Unit 6	**Macroeconomic issues and International Market:** Unemployment: Definition, types, and causes; Inflation: types, causes, and social costs of inflation; Business Cycle; Schumpeter theory of innovation.	**6**
Unit-7	**Project Evaluation and Management:** Meaning of Project Cycle, Project selection and planning; Project Appraisal; Means of financing and financial appraisal tools; Qualitative Methods for Project Evaluation, Social Cost Benefit Analysis; Externalities and environmental concerns.	**6**
	Total	**32**

Course Outcomes (COs):

After completion of the course, students will be able to

1. To introduce economic principles relevant to engineering decision-making
2. To analyse consumer behaviour, cost functions and producer behaviour for Engineering Decisions
3. To understand national income and macroeconomic issues
4. To apply project evaluation techniques and social and environmental cost-benefit analysis

Text Books/ Reference Books:

1. H. G. Thuesen, W. J. Fabrycky, and G. J. Thuesen (1993), Engineering Economy, Prentice Hall International.
2. F. C. Jelen (1970), Cost and Optimisation Engineering, McGraw-Hill Book Co., New York.
3. Hal R. Varian. Intermediate Microeconomics, 8th Edition, W. W. Norton and Company.
4. N. Gregory Mankiw. Principles of Microeconomics. Cengage Learning
5. N. Gregory Mankiw, Ronald D. Kneebone, Kenneth J McKenzie (2023). Principles of Macroeconomics, 9th Edition. Cengage Canada.
6. Salvatore, D. International Economics (11th ed.). John Wiley & Sons.

EI21002	Circuits & Networks	L-T-P-C
	B.Tech. (Electronics & Instrumentation Engineering)	3-0-0-3
	Fourth Semester (Professional Core Theory)	

Prerequisites: Nil

Unit	Course Content	Hours
Unit-1	**Review of circuit elements:** V-I characteristics of R, L and C, classification of circuits, dependent and independent sources, source transformation, star-delta transformation. Analysis of coupled circuits: mutual inductance, Lenz's law, Faraday's law, coupled magnetic circuit analysis, coefficient of coupling, dot polarity convention.	6
Unit-2	**Circuit Theorems:** Thevenin's theorem, Norton's theorem, maximum power transfer theorem, superposition theorem, reciprocity theorem, Millman's theorem, compensation theorem, substitution theorem with applications.	7
Unit-3	**AC circuit analysis:** Concepts of phasor, peak, average and rms values of ac quantities, steady state analysis of balanced and unbalanced Y and delta connected three-phase circuit, relationship between line currents and phase currents, line voltages and phase voltages, concepts of apparent power, active power, reactive power and power factor, series resonance and parallel resonance, bandwidth and Q factor.	7
Unit-4	**Response analysis of Electric circuits:** Review of Laplace transform, transfer function representation, pole-zero plots, response of RL, RC and RLC series and parallel circuits with dc excitation, step input and sinusoidal input, Concepts of time constant, natural frequency, damping factor, underdamped, overdamped, critically damped and undamped conditions.	9
Unit-5	**Analysis of Two port Networks:** Driving point and transfer functions, voltage and current transfer ratios of two-port networks, Parameters: impedance, admittance, hybrid and ABCD parameters for two-port networks, relationship between different parameters, conditions of symmetry and reciprocity, interconnections of two port networks (series, parallel and cascade connection), Π and T networks.	7
	Total Hours	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Analyze linear electrical circuits containing R, L, C elements and independent/dependent sources using basic network reduction techniques such as source transformation and star–delta conversion.
2. Apply circuit theorems (Thevenin, Norton, Superposition, Maximum Power Transfer, Reciprocity, Millman, Compensation, and Substitution) to determine voltages, currents, and power in electrical networks.
3. Evaluate AC circuits, including single-phase and balanced/unbalanced three-phase systems, and compute power parameters, resonance conditions, bandwidth, and quality factor.
4. Analyze transient and steady-state responses of RL, RC, and RLC circuits using Laplace transform techniques, transfer functions, and pole–zero representations.
5. Determine and interpret two-port network parameters (Z, Y, h, ABCD), analyze their interconnections, and verify conditions of symmetry and reciprocity in network systems.

Text Books/ Reference Books:

1. Valkenburg Mac Elwyn Van. Network Analysis. Pearson Education India, New Delhi (2015)
2. Kuo Franklin F. Network Analysis & Synthesis. Wiley, New York (2006)
3. Alexander Charles K. and Sadiku Matthew N. O. Fundamentals of Electrical Networks. Tata McGraw Hill Education, New Delhi (2019)

EI21004	Control Systems	L-T-P-C
	B.Tech. (Electronics & Instrumentation Engineering)	3-0-0-3
	Fourth Semester (Professional Core Theory)	

Prerequisites: Engineering Mathematics (Calculus, Linear Algebra, Transforms), Signals & Systems EI-21007, Circuit & Network Analysis

Unit	Course Content	Hours
Unit-1	**Introduction and System Classification:** Introduction to dynamic systems in biological, engineering, and non-engineering contexts. Interconnected systems and system-of-systems; functional roles of sensors, actuators, controllers. Definition and flow of reference inputs, process outputs, control signals, and manipulated variables. Comparative analysis of open-loop and closed-loop (feedback) configurations. Classification of dynamic systems: Lumped/distributed, SISO/MIMO, and continuous/ discrete-time systems. Linear/nonlinear, time-invariant/varying, causal/non-causal, homogeneous/non-homogeneous systems.	4
Unit-2	**System Modeling:** Mathematical modelling using fundamental laws of conservation (Electrical systems, Mechanical systems, Tank (liquid level) systems, Thermal systems). Recognition of common mathematical structure across physical domains. Transfer function. Block diagram representation and reduction.	7
Unit-3	**Time Domain Analysis:** Effect of poles and zeros on system response and stability. Time response of first-order and second-order systems. Time domain specifications (rise time, settling time, peak time, overshoot). Steady-state error, system type and static error constants. Higher-order systems and dominant pole approximation.	8
Unit-4	**Stability Analysis in Time Domain:** Concept of stability. Routh–Hurwitz stability criterion. Relative stability. Root locus technique: construction rules, effect of poles and zeros, gain selection.	5
Unit-5	**Frequency Domain Analysis:** Correlation between time and frequency domain behaviour. Bode plots and Polar plots. Gain margin and phase margin. Nyquist stability criterion.	5
Unit-6	**Introduction to Controllers and Compensators:** Feedback controllers and performance improvement. P, PI, PID controllers: structure and effect on steady-state error, transient response and stability. Lead, Lag and Lead–Lag compensators: basic concepts and qualitative effect on time and frequency response characteristics.	4
Unit-7	**Introduction to State Space and Linearisation:** Limitations of transfer function approach. State space representation of linear time-invariant systems. Conversion of transfer function to state space form. Linearisation about an operating point using Taylor series expansion. Jacobian matrix concept for linearized state model.	3
	Total Hours	**36**

***** For continuity of discussion Modules 2, 3 and 4 can be explained together.

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain and classify dynamic systems encountered in engineering and allied domains and identify the functional roles of systems within a System-of-Systems framework. (Conceptual understanding, multidisciplinary perspective)
2. Develop mathematical models of systems using fundamental laws, and represent them using transfer functions, block diagrams, and state-space formulations. (Analytical skills, abstraction, problem formulation)
3. Analyze system behavior in time and frequency domains, determine stability, transient and steady-state specifications, and interpret the effect of poles and zeros on system performance. (Critical thinking, analytical reasoning, outcome-based learning)
4. Apply Routh–Hurwitz, root locus, Bode, and Nyquist techniques to assess stability and design P, PI, and PID controllers and basic compensators to meet desired performance specifications. (Design thinking, solution-oriented approach, industry relevance)
5. Formulate state-space models of LTI systems, convert between representations, and perform linearization of nonlinear systems about operating points for analysis and control design. (Advanced competency, readiness for higher studies and research)

Text Books/ Reference Books:

1. Åström, Karl Johan, and Richard Murray. Feedback systems: an introduction for scientists and engineers. Princeton university press, 2021.
2. Nise, Norman S. Control systems engineering. John Wiley & Sons, 2019.
3. Jalili, Nader, and Nicholas W. Candelino. Dynamic systems and control engineering. Cambridge University Press, 2023.
4. Kani, A. Nagoor. Control Systems Engineering. CBS Publishers & Distributors Pvt. Limited, 2020.
5. Joseph J. Di Stefano. Schaum's Outline of Feedback and Control Systems. McGraw-Hill, 2013.

EI21006	Microprocessors & Microcontrollers	L-T-P-C
	B.Tech. (Electronics & Instrumentation Engineering)	3-0-0-3
	Fourth Semester (Professional Core Theory)	

Prerequisites: Nil

Unit	Course Content	Hours
Unit-1	**8085 Microprocessor:** Architecture: General 8-bit microprocessor and its architecture, 8085 functional block diagram, architecture functions of different sections. Instruction Sets: Instruction format, addressing modes, instruction set of 8085 CPU, instruction cycle, timing diagrams, different machine cycles, fetch and execute operations, estimation of execution time. Assembly Language Programming: Assembly format of 8085, assembly directions, multiple precision arithmetic operations, binary to BCD and BCD to binary code conversion, ALU programming using look up table, stack and subroutines.	8
Unit-2	**Memory and I/O Interface with Microprocessor:** Interfacing Memory: Classification of Memory, Address decoding (using logic gates, decoders and PAL), Interfacing Static RAM Interfacing EPROM, Designing Memory Modules (higher capacity say 512K) using memory chips. Interfacing I/O Devices.	6
Unit-3	**Advanced Microprocessor: Intel 8086/8088 Microprocessor:** Architecture, Clock Generator, Resetting the microprocessor, Wait State Inserting, Bus Buffering, Interrupts, and Assembly Language Programming and Addressing Modes.	6
Unit-4	**Communication Interface:** Interfacing and assembly language monitor program for Key Board (one dimensional, two dimensional) and Seven-segment display, Stepper Motor through 8255A, Data transfer between two microprocessor based systems through 8255. 8237 DMA controller and interfacing with 8086 up Programmable communication interface- Intel 8251 USART. Programmable Interrupt Controller-8259A.	8
Unit-5	**Microcontrollers:** Introduction to single chip microcontrollers: Intel MCS-51 family features, 8051/8031 architecture, pin configuration, I/O ports and Memory organization. Instruction set and basic assembly language programming. Interrupts, Timer/Counter and Serial Communication. Applications: Square wave and pulse wave generation, LED, A/D Converter and D/A Converter interfacing to 8051. Introduction to PIC micro-controller.	8
	Total Hours	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Acquire knowledge and concept of the architecture and assembly language programming of μP 8085 and 8086/8088.
2. Understand the addressing modes, instruction set, and interrupt structure of μP 8085 and 8086/8088 and μC 8051/8031.
3. Understand the importance of memory, I/O and communication interfacing.
4. Acquire knowledge of the architecture and assembly language programming of μC 8051/8031.
5. Develop microprocessor and microcontroller based applications.

Text Books/ Reference Books:

1. Gaonkar Ramesh S. Microprocessor Architecture, Programming and application with 8085. Prentice Hall of India, New Delhi (2013).
2. Bhurchandi K. M. and Ray A. K. Advanced Microprocessors & Peripherals. Tata McGraw-Hill, New Delhi (2017)

3. Mazidi Muhammed A. and Mazidi Janice G. The 8051 Microcontroller and Embedded Systems. Pearson Education Limited, USA (2007).
4. Brey Barry B. The Intel Microprocessors. PHI/Pearson Ed. Asia, New Delhi (2009).
5. Deshmukh Ajay V. MicrocontrollersTheory and Applications. Tata McGraw-Hill, New Delhi (2018).
6. Tribel Walter A., Singh Avtar and Srinath N.K. The 8088 and 8086 Microprocessors Pearson Education Limited, USA (2013).
7. Hall Douglas V. Microprocessors & Interfacing. Tata McGraw-Hill, New Delhi (2005).

EI21008	Industrial Instrumentation	L-T-P-C
	B.Tech. (Electronics & Instrumentation Engineering)	3-0-0-3
	Fourth Semester (Professional Core Theory)	

Prerequisites: Nil

Unit	Course Content	Hours
Unit-1	**Level Measurement:** Significance of level measurement in industry, Gauge glass technique coupled with photo electric readout system –float type level indication, Level measurement using displacer and torque tube, Bubbler system – differential pressure method, Electrical types of level gauges using resistance, capacitance, nuclear radiation and ultrasonic sensors, Different scheme to realize level switches.	7
Unit-2	**Pressure Measurement:** Significance of pressure measurement in industry, Definition of absolute pressure, gauge pressure and vacuum, Non-Electric type pressure measurement: manometers, Elastic type pressure gauge: Bourdon tube, Diaphragm and Bellows, Measurement of vacuum: thermal conductivity gauges, Ionization gauge cold cathode and hot cathode types, Electrical pressure transmitter, Testing and calibration of pressure gauges.	7
Unit-3	**Flow Measurement:** Significance of flow measurement in industry, Basics of flow measurement: flow rate, volumetric flowrate and mass flowrate, Types of Flow meters and applications: variable head, variable area, electromagnetic, ultrasonic, turbine and open channel flow meters, Calibration of flow meters, Guidelines for selection of flow meter.	7
Unit-4	**Temperature Measurement:** Significance of Temperature measurement in Industry, Types of Temperature Transducers: thermocouple, bolometer, RTD (3/4 wire), thermistor, pyrometer and semiconductor.	7
Unit-5	**Other Parameters and Industrial Safety:** Viscosity: Rotational viscometer, Vibrational viscometer, Capillary viscometer, Ultra sound and Rheometer. Density: Vibrating tube densitometer, Coriolis density measurement, Nuclear density gauge, Hydrostatic method. Humidity and Moisture: Capacitive Humidity sensor, Dew point measurement techniques, Microwave & NIR moisture meter. Industrial Safety: electrical hazards, hazardous and Non-hazardous areas-classification. Enclosures – NEMA types, fuses and circuit breakers, protection methods: purging, explosion proofing and intrinsic safety, Specification of instruments, preparation of project documentation, process flow sheet, Instrument index sheet, Instrument specification sheet, panel drawing and specifications.	8
	Total Hours	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Remember the techniques for level, flow, temperature and pressure measurement.
2. Remember the techniques for density, viscosity, humidity and moisture measurement
3. Apply the knowledge for selection and applications of appropriate measurement methods.
4. Understand safety regulations for industries.
5. Understand the project documentation, process flow sheet, Instrument index sheet, Instrument specification sheet, panel drawing and specifications.

Text Books/ Reference Books:

1. Jain, R.K. Mechanical and Industrial Measurements. Khanna Publishers, New Delhi.
2. Johnson Curtis D. Process Control Instrumentation Technology. Prentice Hall publishers, United States (2005).
3. Singh, S. K. Industrial Instrumentation and Control. Tata McGraw Hill Publishing Ltd., New Delhi (2009).

4. Sawhney A K, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Co (P) Ltd., New Delhi (2022).
5. Patranabis Dipak. Principles of Industrial Instrumentation. Tata McGraw Hill Publishing Ltd., New Delhi, (2013).
6. Andrew William G. Applied Instrumentation in Process Industries – A survey. Vol. 1 & Vol. 2. Gulf Publishing Company, Houston, (2001).
7. Doebelin Ernest O. Measurement systems Application and Design. International Student Edn, McGraw Hill Publishing Ltd, New York (2001).
8. Liptak, Bela G., Instrument and Automation Engineers' Handbook: Process Measurement and Analysis. CRC Press (2016)

EI22002	Circuits & Networks Laboratory	L-T-P-C
	B.Tech. (Electronics & Instrumentation Engineering)	0-0-3-1.5
	Fourth Semester (Professional Core Laboratory)	

List of Experiments

1. Prove Milmann's Theorem.
2. Prove Reciprocity Theorem.
3. Prove maximum power transfer Theorem.
4. Analyse the steady state response of series and parallel R-C circuits.
5. Analyse the steady state response of series and parallel R-L circuits.
6. Analyse the steady state response of series and parallel R-L-C circuit
7. Analyse the transient response of series and parallel R-C circuits.
8. Analyse the transient response of series and parallel R-L circuits.
9. Analyse the transient response of the series and parallel R-L-C circuit.
10. Determination of Impedance (Z) and Admittance(Y) parameters of two port networks.
11. Determination of hybrid (h) and transmission (ABCD) parameters of two port networks.

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. Analyze a given network by applying various Network Theorems
2. Infer and evaluate the steady state response of R-L-C circuits.
3. Infer and evaluate the transient response of R-L-C circuits.
4. Evaluate and analyze the two-port network parameters.

EI22004	Control Systems Laboratory	L-T-P-C
	B.Tech. (Electronics & Instrumentation Engineering)	0-0-3-1.5
	Fourth Semester (Professional Core Laboratory)	

List of Experiments

1. Introduce Python/MATLAB environment to generate basic time and frequency responses.
2. Simulate step response of first-order systems and study the effect of system parameters on steady-state value, speed of response, and stability.
3. Simulate impulse and ramp responses of first-order systems and compare theoretical and simulated steady-state behavior.
4. Simulate sinusoidal response of first-order systems and analyze variation of output magnitude and phase with input frequency.
5. Simulate step response of second-order systems and study the effect of damping ratio and natural frequency on transient specifications.
6. Simulate impulse and ramp responses of second-order systems and analyze their transient and steady-state characteristics.
7. Simulate step response of higher-order systems and compare with dominant-pole-approximated first- or second-order models.
8. Investigate effect of pole–zero locations on stability and transient response using pole-zero maps and time-domain simulations.
9. Plot root locus and select controller gain for a specified damping ratio and validate using step response.
10. Generate Bode and Nyquist plots to determine gain margin, phase margin, and assess relative stability.
11. Determine steady-state error for step, ramp, and parabolic inputs for Type-0, Type-1, and Type-2 systems.

Additional Experiments (Assignment):

12. Design and simulate P, PI, and PID controllers and study improvement in transient response and steady-state error.
13. Design lead, lag, or lead–lag compensator and evaluate improvement in time- and frequency-domain specifications.
14. Model a nonlinear liquid-level system, linearize about an operating point, and apply PI control for set-point tracking and disturbance rejection.

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. Develop mathematical models of dynamic systems and represent them using differential equation, transfer-function and state-space forms in Python/MATLAB.
2. Simulate and analyze time-domain responses of first-, second-, and higher-order systems, and evaluate transient and steady-state performance parameters.
3. Assess system stability using pole–zero maps, root locus, Bode plots, and Nyquist plots, and interpret their correlation with time-domain behavior.
4. Determine steady-state error for standard inputs and analyze the influence of system type and controller structure.
5. Design and implement P, PI, PID, and lead–lag compensators to improve system performance, and validate results through simulation on linear and nonlinear models.

EI22006	**Microprocessors & Microcontrollers Laboratory**	**L-T-P-C**
	B.Tech. (Electronics & Instrumentation Engineering)	**0-0-3-1.5**
	Fourth Semester (Professional Core Laboratory)	

List of Experiments

1. Study of 8085/8086 Microprocessor and 8051 Microcontroller architecture, instruction set, and development tools (assembler/simulator/kit).
2. Program to perform addition and subtraction of 8-bit and 16-bit numbers using 8085/8086.
3. Program to perform multiplication of two 8-bit numbers using: Built-in instruction (if applicable) and Repetitive addition method.
4. Program to perform division of two 8-bit numbers and compute factorial of an 8-bit number using 8085/8086.
5. Program to generate 1's and 2's complement of an 8-bit number.
6. Program to generate square, triangular, and sawtooth waveforms using DAC interfacing.
7. Stepper motor interfacing and control using 8085/8051.
8. Temperature measurement using suitable sensor (e.g., LM35) and ADC interfacing.
9. Traffic light controller implementation using 8085/8051.
10. LED interfacing and implementation of alternate blinking patterns.
11. Seven-segment display interfacing and numeric display using microprocessor/microcontroller.
12. Matrix keyboard interfacing and key detection program.
13. Relay and opto-coupler interfacing for isolation and control applications.
14. Arithmetic operations (addition, subtraction, multiplication, division of 8-bit numbers) using 8051 microcontroller.

Additional Experiments (Assignment):

15. Design and implementation of a simple embedded system application integrating sensor input, processing, and output display/control.

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. To familiarize with the assembly level programming.
2. To gain knowledge in microprocessor and microcontroller architecture, programming and its various applications.
3. Analyze the concepts related to I/O and memory interfacing.
4. An in-depth knowledge of applying the concepts on real- time applications.

EI22008	**Instrumentation Laboratory**	**L-T-P-C**
	B.Tech. (Electronics & Instrumentation Engineering)	**0-0-3-1.5**
	Fourth Semester (Professional Core Laboratory)	

List of Experiments

1. To design and analyze an instrumentation amplifier using operational amplifiers and to determine its voltage gain and Common Mode Rejection Ratio (CMRR).
2. To design and implement active notch filter and narrowband active filter using operational amplifier and to study their frequency response characteristics.
3. To design and study the operation of Analog-to-Digital Converter (ADC) and Digital-to-Analog Converter (DAC) circuits and analyze their performance parameters.
4. To design and analyze Frequency-to-Voltage (F–V) and Voltage-to-Frequency (V–F) converter circuits and verify their linearity characteristics.
5. To design and analyze astable and monostable multivibrators using IC 555 timer and study their output waveform characteristics.
6. To study and analyze the performance of voltage regulator circuits using IC 723 and 78XX/79XX regulator family and evaluate line and load regulation.
7. To design and analyze a Phase Locked Loop (PLL) for given lock range and capture range and to perform frequency multiplication using PLL.
8. To study the working of a dead weight tester and to calibrate a pressure gauge using standard pressure measurement techniques.
9. To study the characteristics of a photocell/LDR and to measure light intensity variations.
10. To measure temperature using RTD, thermocouple and diode sensors, and to perform calibration with appropriate signal conditioning circuits.
11. To measure distance using ultrasonic methods and analyze the time-of-flight principle.
12. To measure pH and viscosity of given samples and to perform standardization of pH meter for accurate measurement.
13. To measure level and flow parameters, determine discharge coefficient of orifice plate, and study the working of a level transmitter.
14. To study the absorption spectrum of samples using UV–Visible and IR spectrophotometers.
15. To perform data acquisition using different DAQ systems and implement signal monitoring and analysis using LabVIEW programming.

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. Design, implement, and analyze signal conditioning circuits including instrumentation amplifiers, active filters, voltage regulators, multivibrators, PLL, and V–F / F–V converters, and evaluate their performance parameters.
2. Design and test data conversion and interfacing systems such as ADC, DAC, and DAQ-based acquisition systems, and analyze accuracy, resolution, linearity, and dynamic response.
3. Perform calibration and measurement of physical parameters such as temperature, pressure, level, flow, light intensity, distance, pH, and viscosity using appropriate sensors, transducers, and standard instrumentation techniques.
4. Acquire, process, and interpret experimental data using modern instrumentation tools (e.g., LabVIEW and spectrophotometers), and assess measurement errors, sensitivity, and reliability of instrumentation systems.

EI22010	Design Thinking Laboratory	L-T-P-C
	B.Tech. (Electronics & Instrumentation Engineering)	0-0-1-0.5
	Fourth Semester (Professional Core Laboratory)	

List of Experiments

1. Identify a real-world engineering problem (preferably from electronics/instrumentation), perform user-need analysis, and define clear problem statements using structured templates.
2. Develop empathy maps and stakeholder charts for a selected engineering problem to understand user constraints, safety needs, and environmental considerations.
3. Conduct structured brainstorming sessions and generate multiple solution concepts; document at least five alternative ideas and evaluate them using feasibility criteria.
4. Apply decision matrices (e.g., weighted scoring method) to select the most feasible and cost-effective design concept for implementation.
5. Prepare detailed concept sketches and draw functional block diagrams for the selected design solution.
6. Develop a paper/cardboard/mock-up prototype to demonstrate the working principle of the proposed solution.
7. Implement a simple breadboard prototype (e.g., LED indicator system, buzzer alarm circuit, basic sensor-based trigger system) to demonstrate core functionality.
8. Test the prototype for functionality, identify limitations, and refine the design through at least one improvement iteration.
9. Prepare structured documentation including problem statement, block diagram, working principle, component selection, and safety/ethical considerations.
10. Demonstrate the developed prototype, explain the design thinking process followed, justify design choices, and present performance observations.

Course Outcomes (COs):

After completion of the laboratory course, students will be able to

1. Identify real-world engineering problems, analyze user needs and constraints, and formulate clear and structured problem statements.
2. Generate multiple design concepts using structured idea-generation techniques and evaluate alternatives using feasibility and decision-making tools.
3. Develop and test low-fidelity prototypes (mechanical or electronic), demonstrate core functionality, and refine designs through iterative improvement.
4. Prepare and present complete engineering design documentation including block diagrams, concept sketches, safety considerations, and justification of design decisions.

DEPT. OF MECHANICAL ENGINEERING

Algebra and Calculus

	B. Tech (For ALL Branches)	**L-T-P-C**
MA11001	**First Semester (Professional Core)**	**3- 0-0- 3**

Pre-requisites: *Matrix and determinants, Limit, Continuity, Differentiability, Basic idea of integration*.

	Course Content	**Hours**
Unit-1	**Linear Algebra:** R^n as a vector space, Linear dependence and independence of vectors in R^n, Basis & Dimension; Rank and nullity of a matrix, Elementary transformations, Consistency of a System of linear equations & their solutions by Direct Methods: Gaussian Elimination method, Gauss-Jordan method; Eigenvalues & Eigenvectors, Hermitian, Skew-Hermitian & Unitary matrices, Cayley-Hamilton's theorem & its applications.	**8**
Unit-2	**Infinite Series:** Definition of Sequence & Infinite Series, Convergence & Divergence of real Sequence & Infinite Series, Tests of Convergence of positive term infinite series: Comparison Test, D' Alembert's Ratio Test, Raabe's Test, Cauchy's root Test, Integral Test, Alternating Series, Leibnitz's Test (all tests without proofs).	**8**
Unit-3	**Differential Calculus:** Successive Differentiation, Leibnitz's Theorem, Rolle's theorem, Lagrange's & Cauchy's Mean value theorems, Curvature, Radius & centre of curvature, Partial differentiation, Euler's theorem, Jacobian, Taylor's & Maclaurin's Theorems with Lagrange's form of remainder for functions of one and two variables, Expansions of functions of one and two variables, Extreme values for functions of two or more variables, Lagrange's method of undetermined multipliers.	**14**
Unit-4	**Integral Calculus:** Reduction Formulae. Application of integrals in Quadrature, Rectification, Volume and surface area of solids of revolution.	**6**
		Total: 36

Course Outcomes:

On completion of this Course,

1. The students will be able to apply the consistency concepts, eigenvalues, and eigenvectors concepts in engineering problems.

2. The students will be able to apply the concept of convergence of infinite series in mathematical & engineering problems.

3. The students will be capable of applying the knowledge of differentiation in the expansion of functions and optimizing functions appearing in engineering and daily life problems.

4. The students will be able to apply knowledge of integration in finding area, length of arc of curves, volume, and surface area appearing in engineering and real-life problems.

PH11001	Wave Mechanics and Optics	L-T-P-C
	B.Tech (CE, CSE and ME)	3-0-0-3
	First Semester (Common)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Waves and Oscillation:** Introduction to Vibrations and Oscillations, Review on Free Oscillations, Damped motions -under damping -Logarithmic decrement, relaxation time and Q-Factor, overdamping and critical damping, Forced oscillations with damping - Steady state solution and its frequency response, Power absorbed and dissipation in forced oscillator, Resonance- amplitude, velocity and power- sharpness of resonance.	**7**
	Coupled oscillations, introduction of normal modes and normal coordinate and their physical significance- general solutions, wave equation in one dimension, Characteristics and solution, superposition, travelling and standing waves, phase and group velocity.	**5**
Unit-2	**Electromagnetic Waves:** Vector Calculus : Scalar and Vector Fields – Differential calculus, Del operator, Gradient, Divergence and Curl, Product rules, Second Derivative with Del operator, Laplacian operator –Line, Surface and Volume Integrals (definition), Fundamental theorem of Integral calculus qualitatively (Gradient, Divergence and Curl)	**4**
	Electromagnetic theory: Maxwell's equations, Displacement current, Maxwell's equation in matter, Electromagnetic waves: The wave equation, Sinusoidal waves, Polarization EM waves in vacuum, Monochromatic plane waves, Energy in electromagnetic waves, EM waves in conductors, Conservation laws: continuity equation, Poynting's theorem, boundary conditions, reflection and transmission at normal incidence.	**6**
Unit-3	**Wave Optics:** Wave fronts- Huygens Principle, Temporal and spatial coherence, Division of wave front and amplitude, intensity distribution in an interference pattern, Young's double slit experiment, diffraction - single slit, double slit, grating, polarization – polarisation by reflection, refraction and scattering.	**6**
Unit-4	**Modern Physics and Quantum Mechanics:** Failure of classical physics, qualitative review of relevant experiments such as blackbody radiation, photo- electric effect, Compton scattering, de Broglie matter waves and Davison-Germer experiment, Uncertainty principle, Wave packet.	**3**
	Basic postulates of quantum mechanics, Wavefunction, normalization of wave function, quantum mechanical operators, probability density, expectation value, Development of Schrödinger equation (time dependent & time independent), particle on a 1D infinite potential well, potential barrier and quantum tunnelling.	**5**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

6. Explain the fundamental concepts of **classical and quantum wave mechanics.**
7. Interpret fundamental physical laws and principles for relevant engineering applications.
8. Apply principles of physics to solve numerical problems in **classical and quantum wave mechanics**.
9. Analyze various physical phenomena using appropriate concepts such as superposition, wave-particle duality, polarization, and quantization.
10. Evaluate the validity and limitations of theories in waves, electromagnetism, and quantum physics through comparison with experimental observations.

Text Books/ Reference Books:

7. Vibration and waves, A. P. French, CBS Publishers
8. Introduction to Electrodynamics, D. J. Griffiths, *Pearson*
9. *Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles*, Resnick and Eisberg, John Wiley & Sons
10. Quantum Mechanics, D. J. Griffiths, Cambridge University Press
11. Principles of Optics, Max Born and Emil Wolf, Cambridge University Press
12. Optics, Ajoy Ghatak, ata Mcgraw-Hill Publishing Company

CS11001

Programming and Data Structure **L-T-P-C**

B.Tech (CE, CSE and ME) 2-0-2-3

First Semester (Professional Core)

Prerequisites: Nil

		Hours
Unit-1	**Introduction:** Basic operations of digital computers, basic concepts of integer and floating point number representation, algorithm and efficiency.	**4**
Unit-2	**(Elements of C Programming)**: Data types, variables, operators, expression and assignment statements, conditional and branch statements, Loops and iteration statements, 1-d arrays, functions and parameter passing, recursions, Strings, pointers and structures, dynamic memory allocations.	**12**
Unit-3	**(Linear Data Structures): 2-d arrays, linked lists, stacks, and queues.**	**10**
Unit-4	**(Searching and Sorting):** Linear and binary search, bubble sort, insertion sort, merge sort, quick sort.	**8**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Learn the syntax and semantics of C programming language.
2. Test and execute the programs and correct syntax and logical errors.
3. Implement conditional branching, iteration and recursion.
4. Use basic data-structures (arrays, link lists, stacks, and queues) to formulate algorithms and programs.
5. Understand and analyse different searching sorting techniques.

Text Books/ Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.
5. Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, W. H. Freeman and Company.
6. R. G. Dromey, How to Solve it by Computer, Prentice-Hall of India.

HS11001/11002	**English for Technical Communication** Ist / IInd Semester (Professional Core)	L-T-P-C 2-0-2-3

	Course Content	**Hour**
Unit 1	**Organizational Communication:** Introduction to the Course Importance and Relevance of the Course Why Communicative English? What is Communication? Barrier to Communication Non-verbal/Oral/(In)Formal Communication	6
Unit II	**Reading Comprehension** **Ignited mind** (Two Chapters) by APJ Abdul Kalam Essay: **Religion of the forest** by Rabindranath Tagore Essay: **Is Google Making Us Stupid?** by Nicholas Carr **The Story of My Sanskrit** (A chapter) by Kumud Pawde	**8**
Unit III	**Written Communication:** Letter Writing Cover Letter CV/Resume Writing Précis writing Essay Writing Report Writing Email Etiquettes Idioms and Phrases One Word Substitution Technical Communication Documentation and Minutes of Meeting Debate	**12**
Unit IV	**Oral Communication:** Job interviews (Process, stages in job interviews, types of interviews, preparation, use of verbal and non-verbal cues, mock interview sessions) Group Discussion (Features, uses-recruitment, selection, stages, positive and negative roles, organizational GD's (Brain Storming, Normal Group techniques, Delphi Technique)) Pictorial Essays.	**6**

Course Outcomes:

6. Students will recall the content and make inferences on organizational communication setup
7. Students will be able to read faster and comprehend better
8. Students will be able to express their ideas and thoughts clearly and systematically in the form of essays and reports
9. Students will be able to conduct short meetings with the skill to draft simple and short minutes of the meeting.
10. Students will demonstrate the ability to face the employment selection and answer interview questions, and they will be able to participate in group discussions confidently and assertively

Reference Books:

7. Barun K. Mitra & Basundhara Mitra, *Personality Development and Soft Skills.* Oxford University Press, 2024.

8. Meenakshi Raman & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press, 2015. https://d.docs.live.net/0af95281db477321/Desktop/question%20papers%20NITS/Technical%20Communication.pdf

9. Michael Swan. *Practical English Usage*. Oxford University Press, 2016.

10. Nilanjana Gupta. *English for All*. Macmillan Publishers India Ltd, 2011.

11. S. Miglani & S. Goyal. *English for Professionals- A Practical Book of Communication Skills in English*. Vayu Education of India, 2010.

12. Sanjay Kumar & Pushp Lata. *Communication Skills*. Oxford University Press, 2015.

ME11003	Fundamentals of Mechanical Engineering	L-T-P-C
	B.Tech (Mechanical Engg.)	3-0-0-3
	First Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	**Introduction to Mechanical Engineering:** Basic areas and concepts of Mechanical Engineering, Role of mechanical engineers in industries and society.	**6**
Unit-2	**Thermal Science & Its Applications:** Thermodynamic systems and processes; Temperature and Zeroth law of thermodynamics; Thermodynamic concept of energy; Modes of work and heat transfer; Statements of zeroth, first, second and third law of thermodynamics and their applications; Fluid properties.	**8**
Unit-3	**Design Elements in Mechanical Engineering :** Mechanical Properties, Stress and strain, elastic constants, thermal stresses, beams; mechanisms and linkages, degree of freedom, cam, gear, gyroscope; Introduction to machine elements: riveted and welded joints, shafts and coupling, rolling and sliding contact bearings, pressure vessel.	**6**
Unit-4	**Materials & Manufacturing :** Engineering materials, classification of materials, engineering applications of materials, material properties, selection of materials. Introduction to manufacturing, the need for manufacturing, the basics of various manufacturing processes: casting, welding, forming, machining, etc., selection of manufacturing processes, and application to industries.	**8**
Unit-5	**Recent Trends in Mechanical Engineering :** Basics of additive manufacturing, micro and nano fabrication, Mechatronics, microelectromechanical systems (MEMS), robotics and automation, CAD CAM, CIM, and smart manufacturing.	**6**
	Total	**34**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Define the role of mechanical engineers towards industry and society.
2. Explain various topics in thermal engineering.
3. Interpret design ideas in mechanical engineering.
4. Identify various manufacturing processes and correlate it with different engineering materials.
5. Infer about various recent developments in mechanical engineering.

Text Books/ Reference Books:

1. Shigley, Joseph, Charles Mischke, and Richard Budynas. Mechanical Engineering Design. Boston, MA: McGraw-Hill, 2003. ISBN: 9780072921939.
2. Norton, Robert L. Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines. Boston, MA: McGraw-Hill, 2007. ISBN: 9780073290980.
3. Oberg, Erik, Franklin D. Jones, Holbrook L. Horton, and Henry H. Ryffel. Machinery's Handbook. 28th ed. New York, NY: Industrial Press, 2008. ISBN: 9780831128005.
4. Shackelford James, Introduction to Material Science for Engineers, Pearson, 8th Edition, 2014, ISBN: 9780133826654
5. Hajra Choudhury S. K. , Hajra Choudhury A. K. Roy N. Elements of Workshop Technology: Vol.1 & 2, Media Promoters, 2008, ISBN: 978-8185099149
6. Kalpakjian Serope, Schimid Steven R, Manufacturing Engineering and Technology, Pearson Education, 7th Edition, 2018, ISBN: 9789332587908

7. Ghosh Amitava, Mallik Ahsok Kumar, Manufacturing Science, Affiliated East West Press, New Delhi, 2nd Edition, 1985, ISBN: 9788176710633
8. Erian A. Baskharone, Thermal Science: Essentials of Thermodynamics, Fluid Mechanics, and Heat Transfer, 1st Edition, 2012, McGraw-Hill Companies, ISBN: 9780071772341
9. C. Boegnakke and R. E. Sonntag. Fundamentals of Thermodynamics: 10th Edition, 2022, Wiley ISBN 978-93-5464-221-0
10. S. K. Som, G. Biswas and S. Chakraborty. Introduction to Fluid Mechanics and Machines. 3rd Edition, 2012, McGraw Hill Higher Education, ISBN 978-0-07-132919-4.

CE12001	Computer Aided Drawing and Graphics	L-T-P-C
	B.Tech (CE, CSE and ME)	1-0-2-2
	First Semester (Professional Core)	

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction to Engineering Drawing:** Importance and application in engineering, general instruction regarding instruments, dimensions and lettering, types of lines, concept of scales, geometrical constructions.	**9**
Unit-2	**Orthographic Projections:** Introduction to orthographic projections, elements and angles of projections, projection of points, projection of straight lines, projection of planes, conversion of pictorial views of objects into orthographic projections.	**6**
Unit-3	**Projections of Solids:** Orthographic projection of regular solids: Cubes, prisms, pyramids, cylinders, cones, tetrahedrons. Projections of frustum of solids.	**6**
Unit-4	**Isometric View:** Principles of isometric view, isometric view of simple objects, conversion of orthographic projections into isometric views.	**3**
Unit-5	**Introduction to CAD:** Introduction to CAD and advantage of CAD in engineering field, windows and system of AutoCAD, drawing area, command line, model space, layout space and work space. Drawing settings - Unit and limits, pan and zoom. Drafting settings - Grid, object snap, ortho on/off.	**3**
Unit-6	**Drafting Tools in CAD:** Tools and short commands for line, polyline, circle, polygon, arc, rectangle, ellipse, elliptical arc, hatch, spline, construction line, multiline, multiline style, point. Isometric drawing in AutoCAD.	**3**
Unit-7	**Modifying Tools in CAD:** Tools and short commands for move, rotate, trim, extend, copy, mirror, fillet, chamfer, erase, explode, offset, lengthen, edit polyline (fill on/off), edit hatch, edit array, edit multiline, align, break, point break and join. Object properties – Properties of windows, colour, linetype, linetype scale, line weight and match properties.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

9. Produce geometric constructions with appropriate scale and dimension.
10. Apply the skill for preparing detail 2D drawing of engineering objects.
11. Visualize and develop the 3D view of engineering objects.
12. Create basic 2D drawings using AutoCAD software.

Text Books/Reference Books:

9. Bhatt, N. D., Engineering Drawing: Plane and Solid Geometry, 54th Edition, Charotar Publishing House Pvt. Limited, 2023.
10. Venugopal, K., and Prabhu Raja, V., Engineering Drawing and Graphics + AutoCAD, 6th Edition, New Age International, New Delhi, 2022.
11. Narayana, K. L., and Kannaiah, P., Text book on Engineering Drawing, 2nd Edition, Scitech Publishers, 2011.
12. Gopalakrishna, K. R., and Gopalakrishna, S., Textbook of Computer Aided Engineering Drawing, 39th Edition, Subash Stores, Bangalore, 2017.

PH12001	Physics Laboratory	L-T-P-C
	B.Tech (CE, CSE and ME)	0-0-2-1
	First Semester (Common)	

Prerequisites: None

List of Experiments

10. To calibrate an ammeter with the help of a potentiometer.
11. To study the twist in the thin rod by statical method using Barton's horizontal apparatus and thus to determine the modulus of rigidity of the material of the rod.
12. To study the bending of a beam supported at its ends and loaded at the middle and thus to determine the Young's modulus of the material of the beam.
13. To determine the refractive index of the material of a given prism using a spectrometer.
14. To determine frequency of a transverse waves and mass per unit length of given wire by using sonometer apparatus.
15. To study the charging and discharging of a capacitor and hence to determine it's time constant.
16. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph.
17. To determine the wavelength of sodium light using single slit diffraction.
18. Comparison of two low resistances by using Meter Bridge.

Course Outcomes (COs):

After completion of the course, students will be able to

6. Apply the various experimental procedures and techniques for physics related experiments.
7. Use the different measuring devices and setups to record the data with precision.
8. Apply the underlying physical concepts/theories to obtain quantitative results.
9. Evalute and analyze the error in the experiment with respect to the standard values of physical quanties.
10. Develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.

Text Books/ Reference Books:

1. University Practical Physics, D. C. Tayal, HPH Publisher
2. B.Sc. Practical Physics, Samir Kumar Ghosh, New Central Book Agency

Numerical and Mathematical Methods for Differential Equations

MA11002

B. Tech. (For CE, CSE and ME)

Second Semester (Professional Core)

L -T-P- C

3- 0 - 0 - 3

Pre-requisites*: Linear Algebra and Calculus.*

	Course Content	**Hours**
Unit-1	**Ordinary Differential Equation:** Exact differential equation of first order, integrating factors. Second & higher order linear differential equations with constant coefficients, Homogeneous (Cauchy's) linear differential equation, Method of variation of parameters.	**8**
Unit-2	**Partial Differential Equation:** Formation of partial differential equations (PDE), Solution of PDE by direct integration, Lagrange's linear equation & its solution, Non-linear PDE of first order, Charpit's method of solution, Homogeneous and Non-homogeneous linear equations with constant coefficients. Second-order PDE with constant coefficients, solution by the method of separation of variables.	**9**
Unit-3	**Laplace and Fourier Transform:** Basic idea of Integral Transform, Laplace and inverse Laplace transforms & their properties, Convolution Theorem, Solution of ODE by Laplace transform method. Periodic functions, Fourier series representation of a function, half-range series, and the Fourier integral formula. Fourier Transform, Fourier sine and cosine transforms. Linearity, scaling, frequency shifting, and time shifting properties. Convolution theorem.	**10**
Unit-4	**Numerical Analysis:** Finite difference, Interpolation: Newton's forward and backward interpolation formulae, Lagrange's formula. Solution of algebraic and transcendental equations: Fixed point Iteration method, Bisection, Secant, Newton-Raphson Method. Solution of a system of linear equations by Iterative Methods: Gauss-Jacobi's method & Gauss-Seidel method. Solution of ODE: Picard's method, Taylor series method, and Runge-Kutta method (Fourth order).	**9**
		Total: 36

Course Outcomes:

On completion of this course

5. The students will be able to apply ordinary differential equations in engineering and real-life problems.
6. The students will be capable of applying partial differential equations in engineering and real-life problems.
7. The students will be able to apply the Laplace/Fourier transform in engineering problems.

8. The students will be able to apply numerical techniques in engineering problems.

Course Objectives:

5. To enable the students to understand the basic ideas of ordinary differential equations and their solutions, and also the application of series in solving ordinary linear differential equations.
6. To enable the students to understand the basic ideas of partial differential equations and their solutions, and also the applications in IVP & BVP.
7. To enable the students to solve ODE/PDE by using Laplace and Fourier transforms.
8. To enable students to clear their basic concept of solutions of algebraic/transcendental equations and ODE by numerical techniques.

Text Books:

3. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
4. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2017

Reference Books:

5. M.D. Raisinghania, Ordinary and Partial Differential Equations, S.Chand & Company Ltd, 2020.
6. G.F. Simmons, Differential Equations, Tata McGraw-Hill, 2nd edition, 2017.
7. M. K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical Method for Scientific and Engineering Computation, 2022.
8. S. Sreenadh, Fourier Series and Integral Transforms, S. Chand Publication, 2014.

CY11002	Engineering Chemistry	L-T-P-C
	B.Tech (CE, CSE and ME)	3-0-0-3
	Second Semester	

Prerequisites: None

	Course Content	Hours
Unit-1	**Polymer & Composite materials:** Classification of polymers, methods of polymerization, thermosetting and thermoplastic polymers, conducting and biodegradable polymers, synthesis, properties and applications of polyethylene, chloropolyvinyl chloride (CPVC), Composite materials: Classification and basic requirement of composite materials, applications.	**6**
Unit-2	**Fuel & Petroleum:** Fuel: Introduction, classification of fuel, calorific value (HCV and LCV), determination of calorific value by bomb calorimetry, bio-fuels. Petroleum, knocking, octane number and cetane number, petrochemical.	**6**
Unit-3	**Nanomaterials & Green Chemistry:** Nanomaterials: Introduction; synthesis, characterization and applications of nanomaterials. Principles and application of Green Chemistry.	**6**
Unit-4	**Electrochemistry & Corrosion:** Electrode potentials and its relevance to oxidation and reduction, types of electrodes, galvanic cell, measurement of EMF and application of EMF, types of reference electrodes, determination of pH. Dry Cells, lead acid cell and Fuel Cells: Construction, reaction, advantages and applications. Corrosion: Types of corrosion, factors affecting corrosion and corrosion control.	**6**
Unit-5	**Water & its treatment:** Sources of impurities in water; hardness in water and its disadvantages; boiler scale and its prevention; caustic embrittlement; boiler corrosion: treatment of water at industrial and domestic level; biological oxygen demand (BOD) and chemical oxygen demand (COD) and their significance.	**6**
Unit-6	**Spectroscopy:** Basics of spectroscopy, electromagnetic spectrum, Basic principles of IR, UV-Visible and NMR spectroscopy, Application of IR, UV-Visible and NMR spectroscopy in structure elucidation and material characterization.	**6**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

5. Explain the properties and applications of polymers, composites, petroleum-based fuels for engineering and industrial use.
6. Apply the concepts of nanomaterials and green chemistry in the development of sustainable engineering solutions.
7. Analyze electrochemical processes and corrosion mechanisms to propose suitable mitigation techniques.
8. Assess water quality and treatment methods, and interpret spectroscopic data for material analysis.

Text Books/ Reference Books:

6. Jain, P.C., and Jain, M., Engineering Chemistry (2025), Dhanpat Rai Publishing Company
7. Chawla, S., Engineering Chemistry (2019), Dhanpat Rai Publishing Company
8. Glasstone, S., Physical Chemistry (1948), McMillan India
9. Dey, A. K., Environmental Chemistry (2003), New Age International
10. Rao, C. N. R., Müller A., Cheetham, A. K. (Editor), The Chemistry of Nanomaterials Synthesis, Properties and Applications, Chemistry of Nanomaterials (2004) (Wiley-VCH)

ME11002	Engineering Mechanics	L-T-P-C
	B.Tech (CE,CSE and ME)	2-1-0-3
	Second Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	Equivalent Force System, Equilibrium of Rigid Bodies, Law of Coulomb friction: Applications of dry friction in wedge and belt.	**9**
Unit-2	Equilibrium of simple plane trusses. Analysis of trusses by the method of joints and method of section. Principle of virtual work, Simple applications of Principle of virtual work for rigid bodies in static equilibrium.	**9**
Unit-3	Centroid of simple and composite plane figures. Pappus theorem and its applications. Area moment of inertia of simple and composite figures, Perpendicular axis theorem. Parallel axis theorem, Polar moment of inertia.	**6**
Unit-4	*Kinematics of particles:* Rectilinear motion of particles, plane curvilinear motion of particles in different coordinate systems, constrained motion of connected particles. *Plane kinematics of rigid bodies:* Translation of a rigid body in plane motion, rotation of rigid bodies about a fixed axis. *Kinetics of particles:* Applications of Newton's laws of motion, D'Alembert's principle, Principle of work-energy and Impulse-momentum in particle dynamics, Direct central impact and oblique central impact. *Plane kinetics of rigid bodies:* Equation of plane motion of a rigid body, Principle of work-energy in plane motion of a rigid body.	**12**
	Total	**36**

Course Outcomes (COs):

Upon the completion of this course, the students are expected

11. To build a fundamental understanding of static equilibrium in particles, rigid bodies, and friction, and apply it to solve related engineering problems.
12. To develop the ability to analyze simple plane trusses and apply the principle of virtual work to systems in static equilibrium.
13. To apply the theorem of Pappus. Parallel axis theorem and Perpendicular axis theorem.
14. To apply the concept of centroid and moment of inertia in analyzing the simple and composite figures.
15. To develop the ability to apply for solving the practical problems on kinematics and kinetics of motion of particles and rigid bodies.

Text Books:

11. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Statics, John Wiley & Sons, Inc; 3/e.
12. J. L. Meriam & L.G. Kraige. Engineering Mechanics -Dynamics, John Wiley & Sons, Inc; 3/e.
13. F. P. Beer, Jr., E. R. Johnston, E. R. Eisenberg, P. J. Cornwell, D. Mazurek. Vector Mechanics for Engineers- Statics & Dynamics, McGraw-Hill Higher Education; 9/e.
14. 1. H. Shames, Engineering Mechanics - Statics and Dynamics, 4lh edition, Prentice-Hall of India.
15. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati. Engineering Mechanics, McGraw Hill Education; 5/e.

Reference Books:

5. S. Timoshenko, D.H. Young, Engineering Mechanics, 4th edition, McGraw- Hill.
6. R.C. Hibbeler. Engineering Mechanics - Statics & Dynamics, Pearson Education, 4/e.

EE11002	Electrical and Electronics Science	L-T-P-C
	B.Tech (CE, CSE and ME)	3-0-0-3
	Second Semester (Professional Core)	

Prerequisites: Nil

	Course Content	Hours
Unit-1	Electrical safety: Definition, precautions D.C. Circuit & Networks: KVL and KCL, Superposition Theorem, Thevenin's and Norton's Theorems, Maximum power transfer theorem	**4**
Unit-2	A.C. Circuit: A.C. Fundamentals, phasor representation and algebra, Series R-L, R-C and R-L-C circuits, power calculations in A.C. circuit, phasor diagrams. Balanced Star-Delta connections, phase and line currents and voltages and their relations	**6**
Unit-3	Measuring instruments: Ammeter, voltmeter, wattmeter, energy meter – types & connection, concepts of grounding and earthing	**3**
Unit-4	Electrical Machines: D.C machine fundamentals and Transformer (Brief construction, types, working principle, voltage equation and application), 3-phase induction motor (Brief construction, principle, types, applications).	**5**
Unit-5	Introduction to Electronic devices, **Diode:** Basic structure and operating principle, **Diode Applications:** rectifier circuits (half-wave and full-wave rectifier), voltage regulator using Zener diode, clipper circuits, clamper circuits	**5**
Unit-6	**BJT:** Basic structure, operation of transistor in active and saturation mode, DC analysis. **MOSFET:** Introduction to MOSFET Operation and characteristics.	**5**
Unit-7	**Operational Amplifier (Op-Amp):** Ideal op-amp, inverting amplifier, non-inverting configuration, transfer characteristics, op-amp applications like difference amplifier, summing amplifier, integrator, and differentiator.	**3**
Unit -8	**Basic Digital Electronics:** Logic gates, Boolean algebra, De-Morgan's theorem, K-Map, combinational circuits like adder, multiplexer, and demultiplexer.	**5**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

5. Understand the basic structure and operating principle of electronics devices and analyse DC and AC networks.
6. Measure different electrical quantities in simple 1-phase and 3-phase circuits.
7. Classify the electrical machines and the electronics devices; explain their working principles, characteristics and applications.
8. Design and implement simple analog and digital electronic circuits.

Text Books/ Reference Books:

5 Gupta, J. B., *Basic Electrical Engineering*, S. K. Kataria & Sons.
6 Husain, A., and Ashfaq, H., *Basic Electrical Engineering*, Dhanpat Rai & Co.
7 Nashelsky, L., and Boylestad, R., *Electronic Devices and Circuit Theory*, 10th Edition, Pearson India.
8 Kumar, A. Anand, *Fundamentals of Digital Circuits*, 4th Edition, PHI.

ME11004	Engineering Thermodynamics	L-T-P-C
	B.Tech (Mechanical Engg.)	3-0-0-3
	Second Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	**Introduction :** Concepts and Applications of Thermodynamics; Systems and Control Volumes; Processes and Cycles; Temperature and the Zeroth law of Thermodynamics	**3**
Unit-2	**Properties of Pure Substance**; Phase-Change Processes; Property Diagrams; Property Tables; Ideal-Gas Equation of State, Behavior of Real Gases.	**3**
Unit-3	**First Law of Thermodynamics :** First law referred to cyclic and non-cyclic processes, concept of internal energy of a system, conservation of energy for simple compressible closed systems; Definitions of enthalpy and specific heats; Conservation of energy for a control volume (or open system), steady and transient processes.	**6**
Unit-4	**Second Law of Thermodynamics:** Directional constraints on natural processes; Statements of Second law of Thermodynamics and their equivalence, Heat Engines; Refrigerators and Heat Pumps; Reversible and Irreversible Processes; Carnot Cycle and Carnot Principles; Absolute thermodynamic temperature scale; Carnot Heat Engine; Carnot Refrigerators and Heat Pumps; Clausius inequality, Entropy, increase of entropy principle, change in entropy in various thermodynamic processes, Tds relations, Entropy balance for closed and open systems, Entropy principle, Entropy generation, and concept of Third law of Thermodynamics; Entropy change of liquids and solids, Isentropic efficiencies of steady-flow devices.	**8**
Unit-5	**Exergy:** Work Potential of Energy; Reversible Work and Irreversibility; Second-law Efficiency; Exergy change of a System; Exergy Transfer by Heat, Work and Mass, Decrease of Exergy Principle and Exergy Destruction. exergy Destruction.	**6**
Unit-6	**Thermodynamic Property Relations:** Maxwell relations; Clausius-Clapeyron equation; Difference in heat capacities; Ratio of heat capacities; Joule Thompson coefficient.	**8**
	Total	**34**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Calculate properties of pure substances and analyze behaviour of ideal and real gases.
2. Apply first law of thermodynamics to various closed and open systems.
3. Apply second law of thermodynamics to closed and open systems to calculate specified parameters such as work, heat transfer, or entropy.
4. Calculate exergy destruction for various processes carried out on various thermal devices.
5. Develop fundamental relations between commonly encountered thermodynamic properties and express the properties that cannot be measured directly in terms of easily measurable properties.
6. Identify and formulate elementary level engineering problems related to thermodynamics and energy transformation in a conceptual form as well as in terms of mathematical/physical models.

Text Books/ Reference Books:

1. Cengel and Boles. Thermodynamics: An Engineering Approach, 7/e. Tata McGraw Hill.
2. Moran, Shappiro, Boettner and Bailey. Principles of Engineering Thermodynamics, 8e. Wiley.
3. P.K. Nag. Engineering Thermodynamics, 5/e. McGraw Hill.
4. Boegnakke and Sonntag. Fundamentals of Thermodynamics: 10e. Wiley.
5. Rogers and Mayhew. Engineering Thermodynamics, 4e. Pearson Education.

ME12002	Workshop Practice	L-T-P-C
	B.Tech. (CE, CSE and ME)	0-0-3-1
	Second Semester (Professional Core)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	General safety precautions in workshop and introduction.	**3**
Unit-2	**Carpentry Shop:** Safety precaution, Kinds of wood and timber, Application of timber as per their classification, Carpentry hand tools and machines, Different types of carpentry joint, Demonstration of wood working machine like, band saw, circular saw, thickness planner, wood working lathe, surface planners, etc.	**6**
Unit-3	**Welding Shop:** Safety precaution in welding shop, Introduction to gas and arc welding, Soldering and brazing etc. Welding equipment and welding material.	**6**
Unit-4	**Fitting Shop:** Safety precaution, Introduction to fitting shop tools, equipment, Operation and their uses, Marking and measuring practice.	**6**
Unit-5	**Machine Shop:** Safety precautions, Demonstration and working principles of some of the general machines, like lathe, shaper, milling, drilling, grinding, slotting etc., General idea of cutting tools of the machines.	**6**
	Total	**27**

Course Outcomes (COs):

After completion of the course, students will be able to

7. Know the importance of general safety precautions on different shop floors.
8. Identify the basics of tools and equipments used in fitting, carpentry, sheet metal, machine, welding and smithy.
9. Do fabrication of wooden joints and understand joining of metals.
10. Make metal joints and sheet metal work.
11. Understand the basics of removal of material from work piece surface to attain specific shape.
12. Familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.

Text Books/ Reference Books:

3. S K Hajra Choudhury, A K Hajra Choudhury, N. Roy. Workshop Technology Vol I & II, Media Promoters & Publishers Pvt. Ltd; 9/e.
4. H S Bawa. Workshop Practice, McGraw Hill Education; 2nd edition, 2/e.

EE12002	Electrical and Electronics Science Laboratory	L-T-P-C
	B.Tech (CE, CSE and ME)	0-0-2-1
	Second Semester (Professional Core)	

Prerequisites: Nil

Sl. No.	Experiments
1	Verification of Thevenin's and Norton's Theorems in a DC circuit.
2	Verification of Superposition Theorem in DC circuits.
3	Measurement of power in single phase AC circuit using three ammeter method
4	Measurement of three phase power in an AC circuit with star and delta connected variable loads.
5	Familiarization with the components and instruments.
6	Design of a clipper and clamper circuits (both positive and negative)
7	Plot the VI characteristics of a PN junction diode and Zener diode and compare their difference
8	Implement Boolean functions using logic gates.
9	Design of circuits using operational amplifier

Course Outcomes (COs):

After completion of the course, students will be able to

1. Develop practical skills using electrical and electronic components and measuring equipment.
2. Demonstrate and justify results of Network theorems in DC circuits.
3. Compute and verify power consumptions for single and three phase loads.
4. Understand the characteristics of various electronics devices.
5. Design and analyze simple analog and digital circuits.

CY12002	Chemistry Laboratory	L-T-P-C
	B.Tech (CE, CSE and ME)	0-0-2-1
	Second Semester	

Prerequisites: None

List of Experiments:

Experiment 1: To determine the total hardness of pond water/ supplied water using the standard EDTA solution
Experiment 2: Estimation of magnesium from the supplied solution using standard EDTA
Experiment 3: Estimation of calcium from the supplied solution using standard EDTA
Experiment 4: Determination of dissolved oxygen (DO) of lake water
Experiment 5: Determination of total alkalinity of supplied aqueous solution.
Experiment 6: To determine the strength of the $KMnO_4$ solution using a standard oxalic acid solution
Experiment 7: To determine the amount of Fe(II) present in the supplied solution using the standard $KMnO_4$ solution
Experiment 8: To determine the amount of Fe(III) present in the supplied solution using the standard $K_2Cr_2O_7$
Experiment 9: Quantitative determination of Copper (II) using standard HYPO ($Na_2S_2O_3$) solution
Experiment 10: Estimation of calcium in milk powder using standard EDTA solution
Experiment 11. Detection of special elements in supplied organic compounds.
Experiment 12: Determination of functional groups in the supplied organic compounds
Experiment 13: Preparation of Copper (II) glycinato complex
Experiment 14: Determination of the relative viscosity of the given organic compound by Ostwald Viscometer
Experiment 15: Determination of the surface tension of the given organic compound by the stalagmometer

Course Outcomes (COs): After completion of the course, students will be able to

1. Know about the methods for the determination of water quality parameters. They can assess the quality of water for drinking purposes, etc., by performing experiments such as determining total hardness, Ca^{2+}, Mg^{2+}, total alkalinity, and dissolved oxygen.
2. Determine presence of Fe^{3+}, Fe^{2+}, Cu^{2+} ions in water
3. Determine the physical properties of liquids by performing experiments, such as viscosity. They will also be able to determine the viscosity of the lubricating oil. The generated knowledge can be used for industrial product development, like detergent formulation.
4. Determine the surface tension of liquids
5. Synthesise coordination complexes of biologically important transition metal ions.
6. To perform the chemical reactions to find out different elements, functional groups or nonmetals present in the organic compounds. This will also help them to understand the role of different functional groups in chemical reactivity.

Text Books/ Reference Books:

1. Das, S. C., Advanced Practical Chemistry (2024), The World Press Private Limited
2. Laboratory Manual, Dept. of Chemistry, NIT Silchar

MA21001

Applied Mathematical Analysis and Statistics
B.Tech.(For CE,CSE,ME)
Third Semester (Professional Core)

L -T-P- C
3- 0 - 0 - 3

Prerequisites: Ordinary & Partial differentiation, Elementary integration, Vector operations.

	Course Content	Hours
Unit-1	**Vector Integral Calculus:** Line integral, Double integral, Surface integral, Triple integral, Green's theorem, Stokes' theorem and Gauss Divergence theorem and their applications.	**10**
Unit-2	**Complex Analysis:** Limit, continuity, differentiability and analyticity of functions, Cauchy-Riemann equations, line integrals in complex plane, Cauchy's integral theorem, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integrals.	**10**
Unit-3	**Probability & Statistics:** Introduction to probability, Additive & multiplicative Laws of probability, Conditional probability, Independent events, Baye's theorem, Random variable, Probability mass function, Probability density function, Cumulative distribution function, Binomial, Poisson & Normal distributions. Curve fitting: Fitting of straight lines & parabolas by the method of least squares. Correlation & Regression analysis: Coefficient of correlation, Coefficient of regression, Lines of regression.	**12**
Unit-4	**Stochastic Process:** Definition of Stochastic process, Classification and properties of stochastic processes, Simple Markovian stochastic processes, Gaussian processes, Stationary processes.	**6**
	Total	**38**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply concepts of Vector Calculus to solve multivariable integration and field problems.
2. Analyze complex functions using methods of Complex Analysis.
3. Use techniques of Probability and Statistics for data analysis and uncertainty modelling.
4. Model random systems using Stochastic Processes and related probabilistic methods.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India Pvt. Ltd., 2015.
2. B.S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publisher, 2017.
3. J. Ravichandran, Probability and Statistics for Engineers. Wiley India Pvt. Ltd., New Delhi, 2010.
4. A. Papoulis, S. U. Pillai, Probability Random Variables and Stochastic Processes, CBS Publishers and Distributors Pvt. Ltd, 2025.

Reference Books:

1. M.D. Raisinghania, Vector Analysis, S.Chand & Company Ltd, 2020.
2. S. Lipschutz and J. J. Schiller, Complex Variables, Schaum's Outline series, 2009.
3. S. Lipschutz and J. J. Schiller. Introduction to Probability and Statistics. Schaum's Outline Series, 2011.
4. Sheldon M. Ross, Stochastic Processes, Wiley, 2008.

HS21001/21002	Engineering Economics	L-T-P-C
	IIIrd / IVth Semester (Professional Core)	3-0-0-3

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction:** Definition and scope of Economics; Engineering Economics and the role of engineers in economic decision-making; Theory of Consumer Behaviour: Cardinal and Ordinal Utility analysis.	**4**
Unit-2	**Demand Analysis:** Demand: meaning, law, determinants; Supply: meaning, law, determinants; Market equilibrium and price determination; Elasticity of demand; Demand Forecasting techniques.	**4**
Unit-3	**Theory of Cost and Production:** Meaning and classification of costs; Short-run cost concepts; Fixed cost; Variable cost; Total, average, and marginal cost; Long-run cost curves; Law of Variable Proportion and Returns to scale.	**3**
Unit 4:	**Theory of Product Pricing:** Market Structure: Perfect Competition-Characteristics; Price Determination; Monopoly- Characteristics, Price and Output Determination.	**6**
Unit 5	**National Income Determination**: Concepts and Measurement of National Income; Components of National Income; Methods of National Income Calculation; Problems in Measuring National Income.	**3**
Unit 6	**Macroeconomic issues and International Market:** Unemployment: Definition, types, and causes; Inflation: types, causes, and social costs of inflation; Business Cycle; Schumpeter theory of innovation.	**6**
Unit-7	**Project Evaluation and Management:** Meaning of Project Cycle, Project selection and planning; Project Appraisal; Means of financing and financial appraisal tools; Qualitative Methods for Project Evaluation, Social Cost Benefit Analysis; Externalities and environmental concerns.	**6**
	Total	**32**

Course Outcomes (COs):

After completion of the course, students will be able to

1. To introduce economic principles relevant to engineering decision-making
2. To analyse consumer behaviour, cost functions and producer behaviour for Engineering Decisions
3. To understand national income and macroeconomic issues
4. To apply project evaluation techniques and social and environmental cost-benefit analysis

Text Books/ Reference Books:

1. H. G. Thuesen, W. J. Fabrycky, and G. J. Thuesen (1993), Engineering Economy, Prentice Hall International.
2. F. C. Jelen (1970), Cost and Optimisation Engineering, McGraw-Hill Book Co., New York.
3. Hal R. Varian. Intermediate Microeconomics, 8th Edition, W. W. Norton and Company.
4. N. Gregory Mankiw. Principles of Microeconomics. Cengage Learning
5. N. Gregory Mankiw, Ronald D. Kneebone, Kenneth J McKenzie (2023). Principles of Macroeconomics, 9th Edition. Cengage Canada.
6. Salvatore, D. International Economics (11th ed.). John Wiley & Sons.

ME21001	Engineering Materials	L-T-P-C
	B.Tech (Mechanical Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites: PH-11001, ME-11003

	Course Content	Hours
Unit-1	**Introduction:** Classification of materials, Atomic structure, Atomic bonding in solids, Crystal structure, Crystal systems, Crystallographic directions, Miller-Bravais scheme, Polycrystalline Materials.	**6**
Unit-2	**Imperfections in Solids:** Crystal defects, Critical nucleus size and Critical free energy, Nucleation and growth, Strengthening mechanisms, Recovery-recrystallization and grain growth.	**6**
Unit-3	**Phase Diagrams:** Gibbs phase rule, Binary phase diagram, Iron-carbon phase diagram, Phase transformations in metals, Kinetics of phase transformations, Isothermal transformation (TTT) diagrams, CCT diagram, Heat treatments, Surface hardening, Hardenability.	**8**
Unit-4	**Testing and Failures of materials:** Concepts of stress-strain, Interpretation of tensile stress-strain curves, Tensile properties, Hardness, Fracture, Fracture mechanics, Ductile-to-brittle transition, Fatigue, Creep, Stress and temperature effects.	**8**
Unit-5	**Polymers and Composite:** Polymer types and Polymer synthesis & processing, crystallization, Mechanical behavior of polymers, Mechanisms of deformation and strengthening of polymers, Characteristics and typical applications, Particle-reinforced composites, Fiber-reinforced composites, Structural composites, Economic, Environmental and social issues of material usage.	**8**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Explain the atomic structure and crystal arrangement in metals and alloys.
2. Interpret phase diagrams and analyse the effects of heat treatment processes on material properties.
3. Evaluate mechanical properties and identify common failure modes of engineering materials.
4. Perform standard material testing methods and analyse experimental results.
5. Examine structure–property relationships and processing effects in polymers and composite materials.

Text Books/ Reference Books:

1. Sidney H Avner, Introduction to Physical Metallurgy, McGraw Hill Education – 2nd edition, ISBN978-0074630068, 2017
2. George E Dieter, Mechanical Metallurgy, McGraw Hill Education – 3rd edition, ISBN- 978-1259064791, 2017.
3. Callister. Material Science and Engineering. John Wiley & Sons. Inc.
4. Askeland & Fulay. The Science and Engineering of Materials. Nelson Engineering,
5. A.V.K. Suriyanarayana, Testing of metallic materials, BS Publications, ISBN- 978-8178001340, 2007.

ME21003	Mechanics of Solids	L-T-P-C
	B.Tech (Mechanical Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites: Nil

	Course Content	Hours
Unit-1	Principal Stresses, strain, plane; Mohr's Circle; Transformation of stress and strain in a plane. Strain energy, Concept of stress and strain tensor, generalized Hooke's law; Different types of failure theories for ductile and brittle material.	**7**
Unit-2	Theory of bending, Theory of torsion, Application of theory bending and torsion in different sections; Relationship between rate of loading, Shear Force and Bending Moment; SF and BM diagrams for different types of Beam.	**10**
Unit-3	Relationship among curvature, slope and deflections, slope and deflection for different types of beam with application of different types of theories.	**7**
Unit-4	Derivation and solution of differential equations of equilibrium, stresses produced by shrink fit, compound cylinders.	**7**
Unit-5	Definition, basic structures, Euler's Equation and Rankine's formula. Winkler Back theory. Application of different theories in beams.	**6**
	Total	**37**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Understand, comprehend and analyze stresses, strains and its transformation, stress-strain relations for linearly elastic members using theories of failures.
2. Analyze mechanical structures using Shear force and bending moment.
3. Determine and analyze the deflection of beams, combined stresses, torsion for engineering problems.
4. Understand and analyse thick cylinders, columns and struts, and the basics of fracture mechanics.

Text Books/ Reference Books:

1. Timoshenko and Gere, Mechanics of Materials, 4th Edition, CBS Publishers.
2. E.P.Popov, Engineering Mechanics of Solids, 2nd Edition, Pearson.
3. S. B. Junarkar, Mechanics of Structures, Vol. 2, Charotar Publishers.
4. S. S. Rattan. Strength of Material. 3rd Edition, McGraw-Hill.
5. Pytel & Singer, Strength of Materials, 4th Edition, Harper & Row Publishers.
6. L.S Srinath, Advanced Mechanics of Solids, 3rd Edition, McGraw-Hill Education.
7. Beer and Johnston, Mechanics of Materials, 7th Edition, McGraw-Hill India Pvt. Ltd.
8. NPTEL Course on 'Strength of Materials' by Prof. Ramesh K and Prof Hariprasad. nptel.ac.in/courses/112106319;
9. NPTEL Course on 'Strength of Materials' by Prof. MS Sivakumar -nptel.ac.in/courses/112106141
10. NPTEL Course on 'Mechanics of Solids' by Prof. Priyanka Ghosh: nptel.ac.in/courses/105104160

ME21005	Fluid Mechanics	L-T-P-C
	B.Tech (Mechanical Engg.)	3-0-0-3
	Third Semester (Professional Core)	

Prerequisites: Nil

	Course Content	Hours
Unit-1	**Introduction**: Fluids and continuum, Properties of fluids, Pressure and stress tensor, Classification of fluids	**4**
Unit-2	**Fluid Statics:** Hydrostatic Pressure, Pressure variation in a static fluid, Pressure measurement, Forces on submerged surfaces, Buoyancy and stability, Fluids under rigid body motion	**6**
Unit-3	**Fluid Kinematics**: Lagrangian and Eulerian description, Types of fluid flow, streamline, streakline and pathline, Velocity field, Acceleration in fluid flow, Deformation of fluid elements, rotation and vorticity, Continuity equation, Stream function and velocity potential	**6**
Unit-4	**Fluid Dynamics**: Euler equation, Bernoulli's equation and its applications; Reynolds transport theorem - conservation of mass, linear and angular momentum, Stokes law of viscosity and Navier-Stokes equations - some exact solutions Internal flows - pipe flow, friction factor, Moody's diagram, minor and major losses, pipe networks	**16**
Unit-5	**Dimensional analysis**: Fundamental concepts, Buckingham π-Theorem, Model analysis and similarity	**4**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Identify fundamental fluid properties and statics principles.
2. Understand fluid kinematics, dynamics, and flow regimes.
3. Apply fluid flow principles inflow measurement devices and pipe systems
4. Analyze forces, losses, and applications of momentum and energy equations.
5. Evaluate relevant fluid flow problems.

Text Books/ Reference Books:

1. S.K. Som, G. Biswas and S. Chakraborty. Introduction to Fluid Mechanics and Fluid Machines. Tata McGraw Hill
2. Cengel and Cimbala, Fluid Mechanics. Tata McGraw Hill.
3. R.W. Fox, P.J. Pritchard and A. T. McDonald. Introduction to Fluid Mechanics. Wiley
4. Frank M. White. Fluid Mechanics. McGraw Hill.
5. James E. A. John and William L. Haberman. Introduction to Fluid Mechanics. Prentice Hall.

ME21007	Applied Thermal Engineering	L-T-P-C
	B.Tech (Mechanical Engg.)	4-0-0-4
	Third Semester (Professional Core)	

Prerequisites: Engineering Thermodynamics

	Course Content	Hours
Unit-1	**Air Standard Cycles**: Ideal cycle, hot gas engine cycles, Otto, Diesel and dual cycles, Brayton cycle and its performance improvement techniques, aircraft engines.	**14**
Unit-2	**Fuels & Combustion:** Different types of IC engine fuels and their characteristics, Combustion in SI and CI Engines, Air Fuel ratio, Fuel thermochemistry, Engine emission	**4**
Unit-3	**Vapour Power cycle:** Ideal and actual vapour power cycles, Reheat, Regenerative, and intercooling cycle, and Cogeneration and Combined cycle.	**8**
Unit-4	**Nozzles and Steam Turbines**: Types and Shapes of nozzles, Isentropic and non-isentropic flow through nozzles, Choking of Nozzles. Impulse and reaction steam turbines, velocity diagrams and performance	**8**
Unit-5	**Reciprocating Compressors:** Single stage and multistage air compressors, Performance characteristics and improvement measures, different efficiency metrics; Surging and stalling, slip.	**5**
Unit-6	**Refrigeration & Air-conditioning systems:** Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic air conditioning processes.	**9**
	Total	**48**

Course Outcomes (COs):

After completion of the course, students will be able to

Text Books/ Reference Books:

1. Cengel and Boles. Thermodynamics: An Engineering Approach, 7/e. Tata McGraw Hill.
2. Moran, Shappiro, Boettner and Bailey. Principles of Engineering Thermodynamics, 8/e. Wiley

1. P.K. Nag. Engineering Thermodynamics, 5/e. McGraw Hill
2. Boegnakke and Sonntag. Fundamentals of Thermodynamics: 7e. Wiley
3. Rogers and Mayhew. Engineering Thermodynamics, 4e. Pearson Education

ME22001	Thermo-Fluid Lab-I	L-T-P-C
	B.Tech (Mechanical Engg.)	0-0-3-1.5
	Third Semester (Professional Core)	

	Name of Experiment	Hours
Exp-1	Verification of Bernoulli's Theorem.	**3**
Exp-2	Calibration of Different Flow Meters.	**3**
Exp-3	Determination of the Coefficient of Discharge for Rectangular and V-Notches.	**3**
Exp-4	Determination of Metacentric Height of a Floating Body.	**3**
Exp-5	Determination of Various Losses in Pipe Flow.	**3**
Exp-6	Calibration of Thermocouple.	**3**
Exp-7	Estimation of air-fuel ratio in a 4-Stroke Diesel/Petrol Engine.	**2**
Exp-8	Determination of Volumetric Efficiency of a Two-stage Reciprocating Air Compressor.	**2**
Exp-9	Determination of Viscosity of Liquids.	**2**
	Total	**24**

**** No of experiments may vary**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Correlate Bernoulli's theorem with its practical implications and validation.
2. Understand and calibrate flow and temperature measurement devices, and analyse their performance characteristics.
3. Correlate theoretical knowledge on pipe losses, equilibrium of floating bodies, viscosity and estimation of metacentric height.
4. Understand and analyse the working principles and performance parameters of IC engines and reciprocating air compressors.

ME22003	Machine Drawing Lab	L-T-P-C
	B.Tech (Mechanical Engg.)	0-0-3-1.5
	Third Semester (Professional Core)	

Pre-Requisites: Engineering Drawing / Engineering Graphics

	Name of Experiment	Hours
Exp-1	Orthographic projection of machine components (first-angle projection) on drawing sheet with proper dimensioning.	**2**
Exp-2	Sectional views (full, half and offset sections) of simple machine parts on drawing sheet.	**2**
Exp-3	Detailed drawing of standard machine elements (bolt, nut, key, shaft coupling) on drawing sheet.	**2**
Exp-4	Assembly drawing from given part details with bill of materials (BOM) on drawing sheet.	**2**
Exp-5	Introduction to AutoCAD/CATIA/SolidWorks: 2D drafting commands, layers, dimensioning and plotting.	**2**
Exp-6	Creation of detailed 2D part drawings with tolerances and surface finish symbols using CAD software.	**2**
Exp-7	3D solid modeling of simple machine components (shaft, flange, bracket) using solid modeling software.	**2**
Exp-8	Assembly modeling of multiple components and generation of exploded view.	**2**
Exp-9	Generation of orthographic views and sectional views from 3D models.	**2**
Exp-10	Preparation of assembly drawing with automatic Bill of Materials (BOM) using CAD software.	**2**
Exp-11	Modeling and drafting of a machine element assembly (e.g., coupling or bearing housing) using CAD software.	**2**
Exp-12	Complete modeling, assembly and production drawing generation of a small mechanical system using CAD software.	**2**
	Total	**24**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply engineering drawing standards and conventions in preparing working drawings.
2. Prepare orthographic and sectional drawings of machine components.
3. Develop assembly drawings with bill of materials (BOM).
4. Create 2D drafting and 3D solid models using CAD software (AutoCAD/CATIA/ SolidWorks).
5. Generate production-ready drawings from 3D models with tolerances and surface finish symbols.

Text Books/ Reference Books:

1. N. D. Bhatt and V. M. Panchal, Machine Drawing, 48th ed. Anand, India: Charotar Publishing House Pvt. Ltd., 2019.
2. K. L. Narayana, P. Kannaiah, and K. Venkata Reddy, Machine Drawing, 3rd ed. New Delhi, India: New Age International (P) Ltd., 2017.
3. P. S. Gill, Machine Drawing, Rev. ed. New Delhi, India: S. K. Kataria & Sons, 2012.
4. Bureau of Indian Standards, IS 696: Engineering Drawing Practice and relevant IS/ISO standards on dimensioning and tolerancing. New Delhi, India: BIS.

5. International Organization for Standardization, ISO 128: Technical Drawings — General Principles of Presentation and related ISO standards.

Online Resources:

1. NPTEL, “Engineering Drawing and Computer Graphics,” IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc21_me125/preview
2. NPTEL, “Engineering Graphics and Design,” IIT Delhi. https://onlinecourses.nptel.ac.in/noc21_me128/preview
3. NPTEL, “Engineering Drawing,” IIT Guwahati. https://nptel.ac.in/courses/112103019
4. NPTEL/SWAYAM, “Computer Aided Design and Manufacturing (CAD/CAM).” https://onlinecourses.swayam2.ac.in/nou25_me10/preview
5. Autodesk, “AutoCAD Learning Resources.” https://www.autodesk.com/learning
6. Dassault Systèmes, “SOLIDWORKS Training.” https://www.solidworks.com/sw/learning.htm
7. Dassault Systèmes, “CATIA Resources.” https://www.3ds.com/products-services/catia/resources/

ME22005	Soft Skill Development	L-T-P-C
	B.Tech (Mechanical Engg.)	0-0-3-1
	Third Semester (Professional Lab)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	Communication Skills	**3**
Unit-2	Spoken English and Accent Neutralization Skills	**3**
Unit-3	Public Speaking and Presentation Skills	**3**
Unit-4	Interpersonal Skills	**3**
Unit-5	Group Discussion and Teamwork skills	**3**
Unit-6	Leadership development Skills	**3**
Unit-7	Interview and Employability Skills	**3**
Unit-8	Business Etiquette Skills	**3**
Unit-9	Career Readiness	**4**
Unit-10	Comprehensive Laboratory Assessment	**4**
	Total	**32**

Course Outcomes (COs):

After completion of the course, students will be able to possess the requisite soft skills to become a successful professional.

Text Books/ Reference Books: N/A

ME22007	Do-It-Yourself Lab	L-T-P-C
	B.Tech (Mechanical Engg.)	0-0-3-1.5
	Third Semester (Professional Lab)	

Prerequisites: N/A

	Course Content	Hours
Unit-1	Introduction & Safety Orientation	**3**
Unit-2	Mechanical Do-it-Yourself (DIY) Fabrication	**3**
Unit-3	Robotics & Automation Projects	**3**
Unit-4	Arduino-Based Projects	**3**
Unit-5	IoT and Smart Systems (Advanced DIY)	**3**
Unit-6	Engineering Problem-Solving Projects	**6**
Unit-7	Documentation & Presentation	**6**
Unit-8	Final DIY Project (Pinnacle)	**6**
	Total	**33**

Course Outcomes (COs):

After completion of the course, students will be able to possess the requisite skills to practice and implement engineering know-hows in solving real life problems.

Text Books/ Reference Books: N/A

CE21001/21002	Environmental Science	L-T-P-C
	3rd / 4th Semester (Professional Core)	2-0-0-2

Prerequisites: None

	Course Content	Hours
Unit-1	**Introduction and Natural Resources:** Environment, Definition, scope and importance, multidisciplinary nature of environmental studies, Forest Resources –use and over-exploitation of forests, deforestation, water, mineral, land, food resource and energy resources	**5**
Unit-2	**Ecosystem and Biodiversity:** Ecosystem-Concept of an ecosystem, structure and function of an ecosystem, Food chain, food webs and ecological pyramids, Energy flow in ecosystem producers and consumers Ecological Succession, Biodiversity and its Conservation – introduction, definition, genetic species and ecosystem diversity, value of biodiversity, hotspots of biodiversity, threats to biodiversity- habitat loss, poaching of wildlife conflicts, endangered and endemic species in India, conservation of biodiversity	**6**
Unit-3	**Environmental Pollution:** Causes, effects and control measures of air pollution, scales of defining pollutants, various air pollution control equipment, water pollution, wastewater management, primary, secondary and tertiary treatment techniques, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear radiation hazards, Solid waste management, sources of solid waste effects and control measures of urban industrial wastes, hierarchies of solid waste management techniques	**9**
Unit-4	**Environment and society:** Role of an individual prevention of pollution, consumerism and waste products, unsustainable to sustainable development, Environmental Laws, Environmental Impact Assessment, issue involved in enforcement of environmental legalizations, Environment and human health, epidemics, Women and child welfare, Role of information technology in environment and human health.	**4**
	Total	**24**

Course Outcomes (COs):

After completion of the course, students will be able to

13. Understand scope of environmental science and brief knowledge about natural resources
14. Realize the importance of ecosystem and biodiversity in growth of human civilization.
15. Understand the effects of environmental pollution and different strategies to mitigate it
16. Understand various environmental laws and societal issues related to the environment for the benefit of the community

Text Books/ Reference Books:

16. Henry J.G. and Heinke G.W. ***Environmental Science and Engineering.*** Prentice Hall of India. New Delhi.
17. Chandrasekhar M. ***Environmental Science.*** Hi-Tech Publishers.
18. Masters G.M. ***Environmental Engineering and Science.*** Prentice Hall of India, New Delhi.
19. Garg S.K. and Garg R. ***Ecological and Environmental Studies.*** Khanna Publishers, Delhi.
20. Chawla S. ***Environmental Studies.*** Tata McGraw-Hill Publishers, New Delhi.

ME21002	**Mechanisms and Machines** B.Tech (Mechanical Engg.) **Fourth** Semester (Professional Core)	**L-T-P-C** 3-1-0-4

Prerequisites: ME21002 (Engineering Mechanics), ME 11003 (Fundamentals of Mechanical Engineering), MA21001 (Mathematics-III)

	Course Content	**Hours**
Unit-1	**Introduction and Force Analysis:** Basics of Mechanisms, Inversions of four-bar, single slider-crank, and double slider-crank chains, Static Force Analysis: Equilibrium of members under two, three, and four forces; free body diagrams, Velocity and Acceleration Analysis: Graphical Methods, Instantaneous Centre Method. Detailed study of the Coriolis component of acceleration in mechanisms. Dynamic Force Analysis: D'Alembert's Principle, inertia forces, and analysis of the slider-crank mechanism). Balancing: Static and dynamic force diagram, Inertia forces and their balancing for rotating and reciprocating machines, Identification of inertia forces for reciprocating masses in engine mechanisms, Partial primary balance of single cylinder engines and uncontrolled locomotives, Balancing of multi cylinder in line engines, V- twin engines, Radial engines – direct and reverse crank methods.	**9**
Unit-2	**Flywheel Dynamics:** Fluctuation Analysis: Definition and calculation of fluctuation of energy (maximum difference in kinetic energy) and fluctuation of speed (difference between max and min angular velocity), Flywheel Function: Role of the flywheel in stabilizing engine speed; calculating the coefficient of fluctuation of speed and the coefficient of steadiness. Turning Moment Diagram for single-cylinder, double-acting steam engines, four-stroke IC engines, and multi-cylinder engines, calculating work done per cycle and mean torque from these diagrams. Gyroscope: Gyroscopic Principles, Analyzing the gyroscopic effects on the stability and maneuvering of aircraft, naval ships and automobiles. (steering, pitching, rolling)	**9**
Unit-3	**Cam and Follower:** Classification of followers and cams, motion of the follower, displacement, velocity and acceleration diagrams, construction of cam profiles.	**5**
Unit-4	**Gears:** Friction wheels, gear drives and classifications, gear terminology, law of gearing, velocity of sliding of teeth, forms of teeth: cycloidal and involute, centre distance, length of path of contact, length of arc of contact, contact ratio, interference in involute gears, minimum number of teeth on the pinion, minimum number of teeth on the wheel, minimum number of teeth on a pinion for involute rack in order to avoid interference, spur gears, helical gears, spiral gears.	**6**
Unit-5	**Gear Trains:** Introduction, types of gear trains, simple gear train, compound gear train, design of spur gears, reverted gear train, epicyclic gear train, velocity ratio of epicyclic gear train, compound epicyclic gear train (sun and planet wheel), epicyclic gear train with bevel gears, torques in epicyclic gear trains, analytical and tabular method for solving the problems on gear trains.	**4**
Unit-6	**Fundamental of Vibration:**Free Vibrations: Undamped and damped free vibrations of Single and Multi-Degree of Freedom systems; determining natural frequency, Whirling of Shafts: Critical speeds of shafts with and without damping.	**6**
	Total	**39**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Analyze the given machine/mechanism for their type and mobility and balancing.
2. Determine the velocity and acceleration of links in the mechanism using graphical and analytical methods.
3. Students will comprehend the concepts and applications for the dynamics of rigid body, engine flywheel, cam and follower analysis and will be able to solve related problems.

4. Learn to formulate the equations for kinematic and dynamic analysis of gear and gear trains for a given gear arrangement.
5. To learn basic aspects of vibration with deriving governing equations – free and forced vibrations.

Text Books/ Reference Books:

1. Rattan, S. S., (2009). Theory of Machines 3rd Edition Tata McGraw Hill Publication.
2. Ghosh, A. & Mallik, A. K., (2009), Theory of Mechanisms, and Machines, 3rd Edition, East West Press.
3. Uicker, J. J., Pennock, G. R. & Shigley, J. E., (2009), Theory of Machines and Mechanisms,3rd Edition, Oxford University Press.
4. Rao, J. S., & Dukkipati, R.V., (2007) Mechanism & Machine Theory, New Age International Publication.
5. Norton, R. L., (2009), Kinematics and Dynamics of Machinery, Tata McGraw Hill.
6. Myszka David H., (2012), Machines and Mechanisms, Fourth Edition, Pearson Education, Inc., publishing as Prentice Hall, One Lake Street, Upper Saddle River, New Jersey.

Online Resources:

1. NPTEL Theory of machine and Machine Dynamics (IITs)
2. SWAYAM Theory of machine and Machine Dynamics

ME21004	Mechatronics	L-T-P-C
	B.Tech (Mechanical Engg.)	3-0-0-3
	Fourth Semester (Professional Core)	

Prerequisites: ME11001

	Course Content	Hours
Unit-1	**Introduction to mechatronics:** Introduction, examples of mechatronic systems, electric circuits and components, review of fundamentals of electronics and its applications, number systems: binary, hexadecimal and overview of mechatronics systems in CNC machines and industrial robots.	**3**
Unit-2	**Mechatronics elements:** Sensors and transducers, displacement, position & proximity sensors, force, fluid pressure, liquid flow sensors, temperature, light sensor, acceleration and, performance terminology of sensors, semiconductor sensors and micro-electromechanical systems (MEMS).	**6**
Unit-3	**Mechanical measurement:** Introduction to instruments and its characteristics, motion, force and torque measurement, temperature measurement, pressure measurement, vibration measurement	**5**
Unit-4	**Signal conditioning:** Introduction to signal processing, op-amp as a signal conditioner, analogue to digital converter, and digital to analogue converter.	**3**
Unit-5	**Actuators, drives, and mechanisms:** Stepper motors, actuators, motor sizing, power transmission: gears and belt drives; ball screws, linear motion bearings, and cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, and transfer systems, torque, speed, and power equations, efficiency, and inertia.	**5**
Unit-6	**Hydraulic and pneumatic system:** Flow, pressure, direction control valves, actuators, and supporting elements, hydraulic power packs, pumps, and design of hydraulic circuits, pneumatic system production, distribution and conditioning of compressed air, system components and graphic representations, design of systems.	**6**
Unit-7	**Modelling and system response:** Mechanical, electrical, fluid system modelling, dynamic response, transfer function and frequency response.	**4**
Unit-8	**Microprocessors, microcontrollers, and Closed-loop controllers:** Digital circuits, microprocessors, microcontrollers, programming of microcontrollers, P, I, PID controllers, digital controllers, program logic controllers, input/output & communication systems, fault finding.	**4**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Identify different mechatronics elements and systems
2. Design instrument and perform measurement of mechanical parameters
3. Select suitable signal conditioning techniques and microprocessor based systems
4. Analyse various actuators, drives, mechanisms and mechatronics systems
5. Perform modelling and analysis of various industrial systems

Text Books/ Reference Books:

1. Bolton, William. Mechatronics: electronic control systems in mechanical and electrical engineering. Pearson Education
2. Nakra, B. C., and Choudhury, K. K., Instrumentation, Measurement and Analysis, TMH
3. Mahalik, Nitaigour Premchand. Mechatronics. Tata McGraw-Hill.
4. Bishop, Robert H. Mechatronics: an introduction. CRC Press.
5. Shetty, D., and Kolk, R. A., Mechatronics system design, Cengage Learning.
6. R. Iserman, Mechatronic Systems: Fundamentals, Springer.
7. Musa Jouaneh, Fundamentals of Mechatronics, Cengage Learning.

ME21006	Casting and Joining Processes	L-T-P-C
	B.Tech (Mechanical Engg.)	3-0-0-3
	Fourth Semester (Professional Core)	

Prerequisites: ME11001

	Course Content	Hours
Unit-1	**Fundamentals of casting and moulding:** Classification of casting processes; steps involved in the casting process; foundry terminologies; foundry furnaces; patterns and allowances; moulding sand; moulds and moulding processes, solidification of metals and alloys.	**6**
Unit-2	**Gating system:** Gating system and its design; melting and pouring practices; Chvorinov's rule; shrinkage and solidification behaviour.	**6**
Unit-3	**Casting defects, inspection, and special processes:** Casting defects—classification, causes, and prevention; inspection of castings; non-destructive testing; special casting processes.	**6**
Unit-4	**Fundamentals of joining:** Introduction and classification of joining technologies, Nomenclature and symbol of welding joints, Power sources in welding.	**6**
Unit-5	**Various joining processes:** Physics and principle of joining processes, different types of joining methods and their details, advanced joining and welding processes.	**8**
Unit-6	**Welding defects and inspection:** Various types of welding defects, causes and remedies, inspection techniques for welding defect identification.	**4**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Select appropriate casting processes, mould materials, patterns, and core systems.
2. Design and optimise gating and riser systems.
3. Analyse casting defects and apply non-destructive testing methods.
4. Select suitable welding processes and process parameters for different materials and joint configurations.
5. Evaluate weld quality, identify defects, and propose corrective measures to ensure the structural integrity and service performance of welded joints.

Text Books/ Reference Books:

1. Fundamentals of Modern Manufacturing: Materials, Processes, and Systems – Mikell P. Groover, John Wiley & Sons.
2. Manufacturing Engineering and Technology – Serope Kalpakjian and Stephen Schmid, SI Edition, Pearson / Digital Designs
3. Manufacturing Technology, Vol. 1 – P. N. Rao, Tata McGraw-Hill Education.
4. Manufacturing Science – Amitabha Ghosh and Asok Kumar Mallik, Ellis Horwood.
5. Welding Engineering: An Introduction – David H. Phillips, John Wiley & Sons Inc.
6. Welding and Welding Technology – Richard L. Little, McGraw-Hill.
7. Principles of Welding: Processes, Physics, Chemistry, and Metallurgy – Robert W. Messler Jr., Wiley.

ME21008	Forming Technology	L-T-P-C
	B.Tech (Mechanical Engg.)	2-0-0-2
	Fourth Semester (Professional Core)	

Prerequisites: ME11001

	Course Content	Hours
Unit-1	Introduction of metal forming as a manufacturing process, and its relation with other processes, Metal Forming from a systems point of view, Advantages of metal forming as a manufacturing process, Classifications of metal forming processes, Forming equipment, Presses (mechanical, hydraulic, pneumatic).	**4**
Unit-2	Theoretical analysis (theory of plasticity), Material incompressibility, Work of plastic deformation, Work hardening, Yield criteria and flow rules, Forming limit diagrams, Failure mechanisms, Formability tests.	**4**
Unit-3	Forging; open-die forging, closed-die forging, coining, nosing, upsetting, heading, extrusion and tooling, wire, rod and tube drawing, Rolling; flat rolling, shape rolling and tooling, Sheet forming; blanking, piercing, press bending, deep drawing, stretch forming, spinning, hydroforming, rubber-pad forming, Specialized forming operations: High energy rate forming.	**12**
Unit-4	Powdered metals and fabrication procedures, Preparation of powders, Compacting and sintering, Cold isostatic pressing and Hot isostatic pressing, Industrial applications & challenges.	**4**
	Total	**24**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Classify the various metal forming processes and apply the appropriate process for required engineering applications.
2. Apply theories of plasticity and flow rules to analyse deformation behaviour and predict material response under forming conditions.
3. Apply the mechanism of plastic deformation for metals and alloys to convert them into useful shapes for intended engineering applications.
4. Integrate knowledge of powder metallurgy and advanced forming techniques to provide a successful solution to industrial manufacturing challenges.

Text Books/ Reference Books:

1. Principles of Industrial Metal working Processes by G.W. Rowe.
2. Technology of Metal Forming Processes by S. Kumar.
3. Mechanical Metallurgy by G.E. Dieter.
4. Metal Forming: Mechanics and Metallurgy by W.F. Hosford and R.M. Caddell.
5. Metal Forming Handbook (Schuler GmbH)

ME21010	Applied Fluid Mechanics & Machineries	L-T-P-C
	B.Tech (Mechanical Engg.)	3-0-0-3
	Fourth Semester (Professional Core)	

Prerequisites: Fluid Mechanics

	Course Content	Hours
Unit-1	**Ideal Fluid Flows:** Elementary flows, Superposition of elementary flows.	**4**
Unit-2	**Boundary Layer Theory:** Boundary layer growth over a flat plate, Boundary layer thickness: displacement, momentum and energy thicknesses, Prandtl's boundary layer equations, Von Kármán momentum integral equation, Boundary layer separation and form drag, Methods of drag reduction, Lift and drag on submerged bodies and aerofoils, Stalling of aerofoils.	**6**
Unit-3	**Turbulent Flow:** Nature and characteristics of turbulence, Reynolds decomposition and time-averaged flow quantities, Reynolds-averaged Navier–Stokes (RANS) equations, Closure problem of turbulence, Mixing length concept and eddy viscosity, Velocity distribution in turbulent boundary layers and pipe flow.	**4**
Unit-4	**Compressible Flow:** Basic concepts of compressible flow and thermodynamic relations, Compressibility effects and isentropic flow relations, One-dimensional compressible flow, Flow through nozzles and diffusers, Choked flow and critical conditions.	**4**
Unit-5	**Fluid Machines:** Euler equation for turbomachines, velocity triangles, Hydraulic turbines – impulse and reaction turbines, cavitation, centrifugal and axial flow pumps, Air compressors, fans and blowers.	**18**
	Total	**36**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Identify concepts of ideal flow, boundary layer, turbulence, compressible flow, and fluid machinery.
2. Understand flow behaviour in boundary layers, turbulent and compressible flows.
3. Analyze ideal, viscous, turbulent, and compressible flow systems.
4. Apply fluid flow principles in turbomachinery and compressible flow devices.
5. Evaluate performance parameter of fluid flow systems

Text Books/ Reference Books:

1. S.K. Som, G. Biswas and S. Chakraborty. Introduction to Fluid Mechanics and Fluid Machines. Tata McGraw Hill
2. Cengel and Cimbala, Fluid Mechanics. Tata McGraw Hill.
3. R.W. Fox, P.J. Pritchard and A. T. McDonald. Introduction to Fluid Mechanics. Wiley
4. Frank M. White. Fluid Mechanics. McGraw Hill.
5. G.K. Batchelor. An Introduction to Fluid Dynamics. Cambridge University Press.
6. James E. A. John and William L. Haberman. Introduction to Fluid Mechanics. Prentice Hall.

ME22002	**Dynamics of Machines and Control Lab**	L-T-P-C
	B.Tech (Mechanical Engg.)	0-0-3-1.5
	Fourth Semester (Professional Core)	

Pre-Requisites: Theory of Machines, Dynamics of Machines and Control

	Name of Experiment	**Hours**
Exp-1	Study of mechanism models (four-bar, slider-crank) and verification of kinematic relations.	**2**
Exp-2	Determination of the mass moment of inertia of a flywheel or a compound pendulum.	**2**
Exp-3	Static and dynamic balancing of rotating masses using a balancing apparatus.	**2**
Exp-4	Study of gyroscopic effect and measurement of gyroscopic couple.	**2**
Exp-5	Study of governor characteristics (Watt/Porter/Hartnell governor).	**2**
Exp-6	Whirling of the shaft experiment and determination of critical speed.	**2**
Exp-7	Cam profile analysis and follower motion study.	**3**
Exp-8	Experiment on single degree of freedom (SDOF) vibration system to determine natural frequency and damping ratio.	**3**
Exp-9	Determination of transmissibility and resonance in forced vibration setup.	**3**
Exp-10	Simulation Assignment: Experimental validation or MATLAB-based dynamic response comparison.	**3**
	Total	**24**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Demonstrate practical understanding of mechanisms and machine dynamics experiments.
2. Perform experiments related to balancing, gyroscopic motion and governor characteristics.
3. Analyze vibration response and determine dynamic parameters experimentally.
4. Use instrumentation and data acquisition systems for dynamic testing and validation.
5. Demonstrate practical understanding of mechanisms and machine dynamics experiments.

Text Books/ Reference Books:

1. S. S. Rattan, Theory of Machines, 3rd ed. New Delhi, India: Tata McGraw-Hill Education, 2014.
2. S. S. Rao, Mechanical Vibrations, 6th ed. Noida, India: Pearson Education, 2017
3. Dynamics of Machines Laboratory Manual (Institute specific).
4. Equipment user manuals for balancing machine, gyroscope, governor and vibration apparatus.

Online Resources:

1. National Programme on Technology Enhanced Learning, "Dynamics of Machines," offered by Indian Institute of Technology Kharagpur / Indian Institute of Technology Bombay, NPTEL Online Courses.
2. Indian Institute of Technology Guwahati, "Mechanical Vibrations," NPTEL Online Courses. Available: nptel.ac.in/courses/112103111
3. National Programme on Technology Enhanced Learning (NPTEL), "Control Engineering," offered by Indian Institute of Technology Kharagpur. Available: https://nptel.ac.in/
4. MathWorks, "MATLAB Onramp," MATLAB Academy. Available: https://matlabacademy.mathworks.com/details/matlab-onramp/gettingstarted
5. MathWorks, "Simulink Onramp," MATLAB Academy. Available: https://matlabacademy.mathworks.com/details/simulink-onramp/simulink

ME22004	Material Testing Lab	L-T-P-C
	B.Tech (Mechanical Engg.)	0-0-2-1
	Fourth Semester (Professional Core)	

Pre-Requisites: PH 11001, ME 11001, ME 21001

	Name of Experiment	Hours
Exp-1	Study of heat treatment of mild steel	**1.5**
Exp-2	Brinell hardness testing of bare mild steel, fast quenched mild steel, annealed mild steel and normalized mild steel	**1.5**
Exp-3	Rockwell hardness testing of bare mild steel, fast quenched mild steel, annealed mild steel and normalized mild steel	**1.5**
Exp-4	Tensile test of bare mild steel	**1.5**
Exp-5	Tensile test of Annealed mild steel	**1.5**
Exp-6	Tensile test of Normalized mild steel	**1.5**
Exp-7	Tensile test of fast quenched mild steel	**1.5**
Exp-8	Compression test of polymer specimen	**1.5**
Exp-9	Flexural test of polymer specimen	**1.5**
Exp-10	Charpy and IZOD impact test of mild steel specimen	**1.5**
Exp-11	Metallographic investigation of bare mild steel	**1.5**
Exp-12	Metallographic investigation of Annealed mild steel	**1.5**
Exp-13	Metallographic investigation of Normalized mild steel	**1.5**
Exp-14	Metallographic investigation of fast quenched mild steel	**1.5**
Exp-15	Bending Fatigue Test on mild steel rod	**1.5**
Exp-16	Torsion Test on mild steel rod	**1.5**
	Total	**24**

**** No of experiments may vary**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Perform standard mechanical testing procedures and interpret the results as per relevant standards.
2. Conduct heat treatment experiments and evaluate their effects on mechanical properties and microstructure.
3. Prepare metallographic specimens, examine microstructures, and correlate structural features with mechanical behaviour.
4. Analyse experimental data using appropriate tools and prepare structured technical reports demonstrating structure–property relationships.
5. Select and justify suitable material testing and characterization techniques based on material type, service requirements, and performance criteria.

ME22006	Manufacturing Lab	L-T-P-C
	B.Tech (Mechanical Engg.)	0-0-2-1
	Fourth Semester (Professional Core)	

Pre-Requisites: ME11001, ME21006

	Name of Experiment	Hours
Exp-1	Introduction to furnaces for melting iron and aluminium.	**2**
Exp-2	Moulding sand preparation using manual methods and sand muller.	**2**
Exp-3	Permeability test of moulding sand using a permeability meter.	**2**
Exp-4	Grain fineness test of moulding sand.	**2**
Exp-5	Moisture content test of moulding sand using a rapid moisture tester.	**2**
Exp-6	Clay content test of moulding sand using a clay washer.	**2**
Exp-7	Testing of moulding sand strength: compressive, tensile, and shear strength (green and dry).	**2**
Exp-8	Mould making, casting, and post-casting operations.	**2**
Exp-9	Introduction to welding equipment and safety precautions in the welding laboratory.	**2**
Exp-10	Preparation of joints and welding using TIG/MIG/SAW processes.	**2**
Exp-11	Fabrication of welded joints using Friction Stir Welding (FSW).	**2**
Exp-12	Surface preparation, etching techniques, heat treatment, and metallographic studies.	**2**
	Total	**24**

**** No of experiments may vary**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Design patterns, gating, runner and riser systems for metal casting processes
2. Prepare moulds, produce cast components, and evaluate casting quality using appropriate testing methods.
3. Perform arc and solid-state welding processes following safety standards and select suitable welding techniques based on material and application requirements.
4. Fabricate components using appropriate welding processes.
5. Prepare metallographic specimens and examine microstructural characteristics of metals and alloys, correlating them with mechanical and physical properties.

ME22008	**Thermo-Fluid Lab-II**	**L-T-P-C**
	B.Tech (Mechanical Engg.)	0-0-3-1.5
	Fourth Semester (Professional Core)	

	Name of Experiment	**Hours**
Exp-1	Performance Characterization of Wind Tunnel Using Pitot Static Probe and Multichannel Manometric System.	**3**
Exp-2	Determination of Boundary Layer Thickness in Flow Over a Flat Plate.	**3**
Exp-3	Determination of Aerodynamic Parameter of a Circular Cylinder/Airfoil.	**3**
Exp-4	Experiment on Reynold Apparatus	**3**
Exp-5	Determination of Impact of Jet on Vanes	**2**
Exp-6	Determination of Performance Characteristics of Hydraulic Turbines	**2**
Exp-7	Determination of the Performance Characteristics of a Centrifugal Pump.	**2**
Exp-8	Determination of Performance Characteristics of a Centrifugal Blower	**2**
Exp-9	Determination of Performance Characteristics of a HAWT/VAWT.	**2**
Exp-10	Determination of Energy Conversion Losses (Mechanical to Electrical) in a Mini-hydro Turbine.	**2**
	Total	**24**

**** No of experiments may vary**

Course Outcomes (COs):

After completion of the course, students will be able to

1. Apply and analyse flow measurement techniques to correlate pressure, velocity, and flow characteristics in internal and external flows.
2. Understand and experimentally correlate boundary layer behaviour and aerodynamic parameters with theoretical predictions.
3. Analyse and compute performance characteristics of hydraulic machines and wind energy systems.
4. Understand and evaluate energy conversion processes and quantify associated mechanical and hydraulic losses.