Appendix - V (C)

Syllabus for I and II Semester BTech Degree Programme in Instrumentation and Control Engineering

offered by

Department of Instrumentation under Faculty of Technology, Cochin University of Science and Technology.

(With effect from 2024 admissions onwards)

SEMESTER 1

24-219-0101 CALCULUS

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Solve ordinary differential equations and linear differential equations of higher orders with constant coefficients and apply them to engineering problems.

CO2: Estimate the maxima and minima of multi-variable functions.

CO3: Evaluate area as double integrals and volume as triple integrals in engineering applications.

CO4: Illustrate the application and physical meaning of gradient, divergence, and curl.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-		-	1

Module 1 (16 hours, End semester marks 25%)

Ordinary differential equations:
First-order differential equations - exact differential equations, Bernoulli's equations--Methods of solution and Simple applications.

Linear differential equations of higher orders with constant co-efficient-Methods of solution of these equations. Cauchy's linear differential equations. Simultaneous linear differential equations- Simple applications of linear differential equations in engineering problems.

Module 2 (16 hours, End semester marks 25%)

Partial differentiation:
Partial differentiation-Concept of partial derivative - Chain rule, Total derivative- Euler's theorem for homogeneous functions, Differentials and their applications in errors and approximations, Jacobians - Maxima minima of functions of two variables (Proof of the result not required)-Simple applications.

Co-ordinate systems: Rectangular co-ordinates- Polar co-ordinates-In plane and in Space Cylindrical polar co-ordinates-Spherical polar co-ordinates.

Module 3 (16 hours, End semester marks 25%)

Integral calculus: Application of definite integrals: Area, Volume, Arc length, Surface area.
Multiple integrals: Evaluation of double integrals-Change of order of integration. Evaluation of triple integrals-Change of Variables in integrals.
Applications of multiple integrals. Plane Area, Surface area &Volumes of solids.

Module 4 (16 hours, End semester marks 25%)

Vector calculus: Scalar and vector point functions, gradient and directional derivative of a scalar point function, divergence and curl of vector point functions, their physical meaning. Evaluation of line integral, surface integral, and volume integrals, Gauss's divergence theorem, Stoke's theorem (No proofs), conservative force fields, scalar potential.

References:

1. Sastry, S.S. Engineering mathematics: Vol1. (Forty Fourth edition). PHI Learning, New Delhi. (2008).
2. Erwin Kreyzig. Advanced engineering mathematics (Tenth edition). John Wiley& Sons, Hoboken, NJ. (2020)
3. Veerarajan, T. Engineering mathematics. (third edition). Tata McGraw Hill Publishers, New Delhi. (2011)
4. Grewal, B.S. Higher Engineering Mathematics. (Forty Third Edition). Khanna Publishers, New Delhi. (2013).
5. Online courses from swayam (https://swayam.gov.in/), Stanford online (https://online.stanford.edu/) and MIT Open Courseware (https://ocw.mit.edu/).

24-219-0102 ENGINEERING PHYSICS

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Explain wave phenomena and interpret optical phenomena involving interference and diffraction.

CO2: Explain the polarization of light and its applications.

CO3: Understand atomic phenomena based on the principles of quantum and statistical theories.

CO4: Explain the fundamentals of acoustics and ultrasonics.

CO5: Explain crystal structure and x-ray diffraction techniques.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	1	1	-	-	-	-	1
CO5	3	3	2	-	-	-	-	-	-	-	-	1

Module 1 (16 hours, End semester marks 25%)

Waves: One dimensional wave - differential equation and solution. Three dimensional waves - differential equation and solution (no derivation) - transverse and longitudinal waves- transverse vibrations of a stretched string.

Interference of light: Analytical treatment of interference- coherent sources -derivation of expression for fringe width in in double slit experiment - white light fringes - fringe shift with thin transparent plate - interference on thin films - Newton's rings - air wedge - planeness of surfaces - anti reflection coatings.

Module 2 (16 hours, End semester marks 25%)

Diffraction of light: - Fresnel and Fraunhofer diffraction - zone plates - plane diffraction grating - measurement of wavelength - dispersive power of grating - resolving power – Raleigh's criterion - resolving power of telescope and grating.

Polarization of light: polarization by reflection - refraction - Brewster's law - double refraction

- negative and positive crystals - Nicol prism - quarter and half wave plates - production and detection of circularly and elliptically polarized lights - rotatory polarization - half shade polarimeter - applications of polarized light.

Module 3 (16 hours, End semester marks 25%)

Quantum Mechanics: wave particle duality - de Broglie's concept of matter waves - Davison & Germer experiment - uncertainty principle - postulates of quantum mechanics- formulation of time independent and time dependent Schrodinger equation - energy and momentum operators - eigen values and functions - one dimensional infinite square well potential - tunnelling (qualitative ideas only).

Statistical mechanics: macrostates and microstates - phase space - basic postulates of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics and their distribution functions (no derivation) - Fermi level and its significance.

Module 4 (16 hours, End semester marks 25%)

Acoustics: Intensity of sound - loudness - absorption coefficient - reverberation - significance of reverberation time - Sabine's formula (no derivation) - acoustics of buildings.

Ultrasonics: production of ultrasonic waves - magnetostriction and piezoelectric oscillators - detection of ultrasonics - thermal and piezoelectric methods - applications of ultrasonics - NDT and medical applications.

Crystal structure: - space lattice – unit-cell - crystal systems - lattice planes - spacing between lattice planes - Miller indices - x-ray diffraction - Bragg's law - powder diffraction method - production of x-rays- continuous and characteristic x-rays.

References:

1. Aruldas, G., Engineering Physics, PHI Ltd.
2. Beiser, A., Concepts of Modern Physics, McGraw Hill India Ltd.
3. Bhattacharya and Tandon, Engineering Physics, Oxford India.
4. Raghuvanshi, G. S., Prentice Hall of India.
5. Brijlal and Subramanyam, A Textbook of Optics, S. Chand & Co.
6. Philip J., A Textbook of Engineering Physics, Educational Publishers.
7. Vasudeva A. S., A Textbook of Engineering Physics, S. Chand& Co.
8. Kittel C., Introduction to Solid State Physics; 8th edition, Wiley, 2018.

24-219-0103 BASIC ELECTRONICS

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Understand the basics of semiconductors and operation of p-n junction devices.

CO2: Understand the working of diode circuits and their applications.

CO3: Understand the basics of bipolar junction transistors and transistor biasing.

CO4: Understand different types of field effect transistors, their working principles, and applications.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	-	1

Module 1 (15 hours, End semester marks 25%)

P-N junction diode: Semiconductors - band structure of semiconductors - intrinsic and extrinsic semiconductors - doping. Law of mass action - P-N junction - V-I characteristics - Zener diode, LEDs, photodiodes, and solar cells.

Module 2 (15 hours, End semester marks 25%)

Diode circuits: Diode as a circuit element - piecewise linear model - clipping and clamping circuits - voltage multiplier - rectifiers -half wave, full wave, and bridge circuits- voltage equations - capacitive filters- Zener diode voltage regulator.

Module 3 (15 hours, End semester marks 25%)

Bipolar Junction Transistor: Construction and principle of operation - current components, CE, CB, and CC configurations - BJT characteristics - BJT as an amplifier.

Transistor Biasing: Operating point - fixed-bias and self-bias - bias stabilization - bias compensation - thermal runaway - thermal stability.

Module 4 (15 hours, End semester marks 25%)

Field effect transistors: The junction field effect transistor - pinch-off voltage - JFET V-I characteristics - FET small signal model - MOSFET-structure and characteristics - MOSFET gate protection and CMOS - low frequency common source and common drain amplifiers - biasing the FET - FET as a voltage variable resistor (VVR) - the common-source amplifier at high frequencies - the common drain amplifier at high frequencies.

References:

1. Jacob Millman, Christos C. Halkias, and Chetan D Parikh– Integrated Electronics 2/e– Tata McGraw Hill. (2017).
2. Jacob Millman and Arvin Grabel – Microelectronics 2/e– McGraw Hill Education (2017).
3. Adel S. Sedra, Kenneth C. Smith, Arun N. Chandorkar - Microelectronic Circuits: Theory and Applications 7E (Ia) (2017)
4. Sunipa Roy, Chandan Kumar Ghosh, Sayan Dey, Abhijit Kumar Pal - Solid State & Microelectronics Technology (2023)
5. Online courses from Swayam (https://swayam.gov.in/), Stanfrd online (https://online.stanford.edu/) and MIT OpenCourseware (https://ocw.mit.edu/).

24-219-0104 ELECTRICAL ENGINEERING I

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Understand and apply the fundamental laws governing electric and magnetic fields, solve problems related to electrostatics and magnetic circuits, and explain the principles of electromagnetic induction.

CO2: Understand the fundamentals of ac voltage generation and the definition of various terms.

CO3: Define and apply various theorems for solving voltage and currents in DC circuits.

CO4: Analyze AC series and parallel circuits, as well as DC transients in R-L and R-C circuits.

CO5: Gain fundamental knowledge about three-phase power systems.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	-	-	-	-	-	-	-	-	2
CO2	3	2	2	-	-	-	-	-	-	-	-	2
CO3	3	3	2	-	-	-	-	-	-	-	-	2
CO4	3	3	2	-		-	-	-	-		-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2

Module 1 (16 Hours, End semester marks 25%)

Electrostatics: Electric charge, Coulomb's law of electrostatics, Electric field, Electric potential, capacitor, and capacitance.

Electromagnetism: Magnetic field, Biot-Savart law, Magnetic field of an infinite linear conductor, field strength due to circular loop, field strength inside a solenoid, force on current carrying conductor in a magnetic field, hysteresis.

Magnetic Circuits: Magnetomotive force, magnetic field strength, reluctance, laws of magnetic circuits, ampere-turns of magnetic circuit.

Module 2 (16 Hours, End semester marks 25%)

Electromagnetic induction: Relation between magnetism and electricity, Faraday's laws of electromagnetic induction, direction and induced emf, magnitude of induced emf in a coil, dynamically induced emf, statically induced emf.

Fundamentals of AC: generation of alternating current and Voltage, emf equation, phase, and phase difference, rms value, average value form factor, peak factor and vector diagram.

Module 3 (16 Hours, End semester marks 25%)

DC circuit theory: Kirchoff's laws, source transformation, superposition theorem, Thevenin's theorem, Norton's theorem, reciprocity theorem, substitution theorem and maximum power transfer theorems

Single-phase series ac circuits: Purely resistive, capacitive, and inductive ac circuits. R-L, R-C and R-L-C series ac circuits. Resonance, Q-actor, power, and power factor in ac series circuits.

Single-phase parallel ac circuits: R-L, R-C, L-C, L-R-C parallel ac circuits, parallel resonance, Q factor and power factor improvement.

DC transients in R-L and R-C circuits: rise and fall of current, time constant and energy stored in R-L and R-C circuits.

Module 4 (16 Hours, End semester marks 25%)

Three phase system: generation of three phase voltage, star connection and delta connection, star to delta and delta to star conversion, power in 3 phase system, and measurement of 3 phase power in balanced and unbalanced systems.

Symmetrical components: Positive sequence components, negative sequence components and zero sequence components.

Power Transmission Methods and Devices: Introduction to Power Transmission, Belt, Rope, Chain and Gear Drive. Length of belt open and crossed. Ratio of belt tensions (Elementary problems only). Different types of gears (Elementary ideas only). Types and functioning of clutches.

References:

1. John Bird - Electrical Circuit Theory and Technology (Fourth Edition) - Routledge (2010)
2. DP Kothari, I J Nagrath - Basic Electrical Engineering (4th Edition) - McGraw-Hill (2019)
3. Abhijit Chakrabarti, Sudipta Nath, Chandan Chanda - McGraw Hill Education (2017)
4. U. A. Bakshi, A. V. Bakshi - Electromagnetic Field Theory - TECHNICAL PUBLICATIONS
5. David J. Griffiths - Introduction to Electrodynamics (Fourth Edition) - Cambridge University Press (2017)
6. https://onlinecourses.nptel.ac.in/noc22_ee113/preview Fundamentals of Electrical Engineering

24-219-0105 MECHANICAL ENGINEERING

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Understand the basics of thermodynamics and the working of steam turbines.

CO2: Understand the basics of internal combustion engines, refrigeration and air conditioning.

CO3: Acquire an understanding of the operation and functioning of air compressors, power plants, and pumps.

CO4: Identify manufacturing methods encountered in engineering practice and understand the mechanism of power transmission.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	3	-	3	-	-	-	-	1	-	-

Module 1 (16 Hours, End semester marks 25%)

Thermodynamics: Thermodynamics systems – open, closed, and isolated systems, equilibrium state of a system, property and state, process, cycle, Zeroth law of thermodynamics – concept of temperature, temperature scales. First law – internal energy, enthalpy, work and heat, different processes (isobaric, isochoric, isothermal, adiabatic and polytropic processes). Second law – Kelvin-Planck and Clausius statements and their equivalence, Carnot Cycle (Elementary problems only).

Thermodynamic properties of Steam, Steam generator. Different types of boilers, boiler mountings, and accessories. Formation of steam at constant pressure, working of steam turbines, compounding of turbines.

Module 2 (16 Hours, End semester marks 25%)

Internal Combustion Engines: Air standard cycles – Otto and Diesel cycles, working of two stroke and four stroke Petrol and Diesel engines, carburetted and MPFI engines, fuel pump, fuel injector, ignition system, cooling system, lubricating system.

Refrigeration & Air-conditioning: Introduction to refrigeration and air-conditioning, rating of refrigeration machines, coefficient of performance, simple refrigeration vapour compression cycle (Elementary problems only), summer and winter air conditioning.

Module 3 (16 Hours, End semester marks 25%)

Air compressors: Reciprocating air compressors – Mechanical details – Shaft work – Multistage air compressors with intercooling – Introduction to condensers and cooling towers.

Power plants: Hydro-electric power plants, thermal power plants, nuclear power plants, diesel power plants, windmills, solar energy (working principles using schematic representations only)

Pumps: Centrifugal-Reciprocating-Classifications.

Module 4 (16 Hours, End semester marks 25%)

Introduction to Manufacturing Systems: Welding - different types of welding, resistance welding, arc welding, gas welding, brazing, and soldering, different welding defects. Casting - different casting processes, sand casting, casting defects, rolling - hot rolling and cold rolling, two high, three high, cluster rolling mills, wire drawing, forging, extrusion, heat treatment of steel, elementary ideas of annealing, hardening, normalizing, and surface hardening. Principle of CAD/CAM, Rapid and Additive manufacturing.

Power Transmission Methods and Devices: Introduction to Power Transmission, Belt, Rope, Chain and Gear Drive. Length of belt open and crossed. Ratio of belt tensions (Elementary problems only). Different types of gears (Elementary ideas only). Types and functioning of clutches.

References:

1. Nag, P.K. Engineering thermodynamics. (Fifth edition). McGraw Hill Education (India) Pvt. Ltd., New Delhi. (2015)
2. Stoecker, W.F. Refrigeration and air conditioning (Second edition). Tata McGraw Hill, New Delhi. (2014)
3. V Ganesan. Internal Combustion Engines. (4th Edition). McGraw-Hill Education. (2017)
4. Arora, C.P. Refrigeration and Air Conditioning. (Fourth edition). McGraw Hill Education (India) Pvt. Ltd. (2020)
5. Jagadish Lal. Hydraulic Machines Including Fluidics Metropolitan Book Co., New Delhi. (2016)
6. Rajendar Singh. Introduction to basic manufacturing processes and workshop technology (Third Edition), New Age International, New Delhi. (2022)
7. Radhakrishnan, P, Subramanyan S and Raju V. CAD/CAM/CIM. New Age International Pvt Ltd; Fourth edition (2018)
8. https://nptel.ac.in/courses/112105123
9. https://onlinecourses.nptel.ac.in/noc20_me42/preview

24-219-0106 SOFT SKILLS DEVELOPMENT

L	T	P	C
1	1	0	2

Pre-requisites: Nil

Total Hours: 32

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

CO1: Speak English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate.

CO2: Read, comprehend, and answer questions based on literary, scientific and technological texts.

CO3: Develop self-motivation, raised aspiration, belief in one's own abilities and commitment to achieving one's goal

CO4: Demonstrate emotional maturity and emotional health.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	2	1	-	-	3	2	-
CO2	-	-	-	-	-	2	1	-	-	3	2	-
CO3	-	-	-	-	-	2	1	-	-	3	2	3
CO4	-	-	-	-	-	2	1	-	-	3	2	2

Module 1

Role and importance of verbal communication, Everyday active vocabulary, Common words used in transitions, enhancing vocabulary, affixes and changes in pronunciation and grammatical functions, words often confused in pronunciation and usage. Passage comprehension- skimming, scanning techniques, note making, note taking and summarizing. Deciphering meaning from contexts. Two types of meaning- literal and contextual. Constructive criticism of speeches and explanations.

Module 2

Fundamental grammar, Simple structures, passivizing the active sentences, reported speech, the judicious use of tenses and moods of verbs, forming questions and conversion from questions to statements and vice versa, forming open–ended and close-ended questions. Words and style used for formal and informal communication. Practice converting informal language to formal, the diction, and the style of writing. Dealing with the nuances of ambiguous constructions in language. Learning authoritative writing skills, polite writing, and good netiquette. Writing for internships and scholarships.

Module 3

Kinesics, Proxemics, Haptics, and other areas of non-verbal communication, fighting communication barriers, positive grooming, and activities on the same. Different types of interviews, and presentations - oral, poster, PPT. Organizing ideas for group discussions, the difference between GD and debates. Effective listening and seeking to understand others' perspectives. Non-violent negotiation and persuasion, communicating across age groups, cultures, or identity groups. Higher-order thinking and evaluation, information-seeking, research, independent learning, synthesis, creativity, problem analysis, and problem-solving. Decision-making, Self-reflection, and learning from experience.

Module 4

Developing positive self: Understanding oneself, a realistic awareness of oneself and one's abilities, strengths and potential, Self-esteem, Self-efficacy, and steps for improvement. Intra-personal skills – Self-control, emotional regulation and self-discipline, conscientiousness, dutifulness, reliability, truthfulness, honesty, and trustworthiness. Goal orientation and initiative. Time management – prioritizing work. Interpersonal skills – cross-cultural competence and valuing diversity of perspectives, respecting and expressing concern for others. Empathy and ability to notice the effect of one's actions on others, tolerance for disagreement, conflict management, and resolution. Civic engagement and social responsibility – Global and local awareness (issues, challenges, priorities). Vision is the ability to imagine something new or improved. Social responsibility and willingness to take constructive action.

Assessment:

1. 'Soft Skills Development' is a practical and activity-oriented course which has a continuous assessment for 50 marks based on classroom interaction, activities, and assignments. The activities may include 'Just a Minute' (JAM) sessions, group discussion, role-play, debate, and extempore speech.

    The Marks for the different components shall be as follows:
    Classroom interaction – 10 marks
    Activities – 30 marks
    Assignments (mainly from Modules I and II) – 10 marks

2. Semester End Examination is not envisaged.
3. A student should secure a minimum of 50% marks in continuous assessment for a pass in the course.

24-219-0107 LANGUAGE LAB

L	T	P	C
1	1	0	2

Pre-requisites: Nil

Total Hours: 32

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

CO1: Test pronunciation skills through stress on word accent, intonation, and rhythm.

CO2: Use the English language effectively for writing business letters, resumes, minutes of meetings, and reports.

CO3: Use the English language effectively to face interviews, group discussions, and public speaking.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	1	-	3	-	3
CO2	3	-	-	-	-	-	-	1	2	3	3	2
CO3	-	-	-	-	-	-	-	1	2	3	3	3

The following course content is prescribed for the Language Laboratory sessions:

1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Preparing business letters
4. Preparing a resume
5. Conducting a meeting and writing the minutes
6. Writing a report
7. Situational Dialogues / Role Play.
8. Oral Presentations- Prepared and Extempore.
9. 'Just A Minute' Sessions (JAM).
10. Describing Objects / Situations / People.
11. Debate
12. Group discussion

24-219-0108 ENGINEERING GRAPHICS

L	T	P	C
1	0	3	2

Pre-requisites: Nil

Total Hours: 64

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

CO1: Sketch orthographic projection of points and lines as per BIS code of practice for general engineering drawing.

CO2: Draw (a) orthographic projection of solids & sectioned solids (b) development of surfaces of solid and truncated solids.

CO3: Draw (a) curves of intersection of solids, and perspective drawings of objects. (b) Construct isometric scale and isometric projections.

CO4: Draw (a) orthographic views from isometric view of a solid (b) 2D and 3D models of simple solids in modelling software.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	3	-	-	-	-	-	-	-	-	2
CO2	3	2	3	-	-	-	-	-	-	-	-	2
CO3	3	2	3	-	-	-	-	-	-	-	-	2
CO4	3	2	3	-	3	-	-	-	-		-	2

Module 1 (16 Hours, End semester marks 25%)

Relevance of technical drawing in the engineering field, Drawing instruments, Types of lines, Dimensioning, and BIS code of practice for technical drawing.

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

True length and inclination of lines with reference planes; Traces of lines. Application problems of lines.

Module 2 (16 Hours, End semester marks 25%)

Orthographic projection of solids in simple position, axis inclined to either one of the reference planes and axis inclined to both reference planes. Section of solids with section plane inclined to any of the reference planes.

The true shape of the section. Development of surfaces of the solid, truncated solids, Application-based problems.

Module 3 (16 Hours, End semester marks 25%)

Intersection of surfaces: Intersection of prism in prism and cylinder in cylinder - axis bisecting at right angles only.

Perspective projections: Perspective projections of simple solids- Visual ray and vanishing point methods.

Isometric projections: Isometric projections and views of plane figures of simple and truncated solids in simple positions including sphere and hemisphere and their combinations.

Module 4 (16 Hours, End semester marks 25%)

Multi-view projection: Conversion of isometric view of objects to orthographic views.

Introduction to Computer Aided Drawing: Role of CAD in design and development of new products, Advantages of CAD. Creating two-dimensional drawings with dimensions using suitable software. Introduction to Solid Modelling: Creating 3D models of various components using suitable modelling software.

References:

1. N.D. Bhatt - Engineering Drawing - Charotar Publishing House
2. P.I. Varghese - Engineering Graphics with AutoCAD - VIP Publishers
3. N.D. Bhat and V.M. Panchal - Machine Drawing Charotar Publishing House
4. John, K.C. Engineering Graphics, Prentice Hall India Publishers
5. Agrawal, B. and Agrawal, C.M., Engineering Drawing, Tata McGraw Hill Publishers."

24-219-0109 ELECTRICAL AND MECHANICAL WORKSHOP

L	T	P	C
0	0	3	1

Pre-requisites: Nil

Total Hours: 48

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

CO1: understand the safety precautions to be taken in a mechanical workshop.

CO2: understand different tools and equipment used in a mechanical workshop.

CO3: acquire skills for the preparation of different fitting and welding models

CO4: understand different operating of different machining tools used in a mechanical workshop.

CO5: understand the safety precautions to be taken while dealing with electric circuits.

CO6: understand and analyse different types of wiring circuits, both domestic and industrial.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	-	-	-	-	-	-	-	-	-	-	1
CO2	3	-	2	-	2	-	-	-	-	-	-	1
CO3	3	2	2	2	-	-	-	-	-	-	-	1
CO4	3	-	2	2	2	-	-	-	-	-	-	1
CO5	3	-	-	-	-	-	-	-	-	-	-	1
CO6	3	2	2	2	-	-	-	-	-	-	-	1

List of Exercises/ Experiments for Mechanical Engineering Workshop (24 hours, End semester marks 50%)

Safety rules: Understand the safety rules in mechanical engineering workshops.

General: Study of mechanical tools such as screwdrivers, spanners, Allen keys, cutting pliers etc.

Sheet metal works: Make cylindrical, conical, and prismatic shaped jobs from sheet metals**.**

Welding: Make joints using electric arc welding - butt joint, comer joint, T-joint and lap joint.

Fitting: Exercise on one simple fitting job involving practice of chipping, filing, drilling, tapping, cutting etc.

Machines: Demonstration and application of drilling machine, grinding machine, shaping machine, milling machine and lathe.

List of Exercises/ Experiments for Electrical Workshop (24 hours, End semester marks 50%)

Safety rules: Understand the safety rules in electrical engineering labs.

Component identification: Identify different electric wiring components such as different types of wires/cables, fuses, and fuse carriers, MCB, ELCB, MCCB and their uses**.**

Wiring exercises:

1. Simple light controlling circuit, PVC conduit wiring.
2. Light control circuit using the two-way switch.
3. Godown wiring, PVC conduit wiring.
4. Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch, and energy meter.
5. Measurement of voltage, current, and power in a single-phase circuit using voltmeter, ammeter, and Wattmeter. Calculation of the power factor of the circuit.

References:

1. Lab manual provided by the concerned faculty in charge.
2. Virtual labs (http://www.vlab.eo.in/)

SEMESTER 2

24-219-0201 LINEAR ALGEBRA AND TRANSFORM TECHNIQUES

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Solve linear system of equations and to determine Eigen values and vectors of a matrix.

CO2: Evaluation of limits and continuity, Talyor and Maclaurin series.

CO3: Determine Fourier series expansion of functions and transform.

CO4: Solve linear differential equation and integral equation using Laplace transform.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	-	1	-	2	-	-	-	-	-	1
CO2	3	3	-	1	-	2	-	-	-	-	-	1
CO3	3	3	-	2	-	2	-	-	-	-	-	1
CO4	3	3	-	2	-	2	-	-	-		-	1

Module 1 (16 Hours, End semester marks 25%)

Linear Algebra 1:

Rank of a matrix, solution of linear system of equations- existence, uniqueness, general form- Eigen values, and Eigen vectors- properties of Eigen values –Diagonalization of a matrix- Cayley Hamilton theorem (without proof) Verification-Finding inverse and power of a matrix using it-Quadratic form-orthogonal reduction of quadratic form to Canonical form.

Module 2 (16 Hours, End semester marks 25%)

Limits and continuity: Definition, mean value theorem, L'Hospitals rule for the evaluation of limits of indeterminate forms.

Series: Definition, Taylor series and Maclaurin series, its applications.

Module 3 (16 Hours, End semester marks 25%)

Fourier Analysis:

Periodic function, Fourier series, Functions of arbitrary period, Even and odd functions, Half Range Expansion, Harmonic analysis, Complex Fourier Series, Fourier Integrals, Fourier

Cosine and Sine Transform, Fourier Transform. Isometric projections: Isometric projections and views of plane figures of simple and truncated solids in simple positions including sphere and hemisphere and their combinations.

Module 4 (16 Hours, End semester marks 25%)

Laplace Transforms: Gamma functions and Beta Function-Definition and properties, Laplace transforms. Inverse Laplace Transform, shifting theorem, Transform of Derivative and Integrals, Solution of differential equation and integral equation using Laplace transform, Convolution, Unit step function, Second Shifting theorem, Laplace transform of periodic function.

References:

1. Erwin Kreyzig, Advanced Engineering Mathematics, 10th Edition, Wiley, 2011.
2. Grewal, B. S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, 2013.
3. Linear Algebra and Group Representations: Linear algebra and introduction to group representations, Academic Press, 2022.
4. Hsiung, C.Y. and Mao, G.Y.- Linear Algebra, World Scientfic, 1998.
5. Hoffman, K. and Kunze, R., Linear Algebra, Prentice Hall of India, New Delhi 1971.
6. Exercises in algebra: a collection of exercises, in algebra, linear algebra and geometry, CRC Press, 1996.
7. Venkataraman, M. K., Linear Algebra, The National Co., 1999.
8. Online courses from swayam (https://swayam.gov.in/), Stanford online (https://online.stanford.edu/) and MIT Open Courseware (https://ocw.mit.edu/).

24-219-0202 ENGINEERING CHEMISTRY

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Get an understanding of the theoretical principles understanding atomic orbitals and electron distribution, molecular structure, bonding, and properties.

CO2: Discover the importance of electrical energy originating from chemical reactions articulate and utilize corrosion prevention strategies and estimate the corrosion behavior of materials and components.

CO3: Acquire knowledge of various organic reaction mechanisms.

CO4: Develop an ability to design and construct engineering products like fuel cells, batteries, composites, and antistatic materials.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	3	-	-	-	2	-	-	-	-	3
CO2	3	3	3	-	-	-	2	-	-	-	-	3
CO3	3	3	3	-	-	-	2	-	-	-	-	3
CO4	3	3	3	-	-	-	2	-	-	-	-	3

Module 1 (16 Hours, End semester marks 25%)

Atomic Orbitals: Quantum mechanical model of atom and probability distribution function of hydrogen atom – quantum numbers and atomic orbital filling – LCAO approximation for diatomic molecules like N2 and CO – hybridization and molecular shapes.

Module 2 (16 Hours, End semester marks 25%)

Electrochemistry: Galvanic cells – EMF measurement, classification of electrodes – Nernst equation – Electrode potential cell reaction relation between cell potential and thermodynamic quantities, Ni-Cd cell, Hydrogen – Oxygen fuel cell, electro-chemical corrosion.

Corrosion: Theories of corrosion – Factors influencing corrosion – Corrosion Control – Cathode protection – Protective coatings – Metallic coatings – Hot dipping – electroplating, metal spraying, cladding, Non-metallic coatings – properties and functions of ingredients used in paints, varnishes, Enamels and Lacquers – special paints.

Module 3 (16 Hours, End semester marks 25%)

Organic Chemistry: Aliphatic nucleophilic substitution: S N 1 & S N 2 mechanism, structure, reactivity, kinetics and stereochemistry, applications.

Elimination reactions: E1, E2 & E1cb mechanism, structure, reactivity, kinetics and stereochemistry, applications.

Addition reactions: Additions at carbon-carbon multiple bonds, cis-trans addition, structure and reactivity, applications; additions at carbon-oxygen double bonds, structure and reactivity, applications.

Rearrangement reactions: Allylic rearrangement, pinacol-pinacolone rearrangement, Hofmann rearrangement, Beckman rearrangement.

Module 4 (16 Hours, End semester marks 25%)

Fuels: Classification – Calorific value determination of solids, liquids, and Gaseous fuels – solid fuels, wood, peut, lignite, coal and coke proximate analysis of coal – liquid fuels – petroleum and its refining – fractions and their uses – cracking and reforming – petrol knock and octane number – Diesel knock and octane number – Synthetic petrol – Gaseous fuels – Natural cases – Acetylene Combustion calculation

Lubrication: Classification and properties of lubricants – Production of lubricating oils – Synthetic lubricants.

References:

1. K S Tewari & N K Vishnoi – A textbook of organic chemistry – 3 rd edition
2. F A Carey & R J Sundberg - Advanced organic chemistry
3. James E House – Inorganic chemistry
4. Castallan – Physical chemistry – Addison Wesley.
5. Galsitone and Leivis – Elementary Physical Chemistry.
6. G.S. Munku – Theoretical principles of inorganic chemistry.
7. Hendrickson, Cram and Hammond – Organic Chemistry – McGraw Hill.
8. Morrison and Boyd – Organic chemistry – Prentice Hall India.
9. J.C. Kuriakose and Rajaram – Chemistry in Engineering & Technology, Vol.II
10. P.C. Jain and Monika – Engineering Chemistry
11. L. Munree – Chemistry of Engineering Materials.
12. Online courses from Swayam (https://swayam.gov.in/), Stanford online (https://online.stanford.edu/) and MIT OpenCourseware (https://ocw.mit.edu/).

24-219-0203 ANALOG ELECTRONICS

L	T	P	C
3	1	0	3

Pre-requisites: Basic Electronics

Total Hours: 64

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

CO1: Explain the basic MOS physics.

CO2: Analyze transistor amplifiers.

CO3: Explain the concept of feedback and the working of oscillators.

CO4: Understand the operation of power amplifiers and their classification.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	2	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	-	-	-	-	-	-	-	-	1

Module 1 (16 Hours, End semester marks 25%)

Energy bands in intrinsic and extrinsic silicon, Fermi levels, PN junction formation-Energy band diagram-barrier formation-changes in band diagram with forward and reverse bias.

Metal Insulator semiconductor devices: The ideal MOS capacitor, band diagrams at equilibrium, accumulation, depletion and inversion, surface potential, CV characteristics, effects of real surfaces, work function difference, interface charge, threshold voltage.

Module 2 (16 Hours, End semester marks 25%)

Two port networks-transistor hybrid model-conversion formulas-transistor amplifier analysis using h-parameters-CE and CC-comparison of configurations-Miller's theorem and its dual cascading-simplified CE, CC configurations-CE amplifier with emitter resistance.

Transistors at high frequencies: hybrid pi CE transistor model-CE short circuit current gain single stage CE amplifier response, Gain-BW product – emitter follower at high frequencies.

Module 3 (16 Hours, End semester marks 25%)

Feedback amplifiers: Concept of feedback-positive and negative feedback-Voltage series, current series, voltage shunt, current shunt-effect of feedback on amplifiers-expressions and derivations- practical circuits.

Oscillators: Basic concepts- Barkhausen criteria, RC and LC oscillators-principle, analysis, and design.

Module 4 (16 Hours, End semester marks 25%)

Power amplifiers: - Classification of power amplifiers - Class A, Class B, Class AB and Class C- push-pull power amplifier - transformer less class AB - complementary symmetry power amplifier -harmonic distortion.

References:

1. Ben G Streetman, Solid State Devices,7th edition, Pearson.
2. V. Suresh Babu, Solid State Devices and Technology,3rd edition, Pearson.
3. Jacob Milman and Christos C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, E/2, Tata McGraw-Hill Publishing Co. Ltd.
4. Pulse and Digital Switching Circuits, J. B. Gupta, S. K. Kataria & Sons.
5. Microelectronic Circuits and Devices, Mark A. Horenstein, PHI Learning.
6. Online courses from Swayam (https://swayam.gov.in/), Stanford online (https://online.stanford.edu/) and MIT OpenCourseware (https://ocw.mit.edu/).

24-219-0204 ELECTRICAL ENGINEERING II

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Understand the working principles of transformers, including testing methods and applications.

CO2: Comprehend the working principles of rotating DC machines, their basic characteristics, and applications.

CO3: Explain the working principles of alternators, including starting methods.

CO4: Analyse the working principles of different types of induction motors and their performance.

CO5: Describe the basic methods of electric power generation, distribution, and protection circuits.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	1	-	-	-	-	-	-	-	-	1
CO4	3	2	2	-		-	-	-	-		-	1
CO5	3	2	-	-	-	-	-	-	-	-	-	1

Module 1 (16 Hours, End semester marks 25%)

Transformer: Working principles of ideal transformer – constructional features – emf equation – vector diagram – equivalent circuit – impedance transformation – transformer losses – flux leakage – efficiency – open circuit and short circuit tests – auto transformer – working principle and saving of copper – Basic idea of current transformer and potential transformer.

Module 2 (16 Hours, End semester marks 25%)

Rotating DC Machines: Types of rotating D.C. machines, emf generated in the armature, Torque in DC machine, method of excitation, mmf and flux density wave forms in D.C. machines, commutation process, compensating windings, magnetisation curve. Effect of armature mmf on DC machine calculations. Operating characteristics of DC generators and motors. DC motor starting, speed control of DC machines and DC machine applications.

Module 3 (16 Hours, End semester marks 25%)

Alternator: rotating field, speed, and frequency – effect of distribution of winding – emf equation – losses and efficiency regulation – emf and mmf methods. Synchronous motor – torque equation – starting methods – effect of over/under excitation.

Induction motor: Three phase induction motor – constructional features – principle of operation – Vector Diagram and equivalent circuits – performance calculation using circle diagram – starting and speed control of squirrel cage and wound rotor induction motor.

Principle of operation of single-phase induction motor, stepper motor, universal motor, and Hysteresis motor.

Module 4 (16 Hours, End semester marks 25%)

Generation and distribution of electric power: Introduction to hydroelectric, thermal, nuclear, diesel and gas power stations. Elements of transmission and distribution of electric power – Practical working voltages – underground systems and overhead systems – Typical power scheme – Different systems of transmission and circuits – Different types of line insulators used.

Switchgear and protection: Requirement of circuit breaker, basic principle of operation of circuit breakers and types of circuit breakers.

References:

1. P.S. Bimbhara – Electrical Machinery (Edition seven) – Khanna Publishers (1977)
2. S.L. Uppal – Electrical Power Systems (Generation, Transmission, Distribution, Protection and Utilization of Electrical Energy) (Fifteenth Edition) – Khanna Publishers (1987)
3. I. J. Nagrath and D. P. Kothari - Electrical Machines (Fifth Edition), Tata McGraw Hill Publishers (2017).
4. J.B Gupta - Course in Power Systems - S K Kataria and Sons (2013).
5. B L Theraja, AK Theraja - Textbook Of Electrical Technology: Ac And Dc Machines (volume - 2) (Twenty third Edition)- S Chand (1959)
6. Online courses from Swayam (https://swayam.gov.in/), Stanford online (https://online.stanford.edu/) and MIT OpenCourseware (https://ocw.mit.edu/).

24-219-0205 ENGINEERING MECHANICS

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Understand the principles of mechanics (statics and dynamics), the concept of free body diagrams and resolution of forces.

CO2: Understand the concept of moment of inertia, stress and strain.

CO3: Understand the concept of virtual work, dynamics, kinematics and kinetics.

CO4: Analyse the problems under curvilinear translation motion and rotation of rigid bodies.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	2	3	1	-	-	-	-	-	-	-	-	1
CO3	2	3	2	-	-	-	-	-	-	-	-	1
CO4	2	2	3	-	-	-	-	-	-	-	-	1

Module 1 (16 Hours, End semester marks 25%)

Introduction to Mechanics: Definition and classification of mechanics – rigid body (statics and dynamics) and deformable body mechanics.

Forces and Force systems: Force and its characteristics, principles of statics – concept of resultant and equilibrant, composition, and resolution of forces force systems.

Coplanar concurrent force system: Equilibrium of two, three and more than three forces, moment of a force, Varignon's theorem of moments, equations of equilibrium, friction and its effects on bodies, engineering applications.

Coplanar parallel force system: Two parallel forces, general case of parallel forces in a plane, centre of parallel forces, centre of gravity, centre of mass, centroids of curves, areas and volumes– regular and composite. Pappu's theorems, equilibrium of distributed forces in a plane, applications of the concept of centroid in engineering practice.

Module 2 (16 Hours, End semester marks 25%)

Moment of Inertia: Concept of moment of inertia and second moment of area, moment of inertia of regular and composite solids, second moment of area of regular and irregular surfaces, Polar moment of inertia / second moment of area, product of inertia, principal moments of inertia and principal axes, applications of the concepts in engineering practice.

Concepts of stress and strain - Hooke's law, elastic constants - thermal strain - shear stress and strain.

Module 3 (16 Hours, End semester marks 25%)

Principle of virtual work: Concept of virtual work and the principle of virtual work, applications in engineering, equilibrium of ideal systems, stable and unstable equilibrium.

Introduction to Dynamics: Definitions, units, divisions – kinematics, kinetics.

Rectilinear translation: Kinematics of rectilinear motion – displacement, velocity, acceleration, kinetics – differential equations of motion, D'Alembert's principle in rectilinear translation and its applications, motion of a particle due to a constant force, motion of a particle due to a force proportional to displacement – simple harmonic motion, momentum and impulse, work and energy, conservation of energy, collision of two bodies – direct central impact.

Module 4 (16 Hours, End semester marks 25%)

Curvilinear translation: Kinematics of curvilinear translation – components of displacement, velocity and acceleration, normal and tangential acceleration, kinetics – differential equations of motion, motion of projectile – projection on horizontal and inclined surfaces, D'Alembert's principle in curvilinear motion and its applications, moment of momentum, work, and energy in curvilinear motion.

Rotation of a rigid body: Kinematics of rotation – angular displacement, velocity and acceleration, RPM, relations of kinematic parameters of linear and angular motions, kinetics – differential equations of motion of a rigid rotating about a fixed axis, rotation under the action of a constant moment, rotation proportional to angular displacement – compound pendulum, D'Alembert's principle in rotation, resultant inertia force in rotation, principle of angular momentum in rotation, energy equation for rotating bodies.

References:

1. S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, "Engineering Mechanics" 5th Edition 2017, McGraw Hill Education ISBN-10: 9781259062667, ISBN-13: 978-1259062667.
2. Dr. Biju N "Engineering Mechanics Statics & Dynamics" 2nd Edition, Educational Publishers and Distributors, ISBN-10: 8187198214, ISBN-13: 978-8187198215.
3. Ferdinand P. Beer, E. Russell Johnston Jr., David Mazurek, Philip J. Cornwell, "Mechanics for Engineers, Volume 1: Statics", 10th Edition 2023, McGraw-Hill Education, ISBN-10: 1337925230, ISBN-13: 978-1337925231.
4. Ferdinand P. Beer, E. Russell Johnston Jr., David Mazurek, Philip J. Cornwell, "Mechanics for Engineers, Volume 2: Dynamics", 10th Edition 2023, McGraw-Hill Education, IISBN-10: 1337925206, ISBN-13: 978-1337925200.
5. J. L. Meriam, L. G. Kraige, James L. Meriam "Engineering Mechanics, Volume 1: Statics" 7th Edition 2017, John Wiley & Sons, ISBN-10: 1118597228, ISBN-13: 978-1118597222.
6. J. L. Meriam, L. G. Kraige, James L. Meriam "Engineering Mechanics, Volume 2: Dynamics" 7th Edition 2017, John Wiley & Sons, ISBN-10: 111859718X, ISBN-13: 978-1118597180.

7. S. Rajasekaran and G. Sankarasubramanian, "Fundamentals of Engineering Mechanics", 3rd Edition, 2017, Vikas Publishing House Pvt. Ltd., New Delhi, ISBN-10: 8125918655, ISBN-13: 978-8125918653.
8. R.C. Hibbeler, "Engineering Mechanics, Volume 1: Statics", 15th Edition 2023, Pearson Education Asia Pvt. Ltd., New Delhi, ISBN-10: 9789355540255, ISBN-13: 9789355540255.
9. R.C. Hibbeler, "Engineering Mechanics, Volume 2: Dynamics", 15th Edition 2023, Pearson Education Asia Pvt. Ltd., New Delhi, ISBN-10: 9789355540262, ISBN-13: 9789355540262.
10. Online courses from swayam (https://swayam.gov.in/), Stanford online (https://online.stanford.edu/) and MIT OpenCourseware (https://ocw.mit.edu/).

24-219-0206 NETWORK THEORY

L	T	P	C
3	1	0	3

Pre-requisites: Nil

Total Hours: 64

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

CO1: Analyze linear time-invariant electrical networks.

CO2: Apply time-domain, phasor, and Laplace transform methods for linear circuit analysis.

CO3: Investigate the transient response of networks under test signals.

CO4: Understand the principles of resonance, coupled circuits, and two-port networks.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	3	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	-	-	-	-	-	-	-	-	1
CO3	3	3	2	2	-	-	-	-	-	-	-	1
CO4	3	3	2	2	-	-	-	-	-		-	1

Module 1 (16 Hours, End semester marks 25%)

Introduction to circuit variables and circuit elements, Kirchhoff's Laws, Independent and dependent Sources, Network topology, Network graphs, Trees, Incidence matrix, Tie-set matrix, and Cut-set matrix.

Solution methods applied to dc and phasor circuits: Mesh and node, analysis of network containing independent and dependent sources.

Module 2 (16 Hours, End semester marks 25%)

Network theorems applied to dc and phasor circuits: Thevenin's theorem, Norton's theorem, Superposition theorem, Reciprocity theorem, Millman's theorem, Maximum power transfer theorem.

Laplace transform, properties, Laplace Transforms and inverse Laplace transform of common functions, Important theorems: Time shifting theorem, Frequency shifting theorem, Time differentiation theorem, Time integration theorem, s domain differentiation theorem, s domain integration theorem, Initial value theorem, Final value theorem.

Module 3 (16 Hours, End semester marks 25%)

Partial Fraction expansions for inverse Laplace transforms, Solution of differential equations using Laplace transforms Transformation of basic signals and circuits into s-domain.

Transient analysis of RL, RC, and RLC networks with impulse, step, pulse, exponential and sinusoidal inputs, Analysis of networks with transformed impedance and dependent sources.

Module 4 (16 Hours, End semester marks 25%)

Network functions for the single port and two ports, properties of driving point and transfer functions, Poles and Zeros of network functions, Significance of Poles and Zeros, Time domain response from pole zero plot, Impulse Response Network functions in the sinusoidal steady state, Magnitude and Phase response.

Parameters of two port network: impedance, admittance, transmission and hybrid parameters, Interrelationship among parameter sets Series and parallel connections of two port networks Reciprocal and Symmetrical two port network Characteristic impedance, Image impedance and propagation constant (derivation not required)

References:

1. Ravish R., Network Analysis and Synthesis, 2/e, McGraw-Hill, 2015.
2. Valkenburg V., Network Analysis, 3/e, PHI, 2011.
3. Sudhakar A,S. P. Shyam Mohan, Circuits and Networks- Analysis and Synthesis, 5/e, McGraw-Hill, 2015.
4. Choudhary R., Networks and Systems, 2/e, New Age International, 2013.
5. Franklin F. Kuo, Network Analysis and Synthesis, 2/e, Wiley India, 2012.
6. Pandey S. K., Fundamentals of Network Analysis and Synthesis, 1/e, S. Chand, 2012.

24-219-0207 COMPUTER PROGRAMMING

L	T	P	C
1	1	1	2

Pre-requisites: Nil

Total Hours: 48

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

CO1: Solve problems efficiently by choosing loops and decision-making statements programming.

CO2: Implement different operations on arrays.

CO3: Solve problems using functions and recursion.

CO4: Design and implement C programs using the concepts of structure, pointers, and files.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	2	1	-	-	-	-	-	-	2	1	-	-
CO2	1	2	-	-	-	-	-	-	1	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	1	-	-	-	-	-	1	3	3

Cycle I

C Programming Basics:

1. To write a program to calculate and display areas of rectangle and triangle.

Decision Making:

2. To write a program for electricity bill preparation.
3. To write a program to find the roots of a quadratic equation.
4. To write a simple menu driven calculator program using switch statement.
5. To write a program to find the sum of digits of a given number.

Cycle II

Looping:

6. To write a program to print all the prime numbers of a given range.
7. To write a program to print the sine and cosine series.
8. To write a program to print Pascal's triangle.

Arrays:

9. To write a program to print the sum and average of elements in an array.

10. To write a program to sort the given numbers using bubble sort.

11. To write a program to perform Matrix addition and matrix multiplication.

String:

12. To write a program to perform string manipulation functions like string concatenations, comparison, find the length and string copy without using library functions.

13. To write a program to arrange names in alphabetical order.

Cycle III

Functions:

14. To write a C program to calculate the mean, variance and standard deviation using functions.

15. To write a C program to perform sequential and binary search using functions.

Recursion:

16. To write a program to print the Fibonacci series using recursive function.

17. To write a program to print the factorial of the given number using recursive function.

Structure:

18. To print the mark sheet of n students using structures.

Pointers:

19. To write a program using pointers to access the elements of an array and count the number of occurrences of the given number in the array.

Files:

20. To write a program to count the number of characters and lines in a file.

References:

1. Pradip Dey and Manas Ghosh, Computer Fundamentals and Programming in C, Second Edition, Oxford University Press, (2013).
2. Smarajit Ghosh, All of C, PHI Learning Pvt. Ltd, (2009).
3. Byron Gottfried, Programming with C, 2 nd edition, Tata McGraw-Hill, (2006).
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Second Edition, Pearson Education, (2001).
5. Sukhendu Dey, Debobrata Dutta, Complete Knowledge in C, Narosa Publishing House, New Delhi, (2009).
6. Virtual labs (http://www.vlab.co.in/)

24-219-0208 BASIC ELECTRONICS LAB

L	T	P	C
0	0	3	1

Pre-requisites: 24-219-0103 Basic Electronics

Total Hours: 48

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

CO1: Remember how to identify different electronic components and read its specification.

CO2: Read electronic circuits drawn using IEEE standard symbols

CO3: Understand testing of various electronic components.

CO4: Properly use electronic testing and measurement instruments in the laboratories.

CO5: Understand the characteristics of electronic components such as diodes, BJTs and FETs.

Mapping of course outcomes with PO's: **Level - Low (1), medium (2) and high (3)**

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	-	-	2	2	-	2	-	-	-	-	-	-
CO2	-	-	-	2	-	2	-	-	-	-	-	-
CO3	3	3	-	-	-	3	-	-	-	-	-	-
CO4	-	3	3	-	-	3	-	-	-	-	-	-
CO5	-	-	2	2	-	2	-	-	-	-	-	-

List of exercises (18 hours, End semester marks 40%)

1. Familiarization/ identification of electronic components with specification: functionality, type, size/ value, colour coding, package etc. of components such as resistors, capacitors, inductors, ICs, switches, relays, crystals, displays, heat sinks etc.

2. Understanding IEEE symbols for electronic components in drawings.

3. Familiarization of electronic test and measurement instruments such as multi-meter, function generator, power supply, oscilloscope etc.

4. Testing of electronic components such as resistor, capacitor, diode, transistor, UJT and FET

5. Soldering practice: assemble a full wave rectifier using transformer, diodes, capacitor, and Zener diode on a general-purpose PCB.

List of experiments (30 hours, End semester marks 60%)

1. Characteristics of diode

2. Characteristics of Zener diode

3. Transistor characteristics in CB configuration

4. Transistor characteristics in CE configuration

5. Bias and bias stabilization

6. FET characteristics

7. Design of FET amplifiers – frequency response

References:

1. The faculty in charge will provide lab manual

2. Virtual labs (http://www.vlab.co.in/)