GM UNIVERSITY

COURSE DOCUMENT

2025-SCHEME

B. Tech.
in
Electrical and Electronics Engineering

GM UNIVERSITY
Innovating Minds

School of Engineering
Faculty of Engineering & Technology

Semester-1			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1	UE25EE1101	Engineering Mathematics - I	3
2	UE25EE1102	Engineering Physics	3
3	UE25EE1103	Elements of Electrical Engineering	3
4	UE25EE1104	New and Renewable Energy Sources	3
5	UE25EE1105	Programming with C	4
6	UE25EE1106	Electrical Circuit Building	1
7	HG25TCXXXX	Technical Skills	0
8	HG25TPYYYY	Life Skills	0
9	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
10	HG25SAKKKK	Environmental Awareness and Community Services	0
11	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	0
12	HG25SAKKKK	Cultural & Literary Activities	0
13	HG25CC####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	0
14	HG25TPYYYY	Placement Training	0
		Total	**17**

Course Code	UE25EE1101
Course Title	Engineering Mathematics-I

Course Content

Series expansion and partial differentiation: Introduction to Calculus, Polar Coordinates and Parametric Equations. Taylor's and Maclaurin's series expansion for one variable (Statement only) – problems. Indeterminate forms - L'Hospital's rule - Problems. Partial differentiation, total derivative - differentiation of composite functions. Jacobian and problems.

Linear algebra: Elementary row transformation of a matrix, Rank of a matrix. Consistency and Solution of system of linear equations - Gauss-elimination method, Gauss-Jordan method and approximate solution by Gauss-Seidel method. Eigen values and Eigen vectors, Rayleigh's power method to find the dominant Eigen value and Eigen vector, Applications of Linear Algebra in Engineering.

Vector Space: Definition and examples, subspace, linear span, linearly independent and dependent sets, Basis and dimension.

Linear transformations: Definition and examples, Algebra of transformations, Matrix of a linear transformation. Rank-Nullity theorem (without proof) problems.

Integral Calculus: Multiple Integrals: Evaluation of double and triple integrals, evaluation of double integrals by changing into polar coordinates. Applications to find Area and Volume by double integral. Problems.

Beta and Gamma functions: Definitions, properties, relation between Beta and Gamma functions. Problems.

Vector Differentiation: Scalar and vector fields. Gradient, directional derivative, curl and divergence - physical interpretation, solenoidal and irrotational vector fields. Problems.

Vector Integration: Line integrals, Surface integrals, Volume integrals. Applications to work done by a force and flux. Statement of Green's theorem and Stoke's theorem. Problems.

Course Code	UE25EE1102
Course Title	Engineering Physics

Course Content

Electrical Properties of Materials:

Conductors: Quantum Free Electron Theory of Metals: Assumptions, Fermi-energy, Fermi factor, Variation of Fermi Factor with Temperature and Energy, Mention of expression for electrical conductivity.

Superconductivity: Introduction to Superconductors, Temperature dependence of resistivity, Meissner Effect, Critical Field, Temperature dependence of Critical field, Types of Super Conductors, BCS theory (Qualitative), High-Temperature superconductivity, SQUID, Numerical problems.

Semiconductors : Semiconductors: Fermi level in Intrinsic and extrinsic Semiconductor, Expression for concentration of electrons in conduction band & holes concentration in valance band (only mention the expression), Relation between Fermi energy & Energy gap in intrinsic semiconductors (derivation), Law of mass action, Electrical conductivity of a semiconductor (derivation), Hall effect, Expression for Hall coefficient (derivation) and its application. Numerical problems.

Optical Communication: LASER: Characteristic properties of a LASER beam, Interaction of Radiation with Matter, Einstein's A and B Coefficients and Expression for Energy Density (Derivation), Laser Action, Population Inversion, Metastable State, Requisites of a laser system, Semiconductor Diode Laser, Applications: Bar code scanner, Laser Printer, Numerical Problems.

Optical Fiber: Principle and Structure, Propagation of Light, Acceptance angle and Numerical Aperture (NA), Derivation of Expression for NA, Modes of Propagation, RI Profile, Classification of Optical Fibers, Attenuation and Fiber Losses, Applications: Fiber Optic networking Numerical Problems.

Nano technology & Nano electronics Devices

Introduction to Nano Materials: Nanomaterial and nanocomposites, Definition and characteristics of nanomaterials, Size-dependent properties of nanomaterials.

Nano-electronics Devices: Introduction – electron density in bulk material – Size dependence of Fermi energy– quantum confinement – quantum structures – Density of states in quantum well, quantum wire and quantum dot structures, Carbon Nano Tubes and their properties.

Course Code	UE25EE1103
Course Title	Elements of Electrical Engineering

Course Content:

DC Circuits: Elements of electric circuit, Concept of Electric charge, current, voltage, power and energy, Ohm's Law and its Limitations, Kirchhoff's Laws, Circuit Analysis – Series, Parallel, and Series-Parallel Circuits, Simple Numerical Problems.

Electromagnetism: Faraday's Laws of Electromagnetic Induction, Lenz's Law and Fleming's Right and Left-Hand Rules, Types of EMF – Statically and Dynamically Induced EMF, Self and Mutual Inductance, Coefficient of Coupling, Energy Stored in Magnetic Field – Formula and Numerical Problems.

AC Fundamentals: AC Quantities – Equations for AC Voltage and Current, Waveform Parameters – Time Period, Frequency, Amplitude, Phase, Phase Difference, AC Values – Average Value, RMS Value, Form Factor, Peak Factor.

AC Circuits: Behaviour of R, L, and C Elements in AC Circuits – Voltage-Current Relationship with Phasor Diagrams, Series Circuits Analysis – R-L, R-C, and R-L-C Circuits, Numerical Examples Based on AC Series Circuits.

Three-Phase Circuits: Introduction to Three-Phase Systems – Advantages and Generation, Balanced Systems – Star and Delta Connections, Line and Phase Voltage/Current Relationships, Power Measurement in Balanced Systems – Two-Wattmeter Method.

DC Machines: DC Generator: Principle of Operation, Construction, EMF Equation, Terminal Voltage, Simple Problems.

DC Motor: Principle, Construction, Back EMF, Torque Equation, Types of DC Motors and Applications, Numerical Problems on DC Machines.

Transformers: Single-Phase Transformers – Construction, Principle of Operation, EMF Equation, Types of Losses, Efficiency, Condition for Maximum Efficiency, Solved Examples.

Three-Phase Induction Motors: Rotating Magnetic Field Concept, Construction and Working Principle, Types of Motors – Squirrel Cage and Wound Rotor, Slip – Definition, Calculation, Significance, Applications of Induction Motors.

Electrical Energy Consumption and Billing: Power Ratings of Household Electrical Appliances – ACs, PCs, Laptops, Printers, etc., Electrical Energy Unit (kWh) – Definition and Usage, Electricity Tariff – Two-Part Tariff, Electricity Bill Calculation for Domestic Consumers.

Electrical Safety: Electric Shock – Causes and Prevention, Earthing – Need and Types (Pipe, Plate, etc.), Fuses and MCBs – Working Principle, Types, Advantages and Disadvantages.

Course Code	UE25EE1104
Course Title	New and Renewable Energy Sources

Course Content:

Introduction: Principles of renewable energy; energy and sustainable development, Fundamentals and social implications. Worldwide renewable energy availability, Renewable energy availability in India, Classification of energy sources: Conventional and Non-conventional, Introduction to Internet of energy (IOE), Environmental impact of fossil fuels, Importance and need for renewable energy, Renewable energy policies and incentives (India and global overview).

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; solar radiation Measurements- Pyrheliometer, Pyrometer, Sunshine Recorder. Solar Thermal systems: Flat plate collector; solar distillation; solar pond electric power plant. Solar Electric Power Generation: Principle of Solar cell, Photovoltaic system for electric power generation, advantages, Disadvantages and applications of solar photovoltaic system.

Wind Energy: Properties of wind, Availability of wind energy in India, Wind velocity and power from wind, Major problems associated with wind power, Basic components of wind energy conversion system (WECS); Classification of WECS- Horizontal axis- single, double and multiblade system, Vertical axis- Savonius and Darrius types.

Biomass Energy: Introduction, Photosynthesis Process, Biofuels, Biomass Resources Biomass conversion technologies-fixed dome, urban waste to energy conversion, Biomass gasification (Downdraft).

Green Energy: Introduction, Fuel cells: Classification of fuel cells – H2; Operating principles, Zero energy concepts, Benefits of hydrogen energy, Hydrogen production technologies (electrolysis method only), Hydrogen energy storage, Applications of hydrogen energy, Problem associated with hydrogen energy.

Course Code	UE25EE1105
Course Title	Programming with C

Course Content:

Introduction to C Programming: Introduction to C, Structure of C program, Files used in a C program, Compilers, Compiling and executing C programs, keywords, identifiers, Basic Data Types in C, variables, constants, Input/output statements in C.

Operators and Decision-making statements: Operators in C, Type conversion and typecasting. Introduction to decision control, Conditional branching statements, iterative statements, nested loops, break and continue statements, go to statement, Programming Examples.

Function: Introduction to functions, function definition, function declaration, function call, return statement, passing parameters to functions, storage classes, recursive functions., Programming Examples.

Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, operations on arrays, passing arrays to functions, two dimensional arrays, operations on two-dimensional arrays, passing two dimensional arrays to functions, multidimensional arrays, Programming Examples.

Strings: Introduction to strings, Suppressing Input, string taxonomy, and operations on strings, arrays of strings, Programming Examples.

Pointers: Introduction to pointers, declaring pointer variables, null pointers, generic pointers, passing arguments to functions using pointers, Programming Examples.

List of experiments

Sl.No	Contents
1.	Simulation of a Simple Calculator.
2.	Compute the roots of a quadratic equation by accepting the coefficients. Print appropriate messages.
3.	Write a C Program to display the following by reading the number of rows as input 1 1 2 1 1 2 3 2 1 1 2 3 4 3 2 1
4.	Implement Binary search on Integers.
5.	Write a C program using user defined functions to determine whether the given string is palindrome or not.
6.	Implement Matrix multiplication and validate the rules of multiplication.
7.	Compute sin(x)/cos(x) using Taylor series approximation. Compare your result with the built –in library function. Print both the results with appropriate inferences.
8.	Sort the given set of N numbers using Bubble Sort.
9.	Write functions to implement string operations such as compare, concatenate, string length. Convince the parameter passing techniques.
10.	Write a C program to find the length of the string using Pointer.

Course Code	UE25EE1106
Course Title	Electrical Circuit Building

LIST OF EXPERIMENTS:

1) To verify Ohm's Law using a simple resistive circuit.
2) To verify the KCL for DC circuit.
3) To verify the KVL for DC circuit.
4) To analyze and verify voltage and current distribution in series and parallel resistive circuits.
5) To verify the maximum power transfer theorem for DC circuits.
6) Study of the effect of open and short circuits in simple circuits.
7) Measurement of current, power and power factor of incandescent and fluorescent lamp.
8) To verify the truth table of one lamp control from two and three different places.
9) To determine phase and line quantities in three phase star and delta connected load.
10) Measurement of three phase's power using two wattmeter method.
11) Determination of efficiency of a single phase transformer by direct load test.
12) Measurement of earth resistance.

Semester-2			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1	UE25EE1201	Engineering Mathematics – II	3
2	UE25EE1202	Engineering Chemistry	3
3	UE25EE1203	Fundamentals of Electronics Engineering	3
4	UE25EE1204	Electrical Power Generation	3
5	UE25EE1205	Programming with Python	4
6	UE25EE1206	Electronics Circuit Building	1
7	HG25TCXXXX	Technical Skills	2
8	HG25TPYYYY	Life Skills	1
9	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
10	HG25SAKKKK	Environmental Awareness and Community Services	1
11	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	0
12	HG25SAKKKK	Cultural & Literary Activities	0
13	HG25CC####	Co-Curricular Activities (Seminar/Conference/ Exhibition/Technical Competition)	0
14	HG25TPYYYY	Placement Training	0
		Total	**21**

Course Code	UE25EE1201
Course Title	Engineering Mathematics - II

Course Content

Numerical Methods -I: Interpolation using Newton's forward and backward difference formulae, Newton's divided difference formula and Lagrange's interpolation formula (All formulae without proof), Problems.

Numerical integration: Simpson's $(1/3)^{rd}$ and $(3/8)^{th}$ rules)

Numerical Methods –II: Numerical Solution of Ordinary Differential Equations (ODE's): Taylor's series method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's predictor-corrector method (No derivations), Problems.

Higher Order differential equations: Higher-order linear ODE's with constant coefficients - Inverse differential operator, method of variation of parameters, Cauchy's and Legendre homogeneous differential equations, Problems.

Partial Differential Equations: Formation of PDE's by elimination of arbitrary constants and functions, Solution of non-homogeneous PDE by direct integration, Homogeneous PDEs involving derivative with respect to one independent variable only. Derivation of one-dimensional heat equation and wave equation.

Laplace Transform: Transform of elementary functions

Properties–Linearity, Scaling, t-shift property, s-domain shift, differentiation in the s-domain, division by t, differentiation and integration in the time domain. LT of special functions of periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside Unit step function.

Inverse Laplace Transforms: Definition, properties, evaluation using different methods, convolution theorem (without proof), problems, and applications to solve ordinary differential equations.

Course Code	UE25EE1202
Course Title	Engineering Chemistry

Course Content:

Electrode System: Introduction, types of electrodes. Ion selective electrode – definition, construction, working, and applications of the glass electrode. Reference electrode- Introduction, calomel electrode– construction, working, and applications of calomel electrode.

Battery technology: Battery characteristics, Classification of batteries, state-of-the-art batteries-construction, working, and applications of Lithium-ion batteries.

Corrosion Science and Surface Modification

Corrosion science: Definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion). Factors affecting the rate of corrosion.

Corrosion control: Inorganic coatings-Anodization. Metal coatings-Galvanization and its disadvantages. Cathodic protection of Corrosion, Sacrificial anode method and current impression method.

Metal finishing: Introduction, technological importance. Electroplating: Introduction, Electroplating of chromium (hard and decorative). Electroless plating: Introduction, Electroless plating of copper.

Nano Materials and Display Systems

Nanomaterials: Introduction, size-dependent properties of nanomaterials, preparation of nanomaterials by sol-gel and co-precipitation method with example. Introduction, properties, and applications. Nanofibers, Nano-photonics and Nano-sensors.

Display Systems: Liquid crystals (LC)-Introduction, classification, properties, and application in Liquid Crystal Displays (LCDs). Properties and application of Organic Light Emitting Diodes (OLEDs) and Quantum Light emitting diodes (QLEDs).

Polymers Materials in Hardware

Polymers: Introduction to polymers, structure, and property relationship. Synthesis, properties, and applications of Kevlar fiber, preparation, properties, and commercial applications of carbon fiber.

Conducting polymers: Definition, mechanism of conduction in polyacetylene.

Composites: Introduction, properties, and industrial applications of carbon-based reinforced composites (graphene/carbon nano-tubes as fillers) and metal matrix polymer composites.

Analytical Techniques and E-waste management

Analytical Techniques: Introduction, principle, and instrumentation of Colorimetric sensors; its application in the estimation of copper, principle and instrumentation of Potentiometric sensors; and its application in the estimation of iron, Conductometric sensors; its application in the estimation of weak acid.

E-Waste: Introduction, sources of e-waste, Composition, and Need of E-waste Management. Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste. Role of stakeholders in the environmental management of e-waste: producers, consumers, recyclers, and statutory bodies.

Course Code	UE25EE1203
Course Title	Fundamentals of Electronics Engineering

Semiconductor Diodes and Applications: P-N junction diode, Equivalent circuit of diode, Rectification-Half wave rectifier, Full wave rectifier, Bridge rectifier, Capacitor filter circuit, Zener Diode, Zener diode applications, Photodiode, LED, Photo coupler, 7800 series and 7805 Fixed regulators.

BJT Applications, Feedback Amplifiers and Oscillators: Introduction to BJT, BJT construction and operation, BJT Configurations and characteristics: Voltages and Currents, Common Base, Common Emitter and Common Collector configurations, BJT as an amplifier, BJT as a switch, Transistor switch circuit to switch ON/OFF an LED and a lamp in a power circuit using a relay.

Feedback Amplifiers & Oscillators: Feedback Amplifiers: Principle, Properties and advantages of Negative Feedback, Types of feedback, Voltage series feedback, gain stability with feedback, Oscillators: Barkhaunsen's criteria for oscillation, RC Phase Shift oscillator, Wien Bridge oscillator, Tuned oscillators-Hartley oscillator, Colpitts oscillator, IC 555 Timer and Astable Oscillator using IC 555.

FET and SCR: Introduction, JFET: Construction and operation, JFET Drain Characteristics and Parameters, JFET Transfer Characteristic, Square law expression for I/O, Input resistance, MOSFET: Depletion and Enhancement type MOSFET-Construction, Operation, Characteristics and Symbol, Silicon Controlled Rectifier (SCR): Two-transistor model, Switching action, Characteristics.

Number systems and Boolean algebra: Binary to Decimal, Decimal to Binary, Binary to Octal, Octal to Binary, Binary to Hexadecimal, Hexadecimal to Binary, Decimal to Octal, Octal to Decimal, Decimal to Hexadecimal, Hexadecimal to Decimal, Octal to Hexadecimal, Hexadecimal to octal, Complement of Binary Numbers, binary addition, binary subtraction. Boolean Algebraic theorems, Demerger’s law.

Digital logic gates: Introduction to logic gates, NOT Gate, AND Gate, OR Gate, NAND Gate, NOR Gate, XOR Gate, XNOR Gate, Realization of basic gates using universal gates Algebraic Simplification.

Course Code	UE25EE1204
Course Title	Electrical Power Generation

Course Content:

Introduction to Power Generation: Basics of energy and power, Classification of power plants: Conventional and Non-conventional, Basics of energy conversion, Types of loads and load curves, Load factor, demand factor, diversity factor, plant capacity factor, Overview of the energy scenario in India and globally.

Thermal Power Plants: Layout and working principle, Components: Boilers, turbines, condensers, cooling towers, Fuel handling and combustion, Environmental impact and pollution control, Efficiency and economics of thermal power stations.

Hydroelectric Power Plants: Site selection and layout, Classification: Run-of-river, storage type, pumped storage, Hydraulic turbines: Pelton, Francis, Kaplan, Governors and controls, Advantages and limitations.

Nuclear Power Plants: Basic nuclear physics, Nuclear fission and fusion, Components: Reactor, moderator, control rods, shielding, Types of reactors: PWR, BWR, PHWR, Safety measures and waste disposal.

Renewable Energy Sources: Solar power generation- PV systems and solar thermal, Wind power- Wind turbines, site selection, grid connection, Biomass, tidal, and geothermal energy, Hybrid systems and smart grid integration, Advantages and challenges of renewable energy.

Power Plant Economics and Environmental Considerations: Cost of electrical energy, Tariffs and depreciation, Environmental pollution and control measures, Carbon credits and sustainable energy policies, Introduction to energy storage and battery technologies.

Course Code	UE25EE1205
Course Title	PROGRAMMING WITH PYTHON

Python Basics: Introduction, python overview, getting started with python, comments, python identifiers, reserved key words, variables: examples for variable displaying its value. standard data types- examples on data types, operators-examples. statement and expression-examples. string operations, Boolean expressions, control statements, iteration- while statement, input from keyboard. A Short Programs.

Functions: built in functions-examples, composition of functions-examples, user defined functions, parameters and arguments, function calls, Return statement, python recursive functions, Anonymous functions, writing python scripts, A Short programs.

Manipulating Strings and Pattern Matching with Regular Expressions: Working with Strings, Useful String Methods, string slices, strings are immutable, string traversal, escape characters, string formatting operator, string formatting functions, lists, lists are mutable, traversing a list, deleting elements from list, built in list operators, built-in list methods, exercises programs.

Tuples and dictionaries: Tuples, creating tuples, accessing value in tuples, tuples are immutable, tuple assignment, tuples as return values, valuable- length argument tuples, basic tuple operations, dictionaries, creating dictionary, accessing values in a dictionary, updating dictionary, deleting elements from dictionary, operations in dictionary, built-in dictionary methods.

Oriented Object Programming concepts in Python: Overview of OOP (Object oriented programming), Classes and objects: data encapsulation, polymorphism, class definition, creating objects, objects are immutable, objects as arguments, objects as return valuables, built in class attributes-examples, inheritance, multiple inheritance, method overriding, data encapsulation, data hiding.

Course Code	UE25EE1206
Course Title	Electronics Circuit Building

LIST OF EXPERIMENTS:

Sl. No.	Contents
1	Study of CRO & Measurement of Voltage, Amplitude & Frequency.
2	Verify the V-I characteristics of Silicon diode.
3	Construct the Voltage Regulator using Zener Diode and observe the output waveform.
4	Set up the following rectifiers without filters (a) Half wave rectifier (b) Full Wave Rectifier and observe the output waveforms.
5	Static Transistor characteristics for Common Emitter configuration (Input and output Char).
6	Set-up the RC-Phase shifts Oscillator using BJT for a given frequency, and calculate the frequency of output waveform.
7	Set-up the Hartley oscillator using BJT and observe the output waveform.
8	Set-up the Colpitt's oscillator using BJT and observe the output waveform.
9	Verify truth table of basic and universal gates.
10	Realization of Universal gates (NAND and NOR) using Basic gates.

Semester-3			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1	UE25EE2301	Engineering Mathematics – III	3
2	UE25EE2302	Network Theory & Analysis	3
3	UE25EE2303	Analog Electronics	3
3	UE25EE2304	Digital Electronics	3
4	UE25EE2305	Electrical Machine-I	3
5	UE25EE2306	Electrical Machine-I Laboratory	1
8	HG25TCXXXX	Technical Skills	2
9	HG25TPYYYY	Life Skills	1
10	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
11	HG25SAKKKK	Environmental Awareness and Community Services	1
12	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	1
13	HG25SAKKKK	Cultural & Literary Activities	0
14	HG25CC####	Co-Curricular Activities (Seminar/Conference/ Exhibition/Technical Competition)	0
15	HG25TPYYYY	Placement Training	1
		Total	**22**

Course Code	UE25EE2301
Course Title	Engineering Mathematics-III

Course Content:

Fourier series: Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.

Fourier Transform: Infinite Fourier transforms: definition, Fourier sine and cosine transforms. Inverse Fourier transforms Inverse Fourier cosine and sine transforms. Problems.

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems.

Curve Fitting: Curve fitting by the method of least squares- fitting the curves of the form- $y = ax + b$, y$= ax^b$, $y = ax^2 + bx + c$

Probability Distribution: Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson (derivation for mean and standard deviation), exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Course Code	UE25EE2302
Course Title	Network Theory and Analysis

Basic Concepts: Basic definitions, Types of elements, basic laws (Ohms law, KVL, KCL), Active and passive elements, Concept of ideal and practical sources, Source transformation and Source shifting, Network reduction method including star – delta transformation

Loop and Node Analysis: Analysis of networks by loop current and Node voltage methods for AC and DC circuits with independent and dependent sources. Super-Mesh and Super node analysis, Duality.

Network Theorems: Thevenin's theorem, Norton's theorem, Super Position theorem, Maximum power transfer theorem, Millman's theorem- analysis of networks with independent and dependent for AC and DC sources

Two Port networks: Definition, Open circuit impedance, short circuit admittance and Transmission parameters, Hybrid parameter and their evaluation for simple circuits, relationships between parameter sets**.**

Resonant Circuits: Analysis of simple series RLC and parallel RLC circuits under resonances, Resonant frequency, Bandwidth and Quality factor at resonance

Transient Analysis: Transient analysis of RL and RC circuits under DC excitations: Behaviour of circuit elements under switching action, Evaluation of initial conditions

Course Code	UE25EE2303
Course Title	Analog Electronics

Transistor Biasing and stabilization: The operating point, load line analysis, DC analysis & design of fixed bias circuit, emitter stabilized bias circuit, and collector to base bias circuit, voltage divider bias circuit, modified DC bias with voltage feedback. Bias stabilization and stability factors for fixed bias circuit, collector to base bias circuit and voltage divider circuit, bias compensation, Transistor switching circuits.

Transistor at Low Frequencies: Hybrid model, h-parameter for CE, CC and CB modes, mid-band analysis of single stage amplifier, simplified model, analysis for CE, CB, and CC (emitter voltage follower circuit) modes Miller Theorem and its dual.

Feedback Amplifiers: Classification of feedback amplifiers, Concept of feedback, general characteristics of negative feedback amplifiers, Input and output resistance with feedback of various feedback amplifiers.

Power Amplifiers: Classification of Power Amplifiers, Analysis and design of Class A – Directly Coupled and Transformer Coupled, Class B- Complementary Symmetry and Push Pull. Distortion in Amplifiers, Second harmonic Distortion.

Biasing of JFET: Fixed bias configuration, self-bias configuration, voltage divider biasing. Analysis and design of JFET (only Common Source Configuration with fixed bias).

Course Code	UE25EE2304
Course Title	Digital Electronics

Principle of Combinational Logic : Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, Quine-McCluskey minimization technique, Reduce prime implicates Tables.

Analysis and Design of Combinational Logic: Decoders - BCD decoders, Encoders, Digital multiplexers – Using multiplexers as Boolean function generators, Adders and subtractors - Cascading full adders, look ahead carry, Binary Comparators.

Sequential Circuits : Basic Bistable elements, Latches, the master-slave flip-flops (pulse- triggered flip-flops), SR flip-flops, JK flip-flops, characteristic equations, Registers, binary ripple counters, synchronous binary counters, counters based on shift registers. Design of a synchronous mod-6 counter using clocked T, JK, D and SR flip-flops.

Sequential Design: Introduction, Mealy and Moore Models, State Machine Notation, Synchronous Sequential Circuit Analysis and Design.

Course Code	UE25EE2305
Course Title	Electrical Machines-1

Single Phase Transformers: Constructional features of Transformer, equivalent circuit and phasor diagram regulation and efficiency, Harmonic in Transformers, necessity of Transformer, EMF equation, equivalent circuit, open circuit and short circuit tests, calculation of equivalent circuit parameters, Autotransformer, numerical on Auto Transformer, voltage regulation and its significance, all-day efficiency numerical on all day efficiency.

Three-Phase Transformers: Construction, vector groups, Three-phase Transformer connections, Connections: star/star, delta/delta, star/delta, zigzag/star, V/V, Scott connection, parallel operation, polarity and testing of polarity, three-phase auto Transformer, Inrush of magnetising current, Harmonics in Transformers.

Cooling, Testing and parallel operation of Transformers: Cooling of Transformers, Polarity test, Sumpner's test, Necessity of Parallel operation, Conditions for parallel operation– Single Phase and Three Phase, load sharing in case of similar and dissimilar Transformers.

Voltage Regulation: Voltage regulation– EMF, MMF, ZPF methods, open circuit and short circuit characteristics, assessment of reactance-short circuit ratio (SCR), synchronization, synchronous reactance.

Course Code	UE25EE2306
Course Title	Electrical Machines Laboratory -1

List of Experiments:

1. Open Circuit and Short circuit tests on single phase step up or step down transformer and pre-eterminationof(i)Efficiencyandregulation(ii)Calculationofparametersforequivalentcircuit.
2. Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.
3. Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load.
4. Polarity test and connection of 3 single-phase transformers in star – delta and determination of efficiency and regulation under balanced resistive load.
5. Comparison of performance of 3 single-phase transformers in delta – delta.
6. V – V (open delta) connection under load.
7. Voltage regulation of an alternator by EMF and MMF methods.
8. Power angle curve of synchronous generator or direct load test on three phase synchronous generator to determine efficiency and regulation.
9. Model in Simscape for Automatic Voltage Regulation.
10. Simulate power angle curve of generator in MATLAB

Semester-4			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1	UE25EE2401	Electrical Machine-II	3
2	UE25EE2402	Electromagnetic Field Theory	2
3	UE25EE2403	Microcontrollers and Interfacing	3
4	UE25EE2404	Transmission and Distribution	3
5	UE25EE2405	Electrical Machine-II Laboratory	1
6	UE25EE2406	Microcontrollers and Interfacing Laboratory	1
8	HG25TCXXXX	Technical Skills	2
9	HG25TPYYYY	Life Skills	1
10	HG25CIVVVV	Innovation and Entrepreneurial Skills	1
11	HG25SAKKKK	Environmental Awareness and Community Services	1
12	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	1
13	HG25SAKKKK	Cultural & Literary Activities	1
14	HG25CC####	Co-Curricular Activities (Seminar/Conference/ Exhibition/Technical Competition)	0
15	HG25TPYYYY	Placement Training	1
		Total	**21**

Course Code	UE25EE2401
Course Title	Electrical Machine-II

Course Content:

DC Motors: Classification, Back emf, Torque equation, and significance of back emf, Characteristics of shunt, series & compound motors. Speed control of shunt, series and compound motors. Application of motors. DC motor starters – 3 point and 4 point. Losses and Efficiency- Losses in DC motors, efficiency, condition for maximum efficiency.

Testing of DC Motors: Direct & indirect methods of testing of DC motors-Brake test, Swinburne's test, Retardation test, Hopkinson's test, Field's test, merits and demerits of tests.

Three Phase Induction Motors: Review of concept and generation of rotating magnetic field, Principle of operation, construction, classification and types; squirrel-cage, slip-ring, Slip, Torque equation, torque-slip characteristic covering motoring, generating and braking regions of operation.

Performance of Three-Phase Induction Motor: Equivalent circuit, losses, efficiency, No-load and blocked rotor tests, cogging and crawling. High torque rotors-double cage and deep rotor bars. Equivalent circuit and performance evaluation of double cage induction motor. Induction motor working as induction generator.

Starting and Speed Control of Three-Phase Induction Motors: Need for starter. Direct on line, Star-Delta, and autotransformer starting. Rotor resistance starting. Speed control by voltage, frequency, and rotor resistance methods. Construction and operation of split-phase, capacitor start, capacitor run, and shaded pole motors.

Synchronous Motor: Principle of operation, torque and torque angle, effect of change in load, effect of change in excitation, V and inverted V curves. Synchronous condenser, hunting and damping. Methods of starting synchronous motors. Other Motors: Construction and operation of Universal motor, AC servomotor, Linear induction motor, and stepper motors**.**

Course Code	UE25EE2402
Course Title	Electromagnetic Field Theory

Course Content:

Vector Analysis: Scalars and Vectors, Representation of a vector, Vector algebra, Coordinate Systems, Vector Multiplication, Gradient, Divergence, Curl – theorems and applications.

Electrostatics: Electrostatic Fields, Coulomb's Law, Electric Field Intensity(EFI) due to point and Line, Gauss's Law, Application of Gauss's Law, Maxwell's First Law, Divergence theorem – Numericals.

Energy and Potential: Work Done in Moving a Point Charge in Electrostatic Field, Electric Potential due to point charges and line charges, Potential Gradient, Potential difference, Equipotential surfaces, potential gradient, Conductor and Dielectrics Materials –Numerical.

Poisson's and Laplace Equations: Derivations and problems, Uniqueness theorem.

Magnetic Materials and Magnetism: Nature of magnetic materials, magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, inductance and mutual inductance – Numerical.

Magneto statics: Biot-Savart's law, Ampere's circuital law, Stokes theorem, Magnetic flux and flux density ,Scalar and vector magnetic potentials.-Numerical. Force on a moving charge and differential current element, Force between differential current elements. - Numerical.

Time Varying Fields and Maxwell's Equations: Faraday's law, Displacement current, Maxwell's equations in point form– Simple Problems.

Uniform plane wave: Uniform Plane Wave Motion in Free Space and in perfect dielectric medium, Velocity - Wave Length - Intrinsic Impedance and Skin Depth (skin effect), Poynting Theorem– Numerical.

Course Code	UE25EE2403
Course Title	Microcontrollers and Interfacing

Introduction to Microcontrollers and Microcprocessors: Microprocessor Vs Microcontroller, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization, External Memory (ROM & RAM) interfacing.

Assembly Language Programming for 8051: Introduction to assembly language programming, Instruction set and addressing modes, Assembling and running an 8051 program, Data types and Assembler directives Arithmetic, logic instructions and programs, Jump, loop and call instructions, IO port programming. Writing simple programs for the 8051.

8051 Timers and Serial Port: 8051 Timers and Counters – Operation and Assembly language programming to generate a various signal on a port pin.

8051 Serial Communication- Basics of Serial Data Communication, RS-232standard, 9pin RS232 signals, Simple Serial Port programming in Assembly to transmit message and to receive data serially. Programming in C for 8051.

Interfacing: LCD interfacing, Keyboard interfacing. ADC, DAC and Sensor Interfacing: ADC 0808 interfacing to 8051, DAC interfacing, Sensor interfacing and signal conditioning.

Motor Control: Relay PWM, DC and Stepper Motor: Relays and opto-isolators, stepper motor interfacing, DC motor interfacing and PWM.

Programmable Logic Controllers: Introduction, Parts of a PLC, Principles of Operation, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

Course Code	UE25EE2404
Course Title	Transmission And Distribution

Course Content:

Introduction to Power System Structure of electric power system: Generation, transmission and distribution. Advantages of higher voltage transmission: HVAC, EHVAC, UHVAC and HVDC. Interconnection. Feeders, distributors and service mains.

Overhead Transmission Lines: A brief introduction to types of supporting structures and line conductors' Conventional conductors Bundle conductor and its advantages. Importance of sag, Sag calculation – supports at same and different levels, effect of wind and ice. Line vibration and vibration dampers. Overhead line protection against lightening; ground wires.

Overhead Line Insulators: A brief introduction to types of insulators, material used- porcelain, toughened glass and polymer (composite). Potential distribution over a string of suspension insulators. String efficiency, Methods of increasing string efficiency.

Arcing horns Line Parameters: Introduction to line parameters- resistance, inductance and capacitance. Calculation of inductance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Inductance of composite – conductors, geometric mean radius (GMR) and geometric mean distance (GMD). Calculation of capacitance of single phase and three phase lines with equilateral spacing, unsymmetrical spacing, double circuit and transposed lines. Advantages of single circuit and double circuit lines.

Performance of Transmission Lines: Classification of lines – short, medium and long. Current and voltage relations, line regulation and Ferranti effect in short length lines, medium length lines considering Nominal T and nominal circuits, and long lines considering hyperbolic form equations. Equivalent circuit of a long line. ABCD constants in all cases

Corona: Phenomena, disruptive and visual critical voltages, corona loss. Advantages and disadvantages of corona. Methods of reducing corona.

Underground Cable: Types of cables, constructional features, insulation resistance, thermal rating, charging current, grading of cables – capacitance and inter-sheath. Dielectric loss. Comparison between ac and DC cables. Limitations of cables. Specification of power cables**.**

Underground Cable: Types of cables, constructional features, insulation resistance, thermal rating, charging current, grading of cables – capacitance and inter-sheath. Dielectric loss. Comparison between ac and DC cables. Limitations of cables. Specification of power cables.

Distribution: Primary AC distribution systems **–** Radial feeders, parallel feeders, loop feeders and interconnected network system. Secondary AC distribution systems – Three phase 4 wire system and single phase 2 wire distribution, AC distributors with concentrated loads. Effect of disconnection of neutral in a 3 phase four wire system.

Reliability and Quality of Distribution System: Introduction, definition of reliability, failure, probability concepts, limitation of distribution systems, power quality, Reliability aids.

Course Code	UE25EE2405
Course Title	Electrical Machine-II Laboratory

LIST OF EXPERIMENTS:

1. Load test on DC shunt motor to draw speed–torque and horse power efficiency characteristics.
2. Field Test on DC series machines.
3. Speed control of DC shunt motor by armature and field control.
4. Swinburne's Test on DC motor.
5. Retardation test on DC shunt motor.
6. Regenerative test on dc shunt machines.
7. Load test on three phase induction motor.
8. No-load and Blocked rotor test on three phase induction motor to draw (i) equivalent circuit and (ii) circle diagram. Determination of performance parameters at different load conditions.
9. Analyze current and load torque of DC Shunt Motor using Simscape.
10. Model 3-phase induction motor using MATLAB and Simulink.

Course Code	UE25EE2406
Course Title	Microcontrollers and Interfacing Laboratory

Course Content:

1. Data transfer – Program for block data movement, sorting, exchanging, finding largest element in an array.
2. Arithmetic instructions: Addition, subtraction, multiplication and division Square and cube.
3. Counters, Up/Down BCD/ Binary Counters
4. Code conversion programs – BCD to ASCII, ASCII to BCD, ASCII to decimal.
5. Programs to generate delay, Programs using serial port and on-chip timer/counters.
6. Conditional call and return instructions.
7. Boolean and logical instructions (bit manipulation).
8. Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.
9. Stepper motor interface for direction and speed control.
10. Alphanumerical LCD panel interface.

Semester-5			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1	UE25EE3501	Electrical Machine Design	3
2	UE25EE3502	Digital Signal Processing	3
3	UE25EE3503	Power Electronics	3
4	UE25EE3504	Estimation and Costing	3
5	UE25EE3505	Sensors and Transducers	2
6	UE25EE3506	Power Electronics Laboratory	1
6	UE25EE3540	HVDC Transmission	3
7	UE25EE3541	Intelligent Control Systems	
8	UE25EE3542	Computer Networks	
9	HG25TCXXXX	Technical Skills	2
10	HG25TPYYYY	Life Skills	0
11	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
12	HG25SAKKKK	Environmental Awareness and Community Services	0
13	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	1
14	HG25SAKKKK	Cultural & Literary Activities	0
15	HG25CC####	Co-Curricular Activities (Seminar/Conference/Exhibition/Technical Competition)	0
16	HG25TPYYYY	Placement Training	1
		Total	**22**

Course Code	UE25EE3501
Course Title	Electrical Machine Design

Course Content:

Fundamental Aspects of Electrical Machine Design: Design of Machines, Design Factors, Limitations in design. Electrical Engineering Materials: Desirabilities of Conducting Materials, Comparison of Aluminium and Copper wires. Ferromagnetic Materials: Soft Magnetic materials – Solid Core Materials, Electrical Sheet and Strip, Cold Rolled Grain Oriented Steel. Insulating Materials: Desirable Properties, Temperature Rise and Insulating Materials, Classification of Insulating materials based on Thermal Consideration.

Design of DC Machines: Output Equation, Choice of Specific Loadings and Choice of Number of Poles, Main Dimensions of armature, Design of Armature Slot Dimensions, Commutator and Brushes. Estimation of Ampere Turns for the Magnetic Circuit. Design of Shunt and Series Field Windings.

Design of Transformers: Output Equations of Single Phase and Three Phase Transformers, Choice of Specific Loadings, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings. Design of Tank and Cooling (Round and Rectangular) Tubes

Design of Three Phase Induction Motors: Output Equation, Choice of Specific Loadings, Main Dimensions of Stator. Design of stator slots and Winding, Choice of Length Air Gap, Estimation of Number of Slots for Squirrel Cage Rotor. Design of Rotor Bars and End Ring.

Design of Three Phase Synchronous Machines: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors, and Field Winding.

Course Code	UE25EE3502
Course Title	Digital signal processing

Course Content:

Introduction to Digital Signal Processing: Definition of signals and systems, Classification of Signals, Elementary signals: Exponential, sinusoidal, step, impulse and ramp, basic operations on signals, Numerical Problems. Time domain representation of LTI System: Discrete-time LTI systems: The convolution sum, Continuous-time LTI systems: The convolution integral.

Properties of LTI systems: Causal LTI systems described by difference equations (Natural, and Forced Response) **Discrete Fourier Transforms (DFT):** The Discrete Fourier Transform, DFT as a linear transformation, Properties of DFT: Periodicity, Linearity and Symmetry for real valued sequence,

Additional DFT Properties: Time reversal of a sequence, Circular Time shift of a sequence, Circular frequency shift, Complex conjugate property, Multiplication of two sequences, Perceval's theorem. Linear Filtering Methods, Filtering of Long data Sequences. Overlap-add Method, Overlap-save Method.

Fast Fourier Transforms: Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms. Digital Filters Design: FIR filters: Linear phase filters, Windowing techniques for design of Linear Phase FIR filters – Rectangular, Blackman, and Hamming and Hanning windows, Realization of FIR Systems: Direct form, cascade form.

IIR Filter Design: Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Realization of IIR Filters in Direct form I and II.

Course Code	UE25EE3503
Course Title	Power Electronics

Course Content:

Power Semiconductor devices: Power Semiconductor types-BJTs, MOSFETs, IGBTs- switching characteristics. Control characteristics of power semiconductor devices. Gate drive and base drive control, Isolation of Power and gate circuit using pulse transformer and opto-coupler. Concept of power Electronics, Power converter and its classification**.** Applications of power electronics.

Thyristors: VI characteristics, Two-transistor model, SCR Turn-on methods, switching characteristics, di/dt and dv/dt protection, Gate triggering circuits, Series and parallel operation of thyristors.

Controlled Rectifiers: Single-phase Half wave circuit, single-phase Full wave converter- R, RL, Freewheeling diode, Single-phase Dual converters. Three phase full converter with R and RL loads. Application of Controlled Rectifiers.

AC voltage controllers: Principal of Integral cycle and phase control, single phase full wave-controlled Rectifier with Resistive and Inductive loads. Application of AC voltage controllers.

Inverters: Introduction to Inverters, Types of Inverters, Single-phase half and full bridge inverters, PWM techniques, CSI, VSI. Inverter applications, Multilevel Inverters. Performance parameters of inverters.

Choppers: Introduction to choppers, Classification of Choppers. Principle of operation of Step- down and step-up choppers, Control Techniques in Choppers, Performance parameters, Applications of Choppers.

Course Code	UE25EE3504
Course Title	Electrical Estimation and costing

Course Content:

Principles of Estimation: Introduction to Estimation and Costing, Electrical Schedule, , Labor Conditions, Purchase System, Purchase Enquiry and Selection of Appropriate Purchase Mode, Purchase Orders, Payment Of Bills, Tender Form, General Idea about IE Rule, Indian Electricity(IE) Act and IE Rules -29,30,45,46,47,50,51,54,55,77 and79 Determination of Required Quantity of Material, Determination of Cost Material and labour, Contingencies, Overhead Charges, Profit, Market Survey and Source Selection, Comparative Statement

Wiring: Introduction, Distribution of energy in a Building, Desir abilities of Wiring. Multi Strand Cables, Voltage Grading and Specification of Cables Main Switch and Distribution Board, Conduits and its accessories and Fittings. Lighting Accessories and Fittings, Types of Fuses, Earthing Conductor. PVC Casing and Capping, Conduit Wiring, Types of cables used in Internal Wiring

Internal Wiring: General rules for wiring, Design of Lighting Points, Number of Points, Main Switch and Distribution Board and Size of Conductor. Current Density, Layout Service Mains: Introduction, Types, Estimation of Underground and Overhead Service Connections.

Design and Estimation of Power Circuits: Introduction, Important Considerations Regarding Motor Installation Wiring, Input Power, Input Current to Motors, Rating of Cables, Rating of Fuse, Distribution Board Main Switch and Starter **Estimation of Overhead Transmission and Distribution Lines:** Dead End Clamps, Positioning of Conductors and Attachment to Insulators, Jumpers, TeeOffs, Earthing of Transmission Lines, Guarding of Overhead Lines, Clearances of Conductor from Ground, Spacing Between Conductors, Important Specifications, Estimation problems, Repairing and Jointing of Conductors.

Estimation of Substations: Main Electrical connection, Graphical Symbols for Various Types of Apparatus and Circuit Elements on Substation main Connection Diagram, equipment for Substation, Substation Auxiliaries Supply, Substation earthing, Single Line Diagram of Typical Substations.

Course Code	UE25EE3505
Course Title	Sensors and Transducers

Course Content:

Sensors and Transducers: Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Resistance Transducers, Variable Inductance Transducers, Capacitive Transducers, Piezoelectric Transducers, Hall Effect Transducers, Thermoelectric Transducers, Photoelectric Transducers.

Sensors and Transducers (continued): Stain Gages, Load Cells, Proximity Sensors, Pneumatic Sensors, Light Sensors, Tactile Sensors, Fiber Optic Transducers, Digital Transducers, Recent Trends – Smart Pressure Transmitters, Micro Electromechanical Systems.

Signal Condition: Introduction, Functions of Signal Conditioning Equipment, Amplification, Types of Amplifiers, Mechanical Amplifiers Fluid Amplifiers, Optical Amplifiers, Electrical and electronic Amplifiers

Data Acquisition Systems and Conversion: Introduction, Objectives and Configuration of Data Acquisition System, Data Acquisition Systems, Data Conversion, Data/Signal Transmission.

Measurement of Non – Electrical Quantities: Pressure Measurement, Temperature Measurement, Flow Measurement- Electromagnetic Flow meters, Ultrasonic Flow Meters, Thermal Metes, Wire Anemometers. Measurement of Displacement, Measurement of Velocity/ Speed, Measurement of Acceleration, Measurement of Force, Measurement of Torque, Measurement of Shaft Power.

Course Code	UE25EE3506
Course Title	Power Electronics Laboratory

LIST OF EXPERIMENTS:

1) Static Characteristics of SCR.
2) Static Characteristics of MOSFET and IGBT.
3) Characteristic of TRIAC.
4) SCR turn on circuit using synchronized UJT relaxation oscillator for a single-phase controlled rectifier
5) SCR digital triggering circuit for a single-phase controlled rectifier.
6) Single phase controlled full wave rectifier with R load, R –L load, R-L-E load with and without freewheeling diode
7) AC voltage controller using TRIAC and DIAC combination connected to R and RL loads.
8) Speed control of DC motor using single semi converter.
9) Speed control of stepper motor.
10) Speed control of universal motor using ac voltage regulator.
11) Speed control of a separately excited D.C. Motor using an IGBT or MOSFET chopper.
12) Single phase MOSFET/IGBT based PWM inverter.

Course Code	UE25EE3540
Course Title	HVDC TRANSMISSION

Course Content:

GENERAL ASPECTS OF DC TRANSMISSION AND COMPARISON OF IT WITH AC TRANSMISSION: Historical sketch, constitution of EHV AC and DC links, Limitations and Advantages of AC and DC Transmission.

CONVERTER CIRCUITS: Valve Characteristics, Properties of converter circuits, assumptions, single phase, three phase converters, choice of best circuits for HV DC circuits.

ANALYSIS OF THE BRIDGE CONVERTER: Analysis with grid control but no over lap, Analysis with grid control and with over lap less than 60 deg, Analysis with overlap greater than 60 deg, complete characteristics of rectifier, Inversion.

CONTROL OF HVDC CONVERTERS AND SYSTEMS: grid control, basic means of control, power reversal, limitations of manual control, constant current versus constant voltage, desired feature of control, actual control characteristics, constant -minimum -Ignition –angle control, constant –current control, constant –extinction –angle control, stability of control.

Course Code	UE25EE3541
Course Title	Intelligent control system

Course content:

Introduction to Intelligent Control

Review of classical control systems, Need for intelligent control, Comparison of conventional vs intelligent control, Applications in electrical engineering (power systems, drives, etc.).

Fuzzy Logic Control

Fuzzy sets and membership functions, Fuzzy logic operations and inference, Fuzzy rule-based systems, Design of fuzzy controllers, Application: Fuzzy control of DC motor / inverter

Lab/Software: MATLAB Fuzzy Logic Toolbox.

Artificial Neural Networks (ANN)

Introduction to ANN and biological neuron, Supervised learning: Perceptron, Multi-layer Perceptron (MLP), Backpropagation algorithm, Control applications using ANN, ANN-based system identification and control.

Genetic Algorithms (GA) and Evolutionary Computation

Basics of genetic algorithms, Selection, crossover, mutation, Fitness function design, GA-based controller tuning, Hybrid GA with fuzzy/ANN.

Adaptive Control and Reinforcement Learning (RL)

Concept of adaptive control, Model Reference Adaptive Control (MRAC), Introduction to RL and Q-learning, RL for dynamic system control.

Hybrid Intelligent Control Systems

Neuro-fuzzy systems, GA-fuzzy systems, Case studies: smart grid control, renewable energy systems, robotic systems.

Course Code	UE25EE3542
Course Title	Computer Networks

Course Content:

Introduction: Data communication: Components, Data representation, Data flow, Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet. Network Models: TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing, The OSI Model: OSI Versus TCP/IP. Data-Link Layer: Introduction: Nodes and Links, Services, Two Categories of link, Sublayers, Link Layer addressing: Types of addresses, ARP.

Data Link Control (DLC) Services: Framing, Flow and Error Control. Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. Connecting Devices: Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches, Advantages. Wired and Wireless LANs: Ethernet Protocol, Standard Ethernet. Introduction to wireless LAN: Architectural Comparison, Characteristics, Access Control.

Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams. IPv6 addressing and Protocol. Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing.

Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go BackN Protocol, Selective repeat protocol, Piggybacking Transport-Layer Protocols in the Internet: User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Error control, TCP congestion control.

Application Layer: Introduction: providing services, Application- layer paradigms, Standard Client Server Protocols: Hyper Text Transfer Protocol, FTP: Two connections, Control Connection, Data Connection, Electronic Mail: Architecture, Domain Name system: Name space, DNS in internet, Resolution, DNS Messages, Registrars, DDNS, security of DNS. Quality of Service.

Semester-6			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1	UE25EE3601	Power System Analysis and stability	3
2	UE25EE3602	Control Systems Engineering	3
3	UE25EE3603	IoT Applications	3
4	UE25EE3604	Special Electrical Machines	2
5	UE25EE3605	Simulation of Power Electronic Circuits using MATLAB/SIMULINK	2
6	UE25EE3606	Control Systems Engineering laboratory	1
7	UE25EE3640	Energy Management and Audit	3
8	UE25EE3641	Smart Grid Technology	
9	UE25EE3642	Programmable Logic Controller	
10	HG25TCXXXX	Technical Skills	2
11	HG25TPYYYY	Life Skills	0
12	HG25CIVVVV	Innovation and Entrepreneurial Skills	1
13	HG25SAKKKK	Environmental Awareness and Community Services	0
14	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	0
15	HG25SAKKKK	Cultural & Literary Activities	1
16	HG25CC####	Co-Curricular Activities (Seminar/Conference/ Exhibition/Technical Competition)	0
17	HG25TPYYYY	Placement Training	0
		Total	**21**

Course Code	UE25EE3601
Course Title	Power System Analysis & stability

Course Content:

Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks, One-Line Diagram and Impedance or Reactance Diagram, Per Unit (PU) System, Steady State Model of Synchronous Machine, Power Transformer, Transmission of Electrical Power, Representation of Loads.

Symmetrical Fault Analysis: Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine(On No Load), Short Circuit of a Loaded Synchronous Machine, Illustrative simple examples on power systems. Selection of Circuit Breakers.

Symmetrical Components: Introduction, Symmetrical Component Transformation, Phase Shift in Star-Delta Transformers, Sequence Impedances of Transmission Lines, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers.

Unsymmetrical Fault Analysis: Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor Faults.

Power System Stability: Introduction, Dynamics of a Synchronous Machine, Review of Power Angle Equation, Simple Systems, Steady State Stability, Transient Stability, Equal Area Criterion, Factors Affecting Transient Stability, Multi machine stability studies, classical representation

Course Code	UE25EE3602
Course Title	Control Systems Engineering

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Mathematical modelling – Mechanical Systems, Electrical Systems, Analogous Systems. Block diagrams and signal flow graphs: Block diagram reduction techniques, Masson's gain formula, and Transfer functions.

Time Response of feedback control systems: Standard test signals, Unit step response of First and second order Systems. Time response specifications, steady state errors and error constants, Introduction to PI, PD and PID Controllers.

Stability Analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis, Introduction to Root-Locus Techniques, The root locus concepts, Construction of root loci.

Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Introduction to Polar Plots, (Inverse Polar Plots excluded) Nyquist Stability criterion, (Systems with transportation lag excluded) Introduction to lead, lag and lead-lag compensating networks (excluding design).

Introduction to State variable analysis: Introduction, Concept of State, State variables & State model, State model for Linear Continuous & Discrete time systems, Diaganolisation.

Course Code	UE25EE3603
Course Title	IOT APPLICATIONS

Course Content:

Network Basics: Introduction, Network Types-Connection types, Physical Topology, Network Reachability, Layered Network Models-OSI Model, IP suite.

Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components.

IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.

IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

IOT Connectivity Technologies: Introduction, IEEE 802.15.4, Zigbee, Wireless HART, RFID, NFC, ZWave, LoRa, Wi-Fi, Bluetooth

Data Protocols: MQTT, COAP, AMQP, XMPP, REST, Web Socket.

Associate IOT Technology: Cloud Computing: Introduction, Virtualization, Cloud Models, Service Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service. Challenges associated with IOT.

IOT Case Studies and Future Trends: Agricultural IoT–Introduction and Case Studies, Vehicular IoT–Introduction and Case Studies, Healthcare IoT-Introduction and Case Studies.

Course Code	UE25EE3604
Course Title	Special Electrical Machines

Course Content:

Stepper Motor: Introduction, Variable Reluctance Stepper Motor, Permanent Magnet Stepper Motor, Hybrid Stepper Motor, Torque Equation, Characteristics of Stepper Motor, Open – loop Control of Stepper Motor, Closed loop Control of Stepper Motor, Microprocessor – Based Control of Stepper Motor, Applications of Stepper Motor.

Switched Reluctance Motor (SRM): Construction, Principle of Working, Basics of SRM Analysis, Constraints on Pole Arc and Tooth Arc, Torque Equation and Characteristics, Power Converter Circuits, Control of SRM, Rotor Position Sensors, Current Regulators Microprocessor – Based Control of SRM,

Permanent Magnet DC Motor and Brushless Permanent Magnet DC Motor: Permanent Magnet DC (PMDC) motor, Brushless Permanent Magnet DC (BLDC) Motors

Permanent Magnet Synchronous Motor (PMSM): Construction, Principle of Operation, EMF Equation, Torque Equation, Phasor Diagram, Circle Diagram, Comparison of Conventional and PMSM, Control of PMSM, Applications.

Single Phase Special Electrical Machines: AC series Motor, Repulsion Motor, Hysteresis Motor, Single Phase Reluctance Motor, Universal Motor .**Servo Motors:** DC Servo Motors, AC Servo Motors

Permanent Magnet Axial Flux (PMAF) Machines: Comparison of Permanent Radial and Axial Flux Machines, Construction of PMAF Machines, Armature Windings, torque and EMF Equations of PMAF, Phasor Diagram, Output Equation, Pulsating Torque And its Minimization, Control and Applications of PMAF.

Course Code	UE25EE3605
Course Title	Simulation of Power Electronics circuits using Matlab/Simulink

1. Simulate a single phase half wave diode bridge rectifier. Input 100V, 50 Hz. AC supply. At output, resistance of 50 ohms.
2. Simulate a single phase full wave diode bridge rectifier. Input 100V, 50 Hz. AC supply. At output, resistance of 50 ohms.
3. Simulate a single-phase half controlled full wave rectifier. Input 100V, 50 Hz. AC supply. At the output, resistance of 50 ohms.
4. Simulate a single phase fully controlled full wave rectifier. Input 100V, 50 Hz. AC supply. At the output, resistance of 50 ohms.
5. Simulate a buck converter with 20 V DC input, and regulate the output at 10 V by implementing a PI controller for closed loop operation. The out put power to vary from 10 W to 20 W. Ensure that voltage ripple is limited to 1%.
6. Simulate a boost converter with 20 V DC input, and regulate the output at 35 V by implementing a PI controller for closed loop operation. The out put power to vary from 30W to 60 W. Ensure that voltage ripple is limited to 1%
7. Simulate a single phase AC voltage controller using a triac with 100V ,50 Hz. AC supply for an RL load of 10ohms and 2 mH.
8. Simulate a three phase inverter with 180 degree conduction mode with DC input of 100V and a star connected balanced resistive of 40 ohms each. Use IGBT for inverter.
9. Simulate a single phase SPWM inverter with 50V DC input with modulation indices of 0.5, 0.6 and 0.8.connect a resistance of 25 ohms at the output of inverter. Use power Mosfets for inverter.
10. Simulate a three phase inverter with 120 degree mode of conduction. Take input DC voltage of 100V and three phase star connected balanced resistive load of 50 ohms each.

Course Code	UE25EE3606
Course Title	Control Systems Laboratory

Course Content: List of Experimens

1. Experiment to draw speed-torque characteristics of i) DC servo motor ii) AC Servomotor
2. Experiment to draw synchro pair characteristics.
3. Experiment to determine frequency response of second order system.
4. To design a passive RC lead compensating network for the given specifications, viz, the maximumphaseleadandthefrequencyatwhichitoccursandtoobtainthefrequencyresponse
5. To design a passive RC lag compensating network for the given specifications, viz, the maximum phase lag and the frequency at which it occurs and to obtain the frequency response.
6. To determine experimentally the transfer function of the lag compensating network.
7. Experimenttodrawthefrequencyresponsecharacteristicsofthelag–leadcompensator network and determination of its transfer function.
8. To simulate a typical second order system and determine step response and evaluate time response specifications.
9. To examine the relationship between open-loop frequency response and stability.
10. To study the effect of open-loop frequency and closed loop transient response.
11. To study the effect of open loop gain on transient response of closed loop system using root locus.

Course Code	UE25EE3640
Course Title	Energy management and Audit

Course Content:

Introduction: General principles of Energy management and Energy management planning. Peak Demand controls, Methodologies, Types of Industrial Loads, Optimal Load scheduling

Energy management opportunities in Lighting and Motors. Electrolytic Process and Electric heating

Types of boilers, Combustion in boilers, Performances evaluation, Feed water treatment, Blow down, Energy conservation opportunities in boiler.

Properties of steam: Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system, Identifying opportunities for energy saving Classification, General fuel economy measures in furnaces, Excess air, Heat Distribution, Temperature control, Draft control, Waste heat recovery.

HVAC system: Coefficient of performance, Capacity, Factors affecting Refrigeration and Air conditioning system performance and savings opportunities. Classification and Advantages of Waste Heat Recovery system, analysis of waste heat recovery for Energy saving opportunities.

Energy audit -Definition, Need, Types of energy audit, Energy audit Instruments. Cogeneration-Types and Schemes, Optimal operation of cogeneration plants Computer aided energy management.

Economic analysis methods-cash flow model, time value of money, evaluation of proposals, pay-back method, average rate of return method, internal rate of return method, present value method, life cycle costing approach.

Course Code	UE25EE3641
Course Title	Smart Grid Technology

Course Content:

Introduction: Concept of Smart Grid, Difference between conventional and smart grid, Early smart grid initiatives, Opportunities and barriers of smart grid, technologies required for smart grid, core applications of smart grid, demand response and demand side integration, representative architecture of smart grid, functions of various smart grid components.

Smart Grid Architecture and Communication: Smart Grid architecture: Layered model, Functional blocks, Two-way communication technologies: PLC, ZigBee, Wi-Fi, 5G Interoperability and standards (IEC, NIST)

Smart Meters and AMI (Advanced Metering Infrastructure): Smart meters: Functions, components, advantages, Communication protocol, AMI architecture and working, Meter Data Management Systems (MDMS)

Renewable Energy Integration and Micro grids: Distributed Energy Resources (DER): Solar, Wind, Challenges of integration: intermittency, grid balancing, Micro grid definition, types, control strategies, Grid-connected and islanded operation

Power Electronics and Energy Storage in Smart Grid: Role of power converters (inverters, converters, FACTS), Importance of energy storage (battery, flywheel, SMES), Demand Response, Load shaping, Smart inverters and grid synchronization

Wide Area Measurement Systems (WAMS) and SCADA: Phasor Measurement Units (PMUs), WAMS architecture and applications, Supervisory Control and Data Acquisition (SCADA) in Smart Grid, Synchro phasor technology

Emerging Trends and Smart Grid Applications: Cybersecurity and Standards in Smart Grids, AI/ML in smart grid: Forecasting, fault detection, Electric Vehicles (EVs) and V2G, Block chain for energy trading, Indian initiatives: NSGM, Smart Meters National Programme (SMNP)

Course Code	UE25EE3642
Course Title	Programmable Logic Controller

Course Content:

Introduction to PLCs: • Definition, History, and Evolution of PLCs, Architecture and Components of a PLC, Types of PLCs: Modular, Compact, Rack-mounted, Comparison with Relay Logic Systems, Advantages, Limitations, and Applications of PLCs

PLC Hardware and Wiring: • Power Supply, CPU, Input/Output Modules, Discrete vs Analog Inputs/Outputs, Sensor and Actuator Interfacing, Wiring Diagrams and Input/Output Addressing Safety and Grounding Practices

Programming Basics: Programming Languages (IEC 61131-3): Ladder Logic, FBD, STL, Logic Gates in PLC Programming, Bit-level Programming: Latch, Unlatch, Set/Reset, Timers and Counters (TON, TOF, CTU, CTD)

Intermediate Programming Techniques: Comparison, Arithmetic Instructions, Move and Logical Instructions, Sequencing and Process Control, Subroutines, Jump Instructions, Data Handling: Shift Registers, Arrays

Advanced PLC Functions and Communication: Analog Signal Processing in PLCs, PID Control using PLC, SCADA Integration Basics, Communication Protocols (RS-232, Modbus, Profibus), HMI Design and Data Logging

Industrial Applications and Troubleshooting: PLC in Conveyor Systems, Packing Machines, Elevators, Debugging Techniques and Diagnostics, Error Codes and Troubleshooting Methods, Energy Management with PLCs

Capstone Project and Emerging Trends: Smart Home Automation using PLC, PLC-based Industrial Sorting System, IoT Integration with PLC, Industry 4.0 and Smart Manufacturing, Future Trends: Cloud PLCs, Edge Devices, Cybersecurity.

Semester-7			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1	UE25EE4701	Computer Techniques in Power System	3
2	UE25EE4702	Energy Storage and Technologies	3
3	UE25EE4703	High Voltage & Power System Protection	3
4	UE25EE4704	Industrial Drives and Automation	3
5	UE25EE4780	Electrical Installation and Safety	2
6	UE25EE4781	Psychology for Everyday Life	
7	UE25EE4782	Aptitude Development for Career Readiness	
8	UE25EE4705	Capstone Project Phase-1	4
9	HG25TCXXXX	Technical Skills	0
10	HG25TPYYYY	Life Skills	0
11	HG25CIVVVV	Innovation and Entrepreneurial Skills	0
12	HG25SAKKKK	Environmental Awareness and Community Services	0
13	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	0
14	HG25SAKKKK	Cultural & Literary Activities	1
15	HG25CC####	Co-Curricular Activities (Seminar/Conference/ Exhibition/Technical Competition)	1
16	HG25TPYYYY	Placement Training	0
		Total	**20**

Course Code	UE25EE4701
Course Title	Computer Techniques in Power System

Course Content:

Network Topology: Introduction and basic definitions of Elementary graph theory Tree, cut-set, loop analysis. Formation of Incidence Matrices. Primitive network- Impedance form and admittance form, Formation of Y Bus by Singular Transformation. Ybus by Inspection Method. Illustrative examples.

Fundamentals of Load Flow Studies: Introduction, Classification of buses. Power flow equation, Operating Constraints, Data for Load flow, Gauss Seidal iterative method. Illustrative examples. Newton-Raphson method derivation in Polar form, Fast decoupled load flow method, Flow charts of LFS methods. Comparison of Load Flow Methods. Illustrative examples.

Economic Operation of Power System: Introduction and Performance curves Economic generation scheduling neglecting losses and generator limits Economic generation scheduling including generator limits and neglecting losses Economic dispatch including transmission losses Derivation of transmission loss formula. Illustrative examples.

Unit Commitment: Introduction, Constraints and unit commitment solution by prior list method and dynamic forward DP approach (Flow chart and Algorithm only).

Symmetrical Fault Analysis: Z Bus Formulation by Step by step building algorithm without mutual coupling between the elements by addition of link and addition of branch. Illustrative examples. Z bus Algorithm for Short Circuit Studies excluding numerical.

Course Code	UE25EE4702
Course Title	Energy storage technologies and applications

Course Content:

Introduction to Energy Storage Systems: Need for energy storage in modern power systems**,** Classification of energy storage technologies**,** Performance metrics: energy density, power density, efficiency, and cycle life**,** Applications in renewable energy integration, grid stability, and electric vehicles

Electrochemical Energy Storage: Fundamentals of electrochemical storage**,** Battery technologies: Lead-Acid, Nickel-Cadmium, Nickel-Metal Hydride, Lithium-Ion, and Solid-State Batteries**,** Battery performance characteristics and degradation mechanisms**,** Battery management systems (BMS) and safety considerations

Mechanical and Thermal Energy Storage: Mechanical Storage: Flywheels, Compressed Air Energy Storage (CAES), and Pumped Hydro Storage (PHS)**, Thermal Storage:** Sensible heat storage, Latent heat storage, and Thermochemical storage**,** Efficiency, advantages, and limitations of mechanical and thermal storage

Electrical and Thermal Storage Technologies: Electrical Storage: Supercapacitors and superconducting magnetic energy storage (SMES)**,** Thermal storage: Sensible heat, Latent heat, Thermochemical, Use in solar and industrial systems

Applications of Energy Storage: Grid applications: Load levelling, peak shaving, frequency regulation, Renewable energy integration: Solar PV, Wind, EVs and hybrid systems, UPS and power quality systems, Micro grids and off-grid systems

Course Code	UE25EE4703
Course Title	High voltage & Power System Protection

Course Content:

Conduction and Breakdown in Gases, liquid, solid dielectrics: Gases as Insulating Media, Ionization Processes, Townsend's Current Growth Equation Townsend's Criterion for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non- Uniform Fields and Corona Discharges, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids, Different types of break studies in solid dielectics.

Generation of High Voltages and Currents: Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators.

Measurement of High Voltages and Currents: Measurement of High Voltages: DC, AC and Impulse, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillography for Impulse Voltage and Current Measurements.

Introduction to power system protection: Need for protective systems, nature and causes of faults, types of faults and it's effects, zones of protection, primary and back-up protection, essential qualities of protection, classification of protective relays, current transformers (ct) for protection, voltage transformers (vt)

Overcurrent protection: Time-current characteristics, current setting, time setting, overcurrent protective, directional relays, protection of parallel feeders, earth fault and phase fault protection, directional earth fault relay, static overcurrent relays, numerical overcurrent relays

Distance protection, differential protection and pilot relaying: Introduction, impedance relay, differential relays- Simple differential relay, Percentage differential relay, Balanced voltage differential relay, wire pilot protection and carrier current protection.

Transformer and Bus zone Protection: Types of Faults Encountered in Transformers, Percentage Differential Protection, Overheating Protection, Protection against Magnetizing Inrush Current, Buchholz Relay, Protection of earthing transformer, BUSZONE PROTECTION: Differential Current Protection, High Impedance Relay Scheme.

Course Code	UE25EE3704
Course Title	INDUSTRIAL DRIVES AND APPLICATIONS

Course Content:

Electrical Drives: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of DC and ac Drives. Dynamics of Electrical Drives: Fundamental Torque Equations, Speed Torque Conventions and Multi-quadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability. Control Electrical Drives: Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives

Direct Current Motor Drives: Controlled Rectifier Fed DC Drives, Single Phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Single Phase Half Controlled Rectifier Control of DC Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of DC Separately Excited Motor, Multi-quadrant Operation of DC Separately Excited Motor Fed Form Fully Controlled Rectifier, Rectifier Control of DC Series Motor, Chopper Control of Separately Excited DC Motor, Chopper Control of Series Motor.

Induction Motor Drives: Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing, Operation with Unbalanced Rotor Impedances, Analysis of Induction Motor Fed from Non-Sinusoidal Voltage Supply, Starting, Braking, Transient Analysis. Speed Control Techniques-Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources.

Induction Motor Drives (continued): Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control, current regulated voltage source inverter control, speed control of single-phase induction motors.

Course Code	UE25EE4780
Course Title	Electrical installation and safety

Course Content

Basics of Electrical Installations: Types of electrical installations: Residential, Commercial, Industrial Standard voltages and systems (single-phase, three-phase). Wiring systems: PVC conduit, surface and concealed wiring, Electrical symbols, wiring diagrams, and installation drawings, Selection of wires and cables, ratings, and current-carrying capacity, Introduction to IE Rules and IS codes.

Components and Wiring Practices: Switches, sockets, MCBs, ELCBs, RCCBs, Fuses – types and applications, Earthing: Purpose, types (plate, pipe, strip), IS standards, Estimation and costing of wiring installations, Load calculations and demand factor, Overview of lighting systems: LED, fluorescent, emergency lighting. Tools and instruments for electrical installation.

Electrical Safety Fundamentals: Electric shock: Causes, effects, and treatment (first aid), Safety signs, colour codes, and personal protective equipment (PPE), Fire hazards and fire extinguishers in electrical environments, Safe operating procedures and lock-out/tag-out systems, Safety in overhead and underground installations, Importance of insulation, grounding, and isolation.

Testing, Inspection & Maintenance: Testing of wiring installations: Insulation resistance, polarity, earth continuity, Periodic inspection and documentation, Preventive and predictive maintenance of installations, Introduction to fault detection and troubleshooting, Megger and other testing instruments, Legal and regulatory requirements: BIS, IE Rules, IS 732

Codes, Standards & Case Studies: Overview of national and international standards (IS 3043, IS 732, NEC, IEC), Electrical installation in hazardous areas (Zone classifications), Recent trends in electrical safety: Smart safety devices, Case studies on electrical accidents and their root cause analysis, Role of safety audit and certification, Energy conservation and safe design principles.

Course Code	UE25EE4781
Course Title	Psychology for everyday life

Course Content:

Introduction to Psychology and Self-Awareness

What is Psychology? Branches and real-life relevance, Psychology in engineering, technology, and innovation, Self-concept, self-esteem, and self-awareness, Growth vs. fixed mindset (Carol Dweck), Personality types (Big Five Traits, MBTI basics), Reflection and journaling exercises.

Emotional Intelligence and Stress Management

Understanding emotions and emotional intelligence (Daniel Goleman),Self-regulation, motivation, empathy, social skills, Identifying stress triggers in student life, Coping mechanisms and stress reduction techniques, Mindfulness, relaxation, and breathing techniques

Communication and Interpersonal Skills

Verbal and non-verbal communication, Active listening and assertiveness, Conflict resolution and giving/receiving feedback, Team dynamics in academic and engineering projects, Empathy and cultural sensitivity.

Decision-Making, Habits, and Behavior Change

Cognitive biases in decision-making (confirmation bias, availability heuristic), Goal setting using SMART and WOOP frameworks, Habit formation and breaking bad habits (cue-routine-reward), Time management and procrastination, Willpower and self-control.

Motivation, Well-being, and Life Skills

Intrinsic vs. extrinsic motivation, building resilience and optimism, Flow theory and finding purpose, Balancing academic, social, and personal life, psychological well-being and happiness.

Course Code	UE25EE4782
Course Title	Aptitude Development for Career Readiness

Course content:

Quantitative Aptitude – I: Number Systems, HCF & LCM, Simplifications, Ratio & Proportion, Percentages, Profit & Loss, Simple & Compound Interest, Time & Work, Time & Distance, Averages, Mixtures, and Allegations.

Quantitative Aptitude – II: Permutations & Combinations, Probability, Algebra (Linear & Quadratic Equations), Geometry & Mensuration Basics, Data Interpretation (Bar, Line, Pie charts).

Logical Reasoning: Series, Coding-Decoding, Blood Relations, Directions, Puzzles, Seating Arrangements, Syllogisms, Statements & Conclusions, Clocks & Calendars, Data Sufficiency, Venn Diagrams.

Verbal Ability: Vocabulary Building (Synonyms, Antonyms), Reading Comprehension, Para Jumbles, Sentence Correction, Idioms & Phrases, Spotting Errors, Cloze Tests, Basics of Technical Writing (Resume/Email).

Career Readiness & Employability Skills: Resume Writing, Cover Letters, Group Discussion Techniques, Personal Interview Skills (Mock Interviews), Presentation Skills, Goal Setting & Time Management.

Semester-8			
Sl. No.	**Course Code**	**Course Title**	**Credits**
1	UE25EE4801	AI Techniques in Electrical Engineering	2
2	UE25EE4880	Green Mobility	2
3	UE25EE4881	Leadership and Team Management	
4	UE25EE4882	Art, Culture, and Human Civilization	
5	UE25EE4802	Capstone Project Phase-II	6
6	UE25EE4803	Internship	4
7	HG25TCXXXX	Technical Skills	0
8	HG25TPYYYY	Life Skills	0
9	HG25CIVVVV	Innovation and Entrepreneurial Skills	1
10	HG25SAKKKK	Environmental Awareness and Community Services	0
11	HG25SAKKKK	Athletics, Sports, Yoga, Gymnasium	0
12	HG25SAKKKK	Cultural & Literary Activities	0
13	HG25CC####	Co-Curricular Activities (Seminar/Conference/ Exhibition/Technical Competition)	1
14	HG25TPYYYY	Placement Training	0
		Total	**16**

Course Code	UE25EE4801
Course Title	AI techniques in electrical engineering

Course Content:

Sparsity oriented Programming: Introduction, physical structure and sparsity, pivoting, conservation of sparsity by optimal ordering of buses, schemes for ordering, UD table storage scheme.

Artificial Intelligence: What is AI? Definitions, history and evolution, essential abilities of intelligence, AI applications.

Problem solving: problem characteristics, problem search strategies, forward and backward reasoning, AND-OR graphs, game trees, search methods- informed and uninformed search, bread the first search and depth first search methods

Knowledge representation: logical formalisms: propositional and predicate logic: syntax and semantics, wffs, clause form expression s, resolution-use of RRTs for proofs and answers, examples from electric power systems, Non monotonic logic: TMS, modal, temporal and fuzzy logic.

a) Structured representation of knowledge: ISA/ISPART trees, semantic nets, frames and scripts, examples from electric systems.

b) Expert systems: Basic components, forward and backward chaining, ES features, ES development, ES categories, ES tools and examples from electric drive systems.

AI languages: LISP and ProLog- Introduction, sample segments, Lisp primitives, list manipulation functions, function predicates, variables, iteration and recursion, property lists, sample programs for examples from electric power systems.

Course Code	UE25EE4880
Course Title	GREEN MOBILITY

Course content:

Fundamentals of Green Mobility: Definition and scope of green mobility**,**Sustainable transport systems**,**Need for green mobility: Environmental, economic & social impacts**,**Carbon footprint and emissions in the transport sector**,**Policy frameworks: National Electric Mobility Mission Plan (NEMMP), FAME India Scheme**,** Global best practices .

Electric Vehicles and Clean Fuels: Basics of electric vehicles (EVs): BEVs, PHEVs, HEVs,Hydrogen fuel cell vehicles, Biofuels, CNG, LNG – potential and challenges, Vehicle efficiency standards and regulations, Lifecycle analysis: EVs vs. Internal Combustion Engines, Battery technologies & energy storage systems.

Infrastructure for Green Mobility: Public transport systems and non-motorized transport (NMT),Charging infrastructure and renewable energy integration, Smart cities and green mobility planning,Urban mobility plans (UMPs),Last-mile connectivity and rural mobility, Role of smart grids and IoT in mobility.

Mobility as a Service (MaaS) & Policy Integration: Shared mobility: Ride-hailing, carpooling, bike-sharing, Integration of multi-modal transport systems, Data-driven mobility planning, Policies promoting green logistics and supply chains, Institutional roles: NITI Aayog, MoRTH, state-level transport authorities, Green mobility indicators and measurement tools.

Challenges, Innovations & Future Trends: Challenges in implementation: financial, behavioral, policy, Role of startups in green mobility (e.g., Ather, Yulu, BluSmart),Innovations in sustainable transport: autonomous EVs, hyperloop, drone logistics, International case studies: Amsterdam, Copenhagen, Singapore, Research frontiers in green mobility ,Career & entrepreneurship opportunities

Course Code	UE25EE4881
Course Title	Leadership and Team Management

Course Content:

Introduction to Leadership: Definition and Importance of Leadership, Characteristics of Effective Leaders, Leadership vs Management, Leadership Styles (Autocratic, Democratic, Transformational, etc.), Leadership in Engineering Context

Self-Leadership & Emotional Intelligence: Self-awareness and Personal Leadership Style, Emotional Intelligence and its Role in Leadership, Self-regulation, Motivation, Empathy, and Social Skills, Tools for Self-Assessment and Reflection, Case study on Leadership Journey

Team Building and Group Dynamics: Characteristics of Effective Teams, Stages of Team Development (Forming, Storming, Norming, Performing), Roles in a Team (Belbin's Team Roles), Team Communication and Conflict Resolution, Case study and Role Play Activity

Leadership in Action (4 hours): Decision Making and Problem Solving Techniques, Delegation and Empowerment, Time Management and Goal Setting, Agile Leadership in Project Management, Leadership in Startups and Innovation

Communication & Influencing Skills : Verbal and Non-verbal Communication, Public Speaking and Presentation Skills, Persuasion and Negotiation, Cross-cultural Communication in Teams, Leadership Communication Simulation

Ethical Leadership & Social Responsibility : Ethics and Values in Leadership, Leadership Failures and Ethical Dilemmas, Sustainable Leadership, Leadership for Social Impact.

Leadership for Career Growth: Building Leadership Portfolio, Leadership in Professional Organizations, Networking and Mentoring, Resume Building and Interview Tips for Leadership Roles.

Course Code	UE25EE4882
Course Title	Art, Culture and Human Civilization

Course Content:

Introduction to Culture and Civilization: Definitions and scope of culture and civilization, Evolution of human societies: From nomadic to agrarian to industrial, Characteristics of early civilizations: Mesopotamia, Egypt, Indus Valley, and China, Culture vs. civilization: Interrelationships and distinctions, Role of language, religion, and family in shaping cultures, Importance of intangible and tangible heritage.

Indian Art and Culture: Overview of Indian cultural heritage, Vedic and classical traditions: Literature, philosophy, and performing arts, Indian architecture: From Harappan to modern times, Dance, music, and folk traditions across India, Festivals and rituals as expressions of cultural identity, Unity in diversity: Regional and linguistic plurality.

World Art and Cultural Movements: Western classical civilization: Greek, Roman contributions, Renaissance, Enlightenment, and Romanticism, Islamic Art and Architecture, African, East Asian, and Latin American cultural contributions, Modern and Postmodern art movements, Cross-cultural influences in the age of globalization.

Science, Technology, and Human Civilization: Interplay of science, art, and culture, Industrial revolution and its socio-cultural impact, Inventions that transformed societies (printing press, electricity, and internet), Ethical dimensions of scientific progress, Contemporary digital culture and virtual communities, Technology and cultural preservation.

Contemporary Issues and Cultural Responsibility: Cultural conflicts and global peace, Cultural imperialism and resistance, Role of media and cinema in shaping culture ,Environmental ethics and sustainable civilization, Art, activism, and social change, Promoting cultural literacy and sensitivity in engineering.

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