Institute of Engineering and Technology, Lucknow

Evaluation Scheme

&

Syllabus

for

B. Tech. (2nd Year)

in

Electrical Engineering

Based on

CHOICE BASED CREDIT SYSTEM (CBCS)

(Effective from the session: 2023-24)

Department of Electrical Engineering

Institute of Engineering and Technology, Lucknow

(Constituent Institute of Dr. A.P.J. Abdul Kalam Technical University, Lucknow)

EVALUATION SCHEME- B. TECH 2nd YEAR (ELECTRICAL ENGINEERING)

SEMESTER-III															
S. No.	Subject Code	Subject	Type of Course	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	IOE300-310/ IAS303	Inter-Departmental Course of Related Branch / Maths III	ES/BS	3	1	0	20	10	30	--	70	--	100	4
2	IAS301/ IVE301	Technical Communication/ Universal Human values	HS/VE	3	0	0	20	10	30	--	70	--	100	3
3	IEE301	Electromagnetic Field Theory	PC	3	1	0	20	10	30	--	70	--	100	4
4	IEE302	Electrical Measurements & Instrumentation	PC	3	1	0	20	10	30	--	70	--	100	4
5	IEE303	Basic Signals & Systems	PC	3	1	0	20	10	30	--	70	--	100	4
6	IEE351	Basic Signals & Systems Lab	PL	0	0	2	--	--	--	50	--	50	100	1
7	IEE352	Electrical Measurements and Instrumentation Lab	PL	0	0	2	--	--	--	50	--	50	100	1
8	IEE353	Electrical Workshop	PL	0	0	2	--	--	--	50	--	50	100	1
9	IEE354	Mini Project-I or Internship Assessment*	PL	0	0	2	--	--	--	50	--	50	100	1
10	INC301/ INC302	Computer System Security/Python Programming	VA	3	0	0	20	10	30	--	70	--		00
		Total		18	4	8							900	23

* Assessment of Mini Project or Internship done after IInd Semester

Abbreviation Used:

- BS: Basic Science Course
- ES: Engineering Science Course
- HS: Humanities and Social Science Course
- PC: Program Course
- PL: Program LAB
- VE: Value Education Course
- VA: Value Added Course

SEMESTER-IV															
S. No.	Subject Code	Subject	Type of Course	Periods			Evaluation Scheme				End Semester		Total	Credit
				L	T	P	CT	TA	Total	PS	TE	PE		
1	IOE400-410/ IAS403	Maths III/ Inter Departmental Course of Related Branch	BS/ES	3	1	0	20	10	30	--	70	--	100	4
2	IAS401/ IVE401	Universal Human values/ Technical Communication	VE/ HS	3	0	0	20	10	30	--	70	--	100	3
3	IEE401	Analog & Digital Electronics	PC	3	1	0	20	10	30	--	70	--	100	4
4	IEE402	Electrical Machine - I	PC	3	1	0	20	10	30	--	70	--	100	4
5	IEE403	Network Analysis & Synthesis	PC	3	1	0	20	10	30	--	70	--	100	4
6	IEE451	Analog & Digital Electronics Lab	PL	0	0	2	--	--	--	50	--	50	100	1
7	IEE452	Electrical Machine -I Lab	PL	0	0	2	--	--	--	50	--	50	100	1
8	IEE453	Network Lab	PL	0	0	2	--	--	--	50	--	50	100	1
9	IEE454	Mini Project-II	PL	0	0	2	--	--	--	50	--	50	100	1
10	INC401/ INC402	Computer System Security/Python Programming	VA	3	0	0	20	10	30	--	70	--	--	00
		Total		18	4	8							900	23

Abbreviation Used:

BS: Basic Science Course
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PC: Program Course
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VE: Value Education Course
VA: Value Added Course

IEE301 ELECTROMAGNETIC FIELD THEORY

LTP 3 1 0

	Course Outcomes	Cognitive Level
	After completing the course the students will be able to:	
CO1	Apply different coordinate systems and their application in electromagnetic field theory, establish a relation between any two coordinate systems and also understand the vector calculus.	Apply
CO2	Understand the concept of static electric field, current and properties of conductors. Establish boundary conditions and to calculate capacitances of different types of capacitors.	Analyze
CO3	Understand the concept of static magnetic field, magnetic scalar and vector potential.	Analyze
CO4	Understand the forces due to magnetic field, magnetization, magnetic boundary conditions and inductors.	Analyze
CO5	Understand displacement current, time varying fields, propagation and reflection of EM waves and transmission lines.	Apply

UNIT I

Coordinate Systems and Transformation: Basics of Vectors: Addition, subtraction and multiplications; Cartesian, Cylindrical, Spherical transformation. Vector calculus: Differential length, area and volume, line surface and volume integrals, Del operator, Gradient, Divergence of a vector, Divergence theorem, Curl of a vector, Stokes's theorem, Laplacian of a scalar.

UNIT II

Electrostatic fields: Coulombs law and field intensity, Electric field due to charge distribution, Electric flux density, Gausses' Law- Maxwell's equation, Electric dipole and flux line, Energy density in electrostatic fields, Electric field in material space: Properties of materials, convection and conduction currents, conductors, polarization in dielectrics, Dielectric-constants, Continuity equation and relaxation time, boundary conditions, Electrostatic boundary value problems: Poisson's and Laplace's equations, Capacitance.

UNIT III

Magneto statics: Magneto-static fields, Biot - Savart's Law, Ampere's circuit law, Maxwell's equation, Application of ampere's law, Magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, magnetic scalar and vector potential.

UNIT IV

Magnetic forces: Materials and devices, Forces due to magnetic field, Magnetic torque and moment, a magnetic dipole. Magnetization in materials, Magnetic boundary conditions, Inductors and inductances, Magnetic energy.

UNIT V

Waves and Applications: Maxwell's equation, Faraday's Law, transformer and motional electromotive forces, Displacement current, Maxwell's equation in point form and integral form.

Electromagnetic wave propagation: Wave propagation in loss dielectrics, Plane waves in lossless dielectrics, Plane waves in free space. Plain waves in good conductors, Power and the pointing vector, Reflection of a plain wave in a normal incidence. Transmission Lines and Smith Chart.

Text/ Reference Books:

1. MNO Sadiku, "Elements of Electromagnetic", Oxford University Press.
2. W.H. Hayt and J. A. Buck, "Engineering Electromagnetic", McGraw-Hill Education.
3. Joseph A. Edminister, "Schaum's Outline of Electromagnetics", McGraw-Hill.

IEE302 ELECTRICAL MEASUREMENTS & INSTRUMENTATION

LTP 3 1 0

Pre-requisites: Basic Electrical Engineering

	Course Outcomes	**Cognitive Level**
	After completing the course the students will be able to:	
CO1	Evaluate errors in measurement and identify and use different types of instruments to measure voltage, current, power and energy.	Evaluate
CO2	Apply the knowledge of measurement of electrical quantities resistance, inductance and capacitance with the help of bridges.	Apply
CO3	Understand the working of instrument transformers and calculate the errors in current and potential transformers.	Understand
CO4	Demonstrate the working of electronic instruments like digital voltmeters, multi-meters and frequency meters.	Apply
CO5	Identify the transducers in specific applications for measuring physical quantities like motion, force, pressure, temperature, flow and liquid level.	Understand

UNIT I

Electrical Measurements: Instruments and Measurement system, Measurement of system performance, Methods of measurement, Errors in Measurement and measurement standards, Review of indicating and integrating instruments: PMMC, Moving Iron and Electrodynamometer Type Voltmeter, Ammeter and Wattmeter.

UNIT II

Measurement of Resistance, Inductance and Capacitance: Measurement of low, medium and high resistances, insulation resistance measurement, AC bridges for inductance and capacitance measurement.

UNIT III

Instrument Transformers: Construction, types and working of Current and Potential transformers, ratio and phase angle errors and testing.

UNIT IV

Electronic Measurements: Merits and Demerits of Digital Instruments over Analog Ones: Digital Multimeter, Digital Frequency Meter, Digital Voltmeters (DVMs), Time, Frequency and phase angle measurements using CRO; Storage oscilloscope, Spectrum and wave analyser, Digital counter, frequency meter.

UNIT V

Instrumentation: Transducers & and sensors, classification and selection of sensors, Electrical Transducers, Strain Gauges, Electromagnetic Flow Meter, Measurement of temperature using Thermistors and Thermocouples, Measurement of displacement using LVDT, Basic Components of Data Acquisition Systems, Concept of smart sensors and virtual instrumentation.

Text/ Reference Books:

1. Prithwiraj Purkait, Budhaditya Biswas and Santanu Das "Electrical and Electronics Measurements and Instrumentation" McGraw Hill Education (India) Private Limited.
2. A K Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai & Sons, India.
3. BC Nakra & K. Chaudhary, "Instrumentation, Measurement and Analysis," Tata McGraw Hill.

IEE303 BASIC SIGNALS & SYSTEMS

LTP 3 1 0

Pre-requisites: Basic Electrical Engineering, Engineering Mathematics

	Course Outcomes	**Cognitive Level**
	After completing the course the students will be able to:	
CO1	Represent the various types of signals & systems and can perform mathematical operations on them.	Understand
CO2	Analyze the response of LTI system to Fourier series and Fourier transform and to evaluate their applications to network analysis.	Analyze
CO3	Analyze the properties of continuous-time signals and systems using Laplace transform and determine the response of linear systems to known inputs.	Analyze
CO4	Implement the concepts of Z transform to solve complex engineering problems using difference equations.	Apply
CO5	Develop and analyze the concept of state-space models for SISO & MIMO systems.	Analyze

UNIT I

Introduction to Continuous Time Signals and Systems: Introduction to continuous time and discrete time signals, Classification of signals with their mathematical representation and characteristics. Transformation of independent variable, Introduction to various types of system, basic system properties.

Analogous System: Linear& Rotational mechanical elements, force-voltage and force-current analogy, modelling of mechanical and electro-mechanical systems: Analysis of first and second order linear systems by classical method.

UNIT II

Fourier Transform Analysis: Exponential form and Compact trigonometric form of Fourier series, Fourier symmetry, Fourier transform: Properties, application to network analysis. Definition of DTFS, and DTFT, Sampling Theorem.

UNIT III

Laplace Transform Analysis: Review of Laplace Transform, Properties of Laplace Transform, Initial and final value Theorems, Inverse Laplace Transform, Convolution Theorem, Impulse response, Application of Laplace Transform to analysis of networks, waveform synthesis and Laplace Transform to complex waveforms.

UNIT IV

State – Variable analysis: Introduction, State Space representation of linear systems, Transfer function and state Variables, State Transition Matrix, Solution of state equations for homogeneous and non-homogeneous systems, Applications of State – Variable technique to the analysis of linear systems.

UNIT V

Z – Transform Analysis: Concept of Z – Transform& ROC, Z – Transform of common functions, Inverse Z – Transform, Initial & Final value Theorems, Applications to the solution of difference equations, Properties of Z-transform.

Text/ Reference Books:

1. David K. Cheng; "Analysis of Linear System", Narosa Publishing Co.
2. Donald E. Scott, "Introduction to circuit Analysis" Mc. Graw Hill.
3. B. P. Lathi, "Linear Systems & Signals" Oxford University Press
4. J. Nagrath, S.N. Saran, R. Ranjan and S. Kumar, "Signals and Systems", Tata Mc. Graw Hill.
5. M. E. Van-Valkenberg; " Network Analysis", Prentice Hall of India.

IEE351 BASIC SIGNALS AND SYSTEMS LAB

LTP 0 0 2

	Course Outcomes	**Cognitive Level**
	After completing the course the students will be able to:	
CO1	Recognize, sketch, manipulate and perform basic operations on basic signals commonly used in engineering applications	K_3
CO2	Compare signals based on properties like linearity, energy, power and duration.	K_4
CO3	Understand and interpret the magnitude and phase spectrum of continuous and discrete time LTI systems	K_2
CO4	Plot and analyze poles and zeros of continuous and discrete LTI systems and determine the performance characteristics, such as stability and frequency response.	K_4
CO5	Represent and analyse the systems in state space form.	K_5

List of Experiments:

1. To generate various signals and sequences (Periodic and Aperiodic), such as Unit Impulse, Unit Step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, Sinc.
2. Operations on signals and sequences such as Addition, Multiplication, Scaling, Shifting, and Folding.
3. Computation of energy and average power for a signal.
4. To find the Even and Odd parts of the signal/sequence and the real and imaginary parts of the signal.
5. Convolution between Signals and sequences.
6. To analyse the Fourier series of continuous-time signals.
7. To find the Fourier Transform of a given signal and plot its magnitude and phase spectrum.
8. Determination of real and imaginary parts of the DTFT of the sequences.
9. Locating the zeros and poles and plotting the pole-zero maps in S-plane and Z-plane for the given transfer function.
10. Locating pole-zero plot in S-plane and analysis of stability.
11. Verification of linearity properties of a given continuous/discrete system.
12. State space representation of LTI systems.
13. To verify the sampling theorem.

IEE352 ELECTRICAL MEASUREMENT & INSTRUMENTATION LAB

LTP 0 0 2

	Course Outcomes	**Cognitive Level**
	After completing the course the students will be able to:	
CO1	Understand the importance of calibration of measuring instruments.	Understand
CO2	Demonstrate the construction and working of different AC and DC bridges, along with their applications	Apply
CO3	Ability to measure electrical engineering parameters like voltage, current, power & phase difference in industry as well as in power generation, transmission and distribution sectors.	Understand
CO4	Demonstrate the construction and working of different measuring instruments.	Apply
CO5	Capability to analyze and solving the variety of problems in the field of electrical measurements.	Understand

List of Experiments:

1. Calibration of AC voltmeter and AC ammeter.
2. Measurement of inductance using Maxwell's Bridge.
3. Measurement of capacitance using Schering Bridge.
4. Measurement of low resistance using Kelvin's Double Bridge.
5. Measurement of Power using CT and PT.
6. Measuring displacement using LVDT.
7. Measuring temperature using thermocouple.
8. Measuring pressure using piezoelectric pick up.
9. Measurement of speed of DC motor by photoelectric pick up.
10. Speed measurement using Hall Effect sensor.
11. PC based data logging of temperature sensor using LabVIEW/ MATLAB.
12. Signal conditioning of Analog signal using LabVIEW/ MATLAB.
13. Implementation of Mini Project using Analog Electronics and other components.

IEE353 ELECTRICAL WORKSHOP LAB

LTP 0 0 2

	Course Outcomes	Cognitive Level
	After completing the course the students will be able to:	
CO1	Perform various types of Electrical connections.	Apply
CO2	Develop small circuits on PCB.	Create
CO3	Differentiate between various electrical wires, cables and accessories.	Apply
CO4	Demonstrate the layout of the electrical substation and various safety measures.	Understand

List of Experiments:

1. To study the working and Control of two lamps in series and in parallel.
2. To perform the staircase working and it's testing.
3. To study the working principle and wiring of fluorescent lamps.
4. To study and wiring of distribution board, including power plug, using isolator, MCB, and ELCB.
5. To study and estimate a typical, BHK house wiring.
6. Familiarization, soldering, testing and observing the waveforms on CRO of an HW and FW uncontrolled rectifier (using diodes) with a capacitor filter.
7. Visit your college substation and familiarize the supply system, Transformer, HT Panel Distribution, etc.
8. To study construction, working and application of workshop tools. Also, study the Electrical and Electronics Symbols.
9. To study the wires, cables and their gauges, Domestic Electrical Accessories.
10. Mini Project on PCB.
11. To study faults, Remedies in Domestic Installation and Indian Electricity Rules.
12. To study the different types of earthing systems and measure the earth's resistance.

IEE401 ANALOG & DIGITAL ELECTRONICS

LTP 3 1 0

Pre-requisites: Basic Electronics Engineering

	Course Outcomes	**Cognitive Level**
	After completing the course the students will be able to:	
CO1	Apply the concept of Transistor biasing, thermal stability and analyse the transistor at low and high frequencies.	Apply
CO2	Develop the concept of Amplifier, apply it for its application and design the active filter and oscillators.	Evaluate
CO3	Analyze and design Combinational logic circuits.	Analyze
CO4	Analyze and design Sequential logic circuits with their applications.	Analyze
CO5	Implement the Design procedure of Synchronous Sequential Circuits and converters.	Analyze

UNIT I

Transistor Biasing and Thermal Stabilization: Transistor biasing and load line analysis, structure, working and applications of JFET and MOSFET, output and transfer characteristics, Bias Compensation, Thermal Runaway, Thermal Stability.

Transistor at Low and High Frequencies: Low-frequency h-parameter model of BJT, The Hybrid-pi(II) Common-emitter Transistor Model, Hybrid-II conductance, The Hybrid-II Capacitances, variation of Hybrid-II parameters, The CE short-circuit current gain, The gain bandwidth product.

UNIT II

Amplifiers: Review of op-amp and its applications; classification, distortion and frequency response of an amplifier, applications of amplifiers for multi-stage and power amplifications.

Active filters and Oscillators: Design of Butterworth filters using op-amp, condition for sustained oscillation, R-C phase shift, Hartley, Colpitts, Crystal and Wien Bridge Oscillators, Negative Resistance oscillator; Multi-vibrators (Astable, Mono-stable, Bi-Stable).

UNIT III

Combinational Logic: Combinational Circuits: Analysis Procedure, Design procedure, Binary adder subtractor, Decimal adder, Binary multiplier, Magnitude comparator, Multiplexers, Demultiplexers, Decoders, Encoders.

UNIT IV

Sequential Logic and Its Applications: Storage elements: latches & flip flops, Characteristic Equations of Flip Flops, Flip Flop Conversion, Shift Registers, Ripple Counters, Synchronous Counters, Other Counters: Johnson & Ring Counter.

UNIT V

Analysis of clocked sequential circuits with state machine designing, Design procedure, Hazards, Multi-vibrators.

Converter: Digital to Analog conversion, R2R ladder DAC, Weighted Resistor DAC, Analog Digital conversion, Flash type, Counter type ADC, Dual-slope ADC, Successive approximation type ADC. Sample and hold circuit.

Text/ Reference Books:

1. M. Morris Mano and M. D. Ciletti, "Digital Design", Pearson Education.
2. David J. Comer, "Digital Logic & State Machine Design", Oxford University Press.
3. RP Jain, "Modern Digital Electronics", Tata McGraw Hill Publication.
4. Boylestad R. L., Electronic Devices and Circuit Theory, Pearson Education.
5. Millman, J. and Halkias, C.C., Integrated Electronics, Tata McGraw Hill.
6. Floyd, T.L. and Jain, R. P., Digital Fundamentals, Pearson Education.

IEE402 ELECTRICAL MACHINES-I

LTP 3 1 0

Pre-requisites: Basic Electrical Engineering, Engineering Mathematics

	Course Outcomes	**Cognitive Level**
	After completing the course the students will be able to:	
CO1	Analyze the various principles and concepts involved in Electromechanical Energy conversion.	Analyze
CO2	Demonstrate the constructional details of DC machines as well as transformers, and the principle of operation of brushless DC motor, Stepper and DC Servo motors.	Understand
CO3	Evaluate the performance and characteristics of the DC Machine as a motor and as well as a generator.	Analyze
CO4	Evaluate the performance of transformers, individually and in parallel operation.	Analyze
CO5	Demonstrate and perform various connections of three-phase transformers.	Apply

UNIT I

Principles of Electro-Mechanical Energy Conversion: Electromechanical energy conversion, Energy balance during electromechanical energy conversion, Force and torque in electromechanical systems: Singly excited magnetic system, Doubly excited magnetic system, Electromagnetic torque and reluctance torque, General concepts of Rotating Machine: Generator, Motor, Physical concept of torque production in electrical machines, Mechanical degree and electrical degree.

UNIT II

DC Machines: Armature winding in DC Machine: Types: Lap winding, Wave winding, Placement of Brushes, Commutation process, Armature reaction, Methods of compensating armature reaction, Excitation in DC Machines, Types of Excitation, Operating characteristics of DC generators, Applications, Parallel operation of DC Generators.

UNIT III

DC Machines (Contd.): Operating characteristics of DC motors: Shunt and separately excited, series and compound motors, Applications of DC Motor, Starting of DC motors; 3 point and 4 point starters, Speed control of DC motors; Field control, Armature control and Voltage control (Ward Leonard method); Efficiency and Testing of DC machines (Hopkinson's and Swinburne's Test).

UNIT IV

Single Phase Transformer: Transformation ratio, phasor diagram, operation on no load and on load, voltage regulation and all day efficiency, percentage and per unit impedance.

Testing of Transformers- O.C. and S.C. tests, Polarity test, Sumpner's test., Parallel operation of single-phase transformers and load sharing– numerical problems.

UNIT V

Auto Transformer- Single phase and three phase autotransformers, Volt-amp relation, Copper saving in autotransformer Efficiency, Merits & demerits and applications.

Three Phase Transformers: Construction, Three phase transformer, phasor groups and their connections, open delta connection, three phase to 2 phase and their applications, Three winding transformers. Parallel operation of three phase transformers and load sharing.

Text/ Reference Books:

1. I.J. Nagrath & D.P. Kothari, "Electrical Machines", Tata McGraw Hill
2. Prithwiraj Purkait, I. Bandyopadhyay, "Electrical Machines", Oxford University Press
3. PS Bimbhra, "Electrical Machinery", Khanna Publisher
4. AE Fitggerald, C. Kingsley Jr and Umans, "Electric Machinery", McGraw Hill, International Student Edition.
5. H. Cotton, "Electrical Technology", CBS Publication.
6. MG Say, "The Performance and Design of AC machines", Pit man& Sons.
7. P. S. Bimbhra, " Generalized Theory of Electrical Machines", Khanna Publishers.

IEE403 NETWORKS ANALYSIS & SYNTHESIS

LTP 3 1 0

Pre-requisites: Basic Electrical Engineering, Basic signal & systems.

	Course Outcomes	**Cognitive Level**
	After completing the course the students will be able to:	
CO1	Apply the knowledge of basic circuital law, nodal and mesh methods of circuit analysis and simplify the network using the Graph Theory approach.	Apply
CO2	Analyze the AC and DC circuits using Kirchhoff's law and Network simplification Theorems. Evaluate their applications to network analysis.	Analyze
CO3	Analyze steady-state responses and transient response of DC and AC circuits using classical and Laplace transform methods. and determine the response of linear systems to known inputs.	Analyze
CO4	Implement the concepts of Z transform to solve complex engineering problems using Demonstrating the concept of complex frequency and analyze the structure and function of one and two-port networks. Also, evaluate and analyse two-port network parameters. Difference equations.	Analyze
CO5	Estimate travelling wave equations and their parameters using different line loadings its protection, and Bewlay's lattice diagram.	Analyze

UNIT I

Graph Theory: Importance of Graph Theory in Network Analysis, Graph of a network, Definitions, planar & Non-Planar Graphs, Isomorphism, Tree, Co Tree, Link, basic loop and basic cutset, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of analysis using graph theory.

UNIT II

AC Network Theorems (Applications to dependent & independent sources):
Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's Theorem.

UNIT III

Natural response and forced response, Transient response and steady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplace methods for both first and second order network.

UNIT IV

Network Functions: Concept of complex frequency, Transform impedances network functions of one port and two-port networks, Concept of poles and zeros, Properties of driving point and transfer functions. Two Port Networks- Characterization of LTI two port networks; Z, Y, ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Inter-connections of two-port networks, Ladder and Lattice networks: T & Π representation, terminated two Port networks, Image Impedance.

UNIT V

(a) Network Synthesis:

Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms.

(b) Filters:

Image parameters and characteristics impedance, Passive and active filter fundamentals, Low pass filters, High pass (constant K type) filters, Introduction to active filters.

Text/ Reference Books:

1. Hayt, Kimmerly, Durbin, "Engineering Circuit Analysis", McGraw Hill.
2. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach", McGraw Hill.
3. M. E. Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.
4. T.S.K.V. Iyer, "Circuit Theory", Tata McGraw Hill.
5. Samarjit Ghosh, "Network Theory: Analysis & Synthesis" Prentice Hall India.

IEE451 NETWORK LAB

LTP 0 0 2

	Course Outcomes	Cognitive Level
	After completing the course the students will be able to:	
CO1	Verify various network theorems on the AC network using simulation/hardware implementation.	Evaluate
CO2	Demonstrate transient response of AC circuits using simulation/hardware implementation.	Apply
CO3	Verify properties of parameters of filters and/or two-port networks using simulation/hardware implementation.	Evaluate
CO4	Verify parameter properties in inter-connected two-port networks: series, parallel and cascade using Multisim/ PSPICE.	Evaluate
CO5	Develop a mini project using Analog Electronics and other components by hardware implementation/simulation tools.	Create

List of Experiments:

1) Verification of the principle of Superposition with AC sources using simulation tools/hardware implementation.
2) Verification of Thevenin's and Maximum Power Transfer theorems in AC Circuits using simulation tools/ hardware implementation.
3) Verification of Norton theorems in AC Circuits using simulation tools/ hardware implementation. .
4) Verification of Tellegen's theorem for two networks of the same topology using simulation tools/ hardware implementation.
5) Determination of Z and h-parameters (DC only) for a network and computation of Y and ABCD Parameters using simulation tools/ hardware implementation.
6) Determination of driving point and transfer functions of a two-port ladder network and verification with theoretical values using simulation tools/ hardware implementation.
7) Determination of transient response of current in RL and RC circuits with step voltage input using simulation tools/ hardware implementation.
8) Determination of transient response of current in RLC circuit with step voltage input for underdamped, critically damped and overdamped cases using simulation tools/ hardware implementation.
9) Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests using simulation tools/ hardware implementation.
10) Verification of parameter properties in inter-connected two-port networks: series, parallel and cascade using simulation tools/ hardware implementation.
11) Determination of frequency response of a Twin–T–notch filter using simulation tools/ hardware implementation.
12) To determine attenuation characteristics of low pass / high pass active filters using simulation tools/ hardware implementation.
13) Implementation of Mini Project using Analog Electronics and other components using simulation tools/ hardware implementation.

IEE452 ELECTRICAL MACHINES–I LAB

LTP 0 0 2

	Course Outcomes	Cognitive Level
	After completing the course, the students will be able to:	
CO1	Investigate the magnetization and load characteristics of the DC Machine	Analyse
CO2	Determine the performance of DC machines using Swinburne’s test and Hopkinson's test	Evaluate
CO3	Determine the performance of a single-phase transformer by open-circuit test, short-circuit test and Sumpner’s test.	Evaluate
CO4	Investigate Scott connection and parallel operation on three-phase transformers	Analyse

List of Experiments:

1. To obtain magnetization characteristics of a DC shunt generator.
2. To obtain load characteristics of a DC shunt generator and compound generator (a) Cumulatively compounded (b) Differentially compounded.
5. To obtain speed- torque characteristics of a DC shunt motor.
6. To obtain speed control of DC shunt motor using (a) armature resistance control (b) field control
7. To obtain speed control of DC separately excited motor using Ward-Leonard.
3. To obtain the efficiency of a DC shunt machine using Swinburne’s test.
4. To perform Hopkinson’s test and determine the losses and efficiency of DC machine.
8. To obtain equivalent circuit, efficiency and voltage regulation of a single-phase transformer using O.C. and S.C. tests.
9. To obtain efficiency and voltage regulation of a single-phase transformer by Sumpner’s test.
10. To obtain 3-phase to 2-phase conversion by Scott connection.
11. To demonstrate the parallel operation of three-phase transformer and to obtain the load sharing at a load.

IEE453 ANALOG & DIGITAL ELECTRONICS LAB

LTP 0 0 2

	Course Outcomes	**Cognitive Level**
CO1	Plot the parameters of the operational amplifier, RC coupled amplifier and its application.	Apply
CO2	Plot the characteristics and understand the applications of the semiconductor devices (BJT, MOSFET) and oscillators.	Apply
CO3	Design the Sequential circuits with the help of combinational circuits and feedback elements.	Apply
CO4	Design the Combinational circuits with the help of basic logic gates and IC.	Apply
CO5	Design the counters with the help of sequential circuits and basic Gates.	Apply

List of Experiments:

1. To determine voltage gain, current gain, input impedance and output impedance and frequency response of R-C coupled common emitter amplifier.
2. To Plot input /output characteristics of MOSFET and determine MOSFET parameters at a given operating point.
3. To study transistor as a switch and determine load voltage and load current when the transistor is ON.
4. Applications of Op-amp: Op-amp as summing amplifier, Difference amplifier, Integrator and differentiator.
5. To study the characteristics of RC oscillators namely:
   1) Phase shift oscillators.
   2) Wein bridge oscillators.
6. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
7. Implementation and verification of Encoder and Decoder using logic gates.
8. Implementation and verification of using logic gates.
9. Implementation of multiplexer and demultiplexer using logic gates.
10. Implementation of 4-bit parallel adder using 7483 IC.
11. Design, and verify the 4-bit synchronous & asynchronous counter.

IOE034/ IOE044 ENERGY SCIENCE & ENGINEERING

LTP 3 1 0

	Course Outcomes	**Cognitive Level**
	After completing the course the students will be able to:	
CO1	Understand the energy concepts, conversion processes, and their environmental consequences.	Understand
CO2	Understand the diverse non-conventional energy sources, including wind, geothermal, ocean thermal, and hydropower, enabling them to analyze, design, and contribute to sustainable energy solutions and advancements in renewable energy technologies.	Understand , Analyse
CO3	Analyse and contribute to advancements in nuclear science, technology, and safety protocols.	Apply, Analyse
CO4	Understand solar energy principles, semiconductor physics, photovoltaic device operation, and various generations of solar cells, enabling them to design, analyse, and contribute to the development and application of solar energy technologies.	Understand , Analyse
CO5	Understand the fuel cycles, environmental impact, energy storage, conservation strategies, and green engineering principles.	Understand

Unit-1

Energy and its Usage: Classification of energy sources, Common forms of energy, Units and scales of energy use, Mechanical energy and transport, Heat energy: Conversion between heat and mechanical energy, Electromagnetic energy: Storage, conversion, transmission and radiation, Energy in chemical systems and processes, flow of CO_2, Entropy and temperature, carnot and Stirling heat engines, Phase change energy conversion, refrigeration and heat pumps, World energy status, Energy scenario in India, Environmental aspects of energy.

Unit-2

Conventional & Non-Conventional Energy sources: Biological energy sources and fossil fuels, Fluid dynamics and power in the wind, available resources, fluids, viscosity, types of fluid flow, lift, Wind turbine dynamics and design, wind farms, Geothermal power and ocean thermal energy conversion, Tidal-wave/ hydropower, Miscellaneous Non-conventional energy technologies.

Unit-3

Nuclear Energy: Fundamental forces in the universe, Quantum mechanics relevant for nuclear physics, Nuclear forces, energy scales and structure, Nuclear binding energy systematics, reactions and decays, Nuclear fusion, Nuclear fission and fission reactor physics, Nuclear fission reactor design, safety, operation and fuel cycles, Biological effects of radiation, calculation of radiation effects, computation of exposure and dose, philosophy of reactor safety & containment.

Unit-4

Solar Energy: Introduction to solar energy, fundamentals of solar radiation and its measurement aspects, Basic physics of semiconductors, Carrier transport, generation and recombination in semiconductors, Semiconductor junctions: metal-semiconductor junction & p-n junction, Essential characteristics of solar photovoltaic devices, First Generation Solar Cells, Second Generation Solar Cells, Third Generation Solar Cells, Applications of solar energy.

Unit-5

Systems and Synthesis: Fuel cycles, waste and proliferation, Climate change, Energy storage, Energy conservation. Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts, LEED ratings; Identification of energy-related enterprises that represent the breadth of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption.

Reference/Text Books

1. Non-Conventional Energy Resources, B. H. Khan, Mc Graw Hill Education.
2. Energy and the Challenge of Sustainability, World Energy Assessment, UNDP, New York.
3. Introductory Nuclear Physics, R. K. Puri and V.K. Babbar, Narosa Publishing House.
4. Physics of Solar Cells: From Basic Principles to Advanced Concepts by Peter Wurfel, John Wiley & Sons.
5. Principles of Solar Engineering, D.Y. Goswami, F. Kreith and J.F. Kreider, Taylor and Francis, Philadelphia.

IOE035/ IOE045 SENSOR & INSTRUMENTATION

LTP 3 1 0

	Course Outcomes	Cognitive Level
	After completing the course the students will be able to:	
CO1	Understand the energy concepts, conversion processes, and their environmental consequences.	**K1**
CO2	Understand the diverse non-conventional energy sources including wind, geothermal, ocean thermal, and hydro power, enabling them to analyze, design, and contribute to sustainable energy solutions and advancements in renewable energy technologies.	**K2, K4**
CO3	Analyse and contribute to advancements in nuclear science, technology, and safety protocols.	**K3, K4**
CO4	Understand solar energy principles, semiconductor physics, photovoltaic device operation, and various generations of solar cells, enabling them to design, analyse, and contribute to the development and application of solar energy technologies.	**K2, K4**
CO5	Understand the fuel cycles, environmental impact, energy storage, conservation strategies, and green engineering principles.	**K2**

Unit-1:

Definition, Classification & selection of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement of pressure using LVDT based diaphragm & piezoelectric sensor.

Unit-2:

Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.

Unit-3:

Graphical programming techniques, Data types, Advantage of Virtual Instrumentation techniques, Concept of WHILE & FOR loops, Arrays, Clusters & graphs, Structures: Case, Sequence & Formula nodes, Need of software based instruments for industrial automation.

Unit-4:

Basic block diagram, Analog and Digital IO, Counters, Timers, Types of ADC: successive approximation and sigma-delta, Types of DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication.

Unit-5:

General Structure of smart sensors & its components, Characteristics of smart sensors: Self-calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control.

Text/ Reference Books:

1. DVS Murthy, Transducers and Instrumentation, PHI.
2. D Patranabis, Sensors and Transducers, PHI.
3. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED, Instrument Society of America, 1994.
4. Gary Johnson / Lab VIEW Graphical Programing, McGraw Hill.
5. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI.
6. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation & Measurement Techniques, PHI.
7. Hermann K.P. Neubert, "Instrument Transducers", Oxford University Press.