

DR.A.P.J.ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW



**Evaluation Scheme & Syllabus
For
B.Tech. 2nd Year**

- **Electrical Engineering**
- **Electrical & Electronics Engineering**

(Effective from session 2023-24)

DR.A.P.J.ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

SEMESTER –III

SN	Subject Code	Subject	Type	Category	Periods			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total SW+ES E	Credi t Cr
					L	T	P	CT	TA	CT+T A	TE/P E		
1	BOE3** / BAS303	Science Based Open Elective/BSC (Maths- III/Math IV/ Math V)	T	ES/BS	3	1	0	20	10	30	70	100	4
2	BVE301 / BAS301	Universal Human Value and Professional Ethics/ Technical Communication	T	VA/HS	2	1	0	20	10	30	70	100	3
3	BEE301	Electromagnetic Field Theory	T	PC	3	1	0	20	10	30	70	100	4
4	BEE302	Electrical Measurements & Instrumentation	T	PC	3	1	0	20	10	30	70	100	4
5	BEE303	Basic Signals & Systems	T	PC	2	1	0	20	10	30	70	100	3
6	BEE351	Circuit Simulation Lab	P	PC	0	0	2		50	50	50	100	1
7	BEE352	Electrical Measurements and Instrumentation Lab	P	PC	0	0	2		50	50	50	100	1
8	BEE353	Electrical Workshop	P	PC	0	0	2		50	50	50	100	1
10	BCC301 / BCC302	Cyber Security/Python programming	T	VA	2	0	0	20	10	30	70	100	2
11	BCC351	Internship Assessment /Mini Project*	P							100		100	2
		Total			15	5	6						25

- **Mathematics –III** for CE / ENV and allied branches
- **Mathematics-IV** for Computer/Electronics/Electrical & allied Branches, Mechanical & Allied Branches
Textile/Chemical & allied Branches
- **Mathematics-V** for Bio Technology / Agriculture Engineering

SEMESTER –IV

SN	Subject Code	Subject	Type	Category	Periods			Sessional Component		Sessional (SW) (TS/PS)	End Semester Examination (ESE)	Total SW+ ESE	Credit Cr
					L	T	P	CT	TA				
1	BAS403 / BOE4**	BSC(Maths-III/Math IV/ Math V)/Science Based Open Elective	T	BS/ES	3	1	0	20	10	30	70	100	4
2	BAS401 / BVE401	Technical Communication / Universal Human Value and Professional Ethics	T	HS/VA	2	1	0	20	10	30	70	100	3
3	BEE401	Digital Electronics	T	PC	3	1	0	20	10	30	70	100	4
4	BEE402	Electrical Machines-I	T	PC	3	1	0	20	10	30	70	100	4
5	BEE403	Networks Analysis & Synthesis	T	PC	2	1	0	20	10	30	70	100	3
6	BEE451	Network Analysis & Synthesis Lab	P	PC	0	0	2		50	50	50	100	1
7	BEE452	Electrical Machines-I Lab	P	PC	0	0	2		50	50	50	100	1
8	BEE453	Digital Electronics Lab	P	PC	0	0	2		50	50	50	100	1
9	BCC402 / BCC401	Python Programming/Cyber Security	P	VA	2	0	0	20	10	30	70	100	2
10	BVE451 / BVE452	Sports and Yoga - II / NSS-II	P	VA	0	0	3			100		100	0
		Total			15	5	9						23
		Minor Degree/ Honors Degree MT-1/HT-1											

*The Mini Project or internship (4 weeks) will be done during summer break after 4th Semester and will be assessed during V semester.

SYLLABUS
BEE301- ELECTROMAGNETIC FIELD THEORY

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO1	Apply different coordinate systems and their application in electromagnetic field theory, establish a relation between any two systems and also understand the vector calculus.	K ₃
CO2	Understand the concept of static electric field. Understand the concept of current and properties of conductors. Establish boundary conditions and to calculate capacitances of different types of capacitors	K ₄
CO3	Understand the concept of static magnetic field, magnetic scalar and vector potential	K ₄
CO4	Understand the forces due to magnetic field, magnetization, magnetic boundary conditions and inductors.	K ₄
CO5	Understand displacement current, time varying fields, propagation and reflection of EM waves and transmission lines.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

Detailed Syllabus:

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, Gauss's 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., Methods of Images.

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 final form Electromagnetic wave propagation: Wave propagation in loss dielectrics, Plane waves in lossless dielectrics Plane wave 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 Book: 1. MNO Sadiku, "Elements of Electromagnetic", Oxford University Press.

Reference Books: 1. WH Hayt and JA Buck, "Engineering Electromagnetic", McGraw- Hill Education.

BEE302- ELECTRICAL MEASUREMENTS & INSTRUMENTATION

Pre-requisites of course: Basic Electrical Engineering

Course Outcomes:		Knowledge Level, KL
At the end of this course students will demonstrate the ability to:		
CO 1	Evaluate errors in measurement as well as identify and use different types of instruments for the measurement of voltage, current.	K ₁
CO2	Demonstrate the construction and working of different measuring instruments for Power, energy and frequency measurements.	K ₂
CO3	Demonstrate the construction and working of different AC and DC bridges, along with their applications.	K ₂
CO4	Demonstrate the working of instrument transformers as well as calculate the errors in current and potential transformers, Manifest the working of electronic instruments like voltmeter, multi-meter, frequency meter and CRO and ability to measure electrical engineering parameters like voltage, current, power, phase difference and frequency.	K ₂
CO5	Display the knowledge of transducers, their classifications and their applications for the measurement of physical quantities like motion, force, pressure, temperature, flow and liquid level.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

Detailed Syllabus:

UNIT I

ELECTRICAL MEASUREMENTS & INTRODUCTION TO MEASURING INSTRUMENTS: Measurement system, Characteristics of instruments, Methods of measurement, Errors in Measurement & Measurement standards, Classification of Instrument – deflecting, controlling and damping torques – Ammeters and Voltmeters – PMMC, moving iron, Electrostatic, induction type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range of instruments.

UNIT II

MEASUREMENT OF POWER & ENERGY: Types of watt meters, Single phase dynamometer & induction type wattmeter, Expression for deflecting and control torques. Measurement of active and reactive power in balanced and unbalanced three phase systems, theory and operation of single & three phase induction type energy meter, power factor meter & analog frequency meter.

UNIT III

POTENTIOMETERS, DC & AC BRIDGES: Principle and operation of D.C. Crompton's potentiometer standardization – Measurement of unknown resistance, current, voltage. A.C. Potentiometers. Method of measuring low, medium and high resistance – sensitivity of wheat-stone's bridge – Kelvin's double bridge for measuring low resistance. Measurement of inductance-Maxwell's bridge, Hay's bridge, Anderson's bridge, Owens's bridge. Measurement of capacitance and loss angle – Desauty's bridge, Wien's bridge, Schering Bridge.

UNIT IV

INSTRUMENT TRANSFORMER & ELECTRONIC MEASUREMENTS: CT and PT Construction and working, Ratio and phase angle errors, testing and design considerations. Electronic Voltmeter- Ammeter, Multimeter, Wattmeter & Energy meter, Principle of CRO, Time, Frequency and phase angle measurements using CRO. Spectrum & Wave analyzer and Digital Voltmeter.

UNIT V

TRANSDUCERS: Definition of transducers, Classification of transducers, Advantages of Electrical transducers, Characteristics and choice of transducers; Principal operation of LVDT and capacitor transducers, LVDT Applications, Strain and its principle of operation, gauge factor, Thermistors, Thermocouples, Piezo electric transducers, photovoltaic, photo conductive cells, and photo diodes.

Text Book:

1. A K Sawhney, "Electrical & Electronic Measurement & Instrument", DhanpatRai&Sons, India
2. BC Nakra & K. Chaudhary, "Instrumentation, Measurement and Analysis," Tata McGraw Hill 2nd Edition
3. Purkait, "Electrical & Electronics Measurement & Instrumentation", TMH

Reference Books:

1. Forest K. Harris, "Electrical Measurement", Willey Eastern Pvt. Ltd. India
2. M. Stout , "Basic Electrical Measurement", Prentice Hall of India
3. WD Cooper, "Electronic Instrument & Measurement Technique", Prentice Hall International
4. EW Golding & F.C. Widdis, "Electrical Measurement & Measuring Instrument", AW Wheeler & Co. Pvt. Ltd. India

BEE303- BASIC SIGNAL & SYSTEMS

Pre-requisites of course: Basic Electrical Engineering, Engineering Mathematics

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO 1	Represent the various types of signals & systems and can perform mathematical operations on them.	K ₂
CO2	Analyze the response of LTI system to Fourier series and Fourier transform and to evaluate their applications to network analysis.	K ₄
CO3	Analyze the properties of continuous time signals and system using Laplace transform and determine the response of linear system to known inputs.	K ₄
CO4	Implement the concepts of Z transform to solve complex engineering problems using difference equations.	K ₃
CO5	Develop and analyze the concept of state-space models for SISO & MIMO system.	K ₄

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

Detailed Syllabus:

UNIT I

Pre- Requisites: *Differential Equations.*

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 type of system, basic system properties.

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

UNIT II

Pre- Requisites: *Fourier Series & Fourier Transform*

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

UNIT III

Pre- Requisites: *Laplace Transform*

Laplace Transform Analysis: Review of Laplace Transform, Properties of Laplace Transform, Initial & 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

Pre- Requisites: *Matrix Calculations.*

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

Pre- Requisite: *Z-Transforms.*

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

Text Books:

1. Oppenheim, Wilsky, Nawab, "Signals & Systems", Pearson Education, 2015
2. Anand Kumar, "Signals & Systems", PHI
3. Choudhary D. Roy, "Network & Systems", Wiley Eastern Ltd.

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. BP Lathi, "Linear Systems & Signals" Oxford University Press, 2008.
4. IJ Nagrath, S.N. Saran, R. Ranjan and S. Kumar, "Signals and Systems", TataMc.Graw Hill, 2001.
5. ME Van-Valkenberg; " Network Analysis", Prentice Hall of India

BEE351- CIRCUIT SIMULATION LAB

Pre-requisites of course: Basic Electrical Engineering

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO 1	Apply the knowledge of basic circuit law, nodal and mesh analysis for given circuit.	K2
CO2	Analysis of the AC and DC circuits using simulation techniques.	K3
CO3	Analysis of transient response of AC circuits.	K3
CO4	Evaluation and analysis of two-port network parameters.	K2
CO5	Estimation of parameters of different filters.	K2

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K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

List of Experiments

Ten experiments to be performed

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

Note: Any two experiments from above list should also be performed by students on Virtual Lab.

BEE352- ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB

Pre-requisites of course: Basic Electrical Engineering

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO 1	Understand the importance of calibration of measuring instruments.	K2
CO2	Demonstrate the construction and working of different measuring instruments.	K3
CO3	Demonstrate the construction and working of different AC and DC bridges, along with their applications.	K3
CO4	Ability to measure electrical engineering parameters like voltage, current, power & phase difference in industry as well as in power generation, transmission and distribution sectors.	K2
CO5	Capability to analyze and solving the variety of problems in the field of electrical measurements.	K2

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

Note : Minimum ten experiments are to be performed from the following list:

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.

Note: Any two experiments from above list should also be performed by students on Virtual Lab.

BEE353- ELECTRICAL WORKSHOP

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO 1	Perform various types of Electrical connections.	K ₃
CO2	Develop small circuits on PCB	K ₆
CO3	Differentiate between various electrical wires, cables and accessories.	K ₃
CO4	Demonstrate the layout of electrical substation & various safety measures.	K ₂

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

Detailed Syllabus:

Note: Minimum ten experiments are to be performed from the following list:

1. To study the working and Control of two lamps in series and in parallel
2. To perform the stair case working and it's testing.
3. To study the working principle and wiring of fluorescent lamp.
4. To study and wiring of distribution board including power plug using isolator, MCB, ELCB.
5. To study and estimate a typical, BHK house wiring.
6. Familiarization, soldering, testing and observing the wave forms on CRO of a HW and FW uncontrolled rectifier (using diodes) with capacitor filter.
7. Visit your college substation and familiarize the supply system, Transformer, HT Panel and 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 fault, Remedies in Domestic Installation and Indian Electricity Rules.
12. To study the different types of earthing system and measure the earth resistance.

SEMESTER –IV
BEE401- DIGITAL ELECTRONICS

Course Outcomes:		Knowledge Level, KL
At the end of this course students will demonstrate the ability to:		
CO 1	Perform number style arithmetic and logic simplification using various methods.	K ₃
CO2	Design and analyze modular combinational circuits with MUX / DEMUX, Decoder & Encoder	K ₄
CO3	Design & analyze synchronous sequential logic circuits	K ₄
CO4	Analyze various logic families and design circuits using PLDs.	K ₃
CO5	Design various ADCs and DACs according to the given specifications.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

Detailed Syllabus

UNIT I

Logic simplification and combinational logic design: Number Systems, Binary arithmetic, signed magnitude representation, Binary codes, code conversion, review of Boolean algebra and Demorgan's theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 5 variables, tabulation method.

UNIT II

Analysis and Design of combinational circuits, MSI devices like comparators, multiplexers, demultiplexers, encoder, decoder, circuit realization using Multiplexers and decoders, half and full adders, subtractors, serial and parallel adders, BCD adder, barrel shifter.

UNIT III

Sequential logic design: Building blocks like S-R, JK and Master-Slave JK FF, D FF, T FF, edge triggered FF, Flip flop conversion, Applications of Flip Flops: ripple and synchronous counters, Ring counter, Johnson counter, shift registers: SISO, SIPO, PISO, PIPO, Bidirectional shift register, Universal shift register; Finite state machines: Mealy and Moore machines, State diagrams, state reduction, Analysis of clocked sequential circuits, Design of clocked sequential circuits,

UNIT IV

Logic families and semiconductor memories: A TTL NAND gate, specifications, noise margin, propagation delay, fan-in, fan-out, tristate TTL, ECL, CMOS families and their interfacing, memory elements, concept of programmable logic devices like FPGA, logic implementation using programmable devices.

UNIT V

Memory & Programmable Logic Devices: Specifications of DACs, Weighted resistor, R-2R ladder, Analog-to-digital converters (ADC): Specifications of ADCs, principle of ADC, switched capacitor circuits: Basic concept, practical configurations, ADC etc. ADC Types: dual slope, successive approximation, counting type, flash etc.

Text 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. A. Anand Kumar, "Fundamental of Digital Circuits," PHI 4th edition, 2018.

BEE402- ELECTRICAL MACHINES – I

Pre-requisites of course: Basic Electrical Engineering, Engineering Mathematics

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO 1	Analyze the various principles & concepts involved in Electromechanical Energy conversion.	K ₄
CO2	Demonstrate the constructional details of DC machines as well as transformers, and principle of operation of brushless DC motor, Stepper and DC Servo motors.	K ₂
CO3	Evaluate the performance and characteristics of DC Machine as motor and as well as generator.	K ₄
CO4	Evaluate the performance of transformers, individually and in parallel operation.	K ₄
CO5	Demonstrate and perform various connections of three phase transformers.	K ₃

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

Detailed Syllabus:

UNIT I

Pre- Requisites: *Magnetic Materials, BH characteristics*

Principles of Electro-mechanical Energy Conversion: Introduction, Review of magnetic system, Energy in Magnetic system, Force and torque in magnetic field system, Energy balance equation, Energy conversion via electrical field, Energy in a singly excited system, Determination of the Force and Torque from energy and co-energy, Generation of EMF in Machines, Torque in machine with cylindrical air gap.

UNIT II

Pre- Requisites: *Principle & Construction, Classification and circuit model, EMF equation of generator and torque equation of motor*

DC Machines: Armature winding (Concentrated and Distributed), Winding Factor, Armature reaction, Commutation, Interpoles and compensating windings, Performance characteristics of DC generators, Applications.

UNIT III

DC Machines (Contd.): Performance characteristics of DC motors, 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), Applications, stepper motor and DC Servo motor and their applications.

UNIT IV

Pre- Requisites: *Construction & Principle, Ideal and practical transformer, equivalent circuit & phasor diagram, losses in transformers.*

Single Phase Transformer: Efficiency and voltage regulation, all day efficiency, Excitation phenomenon and harmonics in transformers.

Testing of Transformers- O.C. and S.C. tests, Polarity test, Sumpner's test.

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

UNIT V

Pre- Requisite: *Three-phase connections – Star/Delta.*

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 single phase and three phase transformers and load sharing.

Text Books:

1. IJ Nagrath & D.P. Kothari, "Electrical Machines", Tata McGraw Hill
2. Rajendra Prasad , "Electrical Machines", PHI
3. PS Bimbhra, "Electrical Machinery", Khanna Publisher
4. AE Fitzgerald, C. Kingsley Jr and Umans, "Electric Machinery", McGraw Hill, International Student Edition.

Reference Books:

1. H. Cotton, "Electrical Technology", CBS Publication.
2. MG Say, "The Performance and Design of AC machines", Pit man& Sons.
3. PS Bimbhra, " Generalized Theory.

BEE403- NETWORK ANALYSIS & SYNTHESIS

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

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO 1	Apply the knowledge of basic circuit law, nodal and mesh methods of circuit analysis and simplify the network using Graph Theory approach.	K ₃
CO2	Analyze the AC and DC circuits using Kirchhoff's law and Network simplification theorems.	K ₄
CO3	Analyze steady-state responses and transient response of DC and AC circuits using classical and Laplace transform methods.	K ₄
CO4	Demonstrate the concept of complex frequency and analyze the structure and function of one and two port network. Also evaluate and analysis two-port network parameters.	K ₄
CO5	Synthesize one port network and analyze different filters.	K ₄

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

Detailed Syllabus:

UNIT I

Graph Theory:

Pre- Requisites: Basic circuit law, Mesh & Nodal analysis.

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.

Unit II

AC Network Theorems (Applications to dependent & independent sources):

Pre- Requisites: Concepts of DC Network Theorems, Electrical Sources & Basic circuit law. Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem. Millman's theorem, Compensation theorem, Tellegen's Theorem.

Unit III

Transient Circuit Analysis:

Pre- Requisites: Laplace Transform & Concept of Initial conditions.

Natural response and forced response, Transient behaviour of RL, RC and RLC networks, Evaluation of initial conditions, Transform Impedance, Transient response and steady state response for arbitrary inputs (DC and AC), Evaluation of time response of RL, RC and RLC networks with and without initial conditions both through classical and Laplace transform methods.

Unit IV

Network Functions:

Pre- Requisites: *Concept of basic circuital law, parallel, series circuits.*

Concept of complex frequency, 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, 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.

Unit V

a. Network Synthesis:

Pre- Requisites: *Laplace Transform, Concept of immittance functions.*

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

Pre- Requisites: *Concept of Passive & active elements.*

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

Text Books:

1. ME Van Valkenburg, "Network Analysis", 3rd edn, Pearson Education.
2. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw Hill.
3. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.
4. CL Wadhwa, "Network Analysis and Synthesis", New Age International Publishers.
5. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co.

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. ME 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.

BEE451- NETWORK ANALYSIS AND SYNTHESIS LAB

Pre-requisites of course: Basic Electrical Engineering

Course Outcomes:	Knowledge Level, KL
At the end of this course students will demonstrate the ability to:	
CO 1 Understand basics of electrical circuits with nodal and mesh analysis.	K2
CO2 Appreciate electrical network theorems.	K3
CO3 Analyse RLC circuits.	K3
CO4 Determine the stability of an electrical circuit.	K2
CO5 Design network filters.	K2

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

List of Experiments

Ten experiments to be performed:

1. Verification of Maximum power transfer theorem.
2. Verification of Tallegen's theorem.
3. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
4. Design and find cut-off frequency of low pass and high pass filters.
5. Design and find the pass band frequencies of band pass filters.
6. Design and find the stop band frequencies of band reject filters.
7. Determination of two port network Z and h parameters.
8. Verification of parameters properties in interconnection of 2, two port networks in series-series interconnection.
9. Verification of parameters properties in interconnection of 2, two port networks in parallel-parallel interconnection.
10. Determination of Z parameters of a T network and Computation of corresponding parameters to equivalent π network.
11. To perform the transient response of RL circuit.
12. Verification of parameters properties in interconnection of 2, two port networks in cascade interconnection.

Note: Any two experiments from above list should also be performed by students on Virtual Lab.

BEE452- ELECTRICAL MACHINES-I LAB

Pre-requisites of course: Basic Electrical Engineering

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO1	Analyze and conduct basic tests on DC Machines and single-phase Transformer	K2
CO2	Obtain the performance indices using standard analytical as well as graphical methods.	K3
CO3	Determine the magnetization, Load and speed-torque characteristics of DC Machines.	K3
CO4	Demonstrate procedures and analysis techniques to perform electromagnetic and electromechanical tests on electrical machines.	K2

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

List of Experiments

Note: Minimum ten experiments are to be performed from the following list, out of which there should be at least two software-based 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.
3. To obtain efficiency of a DC shunt machine using Swinburne's test.
4. To perform Hopkinson's test and determine losses and efficiency of DC machine.
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.
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.

Note: Any two experiments from above list should also be performed by students on Virtual Lab.

BEE453- DIGITAL ELECTRONICS LAB

Course Outcomes:		Knowledge Level, KL
Upon the completion of the course, the student will be able to:		
CO 1	Understanding of Digital Binary System and implementation of Gates.	K ₂ , K ₃
CO2	Design the Sequential circuits with the help of combinational circuits and feedback element.	K ₃ , K ₄
CO3	Design data selector circuits with the help of universal Gates.	K ₃ , K ₄
CO4	Design the counters with the help of sequential circuit and basic Gates.	K ₃ , K ₄
CO5	Implement the projects using the digital ICs and electronics components.	K ₃ , K ₅

KL- Bloom's Knowledge Level (K₁, K₂, K₃, K₄, K₅, K₆)

K₁ – Remember K₂ – Understand K₃ – Apply K₄ – Analyze K₅ – Evaluate K₆ – Create

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, Concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.
2. Implementation of the given Boolean function using logic gates in both SOP and POS forms.
3. Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
4. Implementation and verification of Decoder using logic gates.
5. Implementation and verification of Encoder using logic gates.
6. Implementation of 4:1 multiplexer using logic gates.
7. Implementation of 1:4 demultiplexer using logic gates.
8. Implementation of 4-bit parallel adder using 7483 IC.
9. Design, and verify the 4-bit synchronous counter.
10. Design, and verify the 4-bit asynchronous counter.
11. Implementation of Mini Project using digital integrated circuit's and other components.

Note: Any two experiments from above list should also be performed by students on Virtual Lab.