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

Evaluation Scheme & Syllabus

For

B.Tech. 2nd Year

Electrical & Computer 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+ESE	Credit Cr
					L	T	P	CT	TA	CT+TA	TE/PE		
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	BCS301	Data Structure	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	BEE309	Network Analysis and Synthesis	T	PC	2	1	0	20	10	30	70	100	3
6	BCS351	Data Structure 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	BEE359	Network Analysis and Synthesis Lab	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	CT+TA	TE/PE		
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	BCS409	Design and Analysis of Algorithm	T	PC	2	1	0	20	10	30	70	100	3
6	BEE452	Electrical Machines-I Lab	P	PC	0	0	2		50	50	50	100	1
7	BEE453	Digital Electronics Lab	P	PC	0	0	2		50	50	50	100	1
8	BCS459	Design and Analysis of Algorithm	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

BCS301 DATA STRUCTURE

	Course Outcome (CO)	Bloom's Knowledge Level (KL)
	At the end of course , the student will be able to understand	
CO 1	Describe how arrays, linked lists, stacks, queues, trees, and graphs are represented in memory, used by the algorithms and their common applications.	K_1, K_2
CO 2	Discuss the computational efficiency of the sorting and searching algorithms.	K_2
CO 3	Implementation of Trees and Graphs and perform various operations on these data structure.	K_3
CO 4	Understanding the concept of recursion, application of recursion and its implementation and removal of recursion.	K_4
CO 5	Identify the alternative implementations of data structures with respect to its performance to solve a real world problem.	K_5, K_6

DETAILED SYLLABUS

Unit	Topic	Proposed Lecture
I	**Introduction:** Basic Terminology, Elementary Data Organization, Built in Data Types in C. Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Big Oh, Big Theta and Big Omega, Time-Space trade-off. Abstract Data Types (ADT) **Arrays**: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Derivation of Index Formulae for 1-D,2-D,3-D and n-D Array Application of arrays, Sparse Matrices and their representations. **Linked lists:** Array Implementation and Pointer Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition Subtraction & Multiplications of Single variable & Two variables Polynomial.	08
II	**Stacks:** Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Iteration and Recursion- Principles of recursion, Tail recursion, Removal of recursion Problem solving using iteration and recursion with examples such as binary search, Fibonacci numbers, and Hanoi towers. Tradeoffs between iteration and recursion. **Queues:** Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Dequeue and Priority Queue.	08
III	**Searching:** Concept of Searching, Sequential search, Index Sequential Search, Binary Search. Concept of Hashing & Collision resolution Techniques used in Hashing. **Sorting:** Insertion Sort, Selection, Bubble Sort, Quick Sort, Merge Sort, Heap Sort and Radix Sort.	08
IV	Trees: Basic terminology used with Tree, Binary Trees, Binary Tree Representation: Array Representation and Pointer(Linked List) Representation, Binary Search Tree, Strictly Binary Tree ,Complete Binary Tree . A Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder, Constructing Binary Tree from given Tree Traversal, Operation of Insertation , Deletion, Searching & Modification of data in Binary Search . Threaded Binary trees, Traversing Threaded Binary trees. Huffman coding using Binary Tree. Concept & Basic Operations for AVL Tree , B Tree & Binary Heaps	08
V	**Graphs:** Terminology used with Graph, Data Structure for Graph Representations: Adjacency Matrices, Adjacency List, Adjacency. Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Transitive Closure and Shortest Path algorithm: Warshal Algorithm and Dijikstra Algorithm.	08

Text books:

1. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein, “Data Structures Using C and C++”, PHI Learning Private Limited, Delhi India.
2. Gilberg ,Forouzan, Data Structures: A Pseudocode Approach with C 3rd edition , Cengage Learning publication.
3. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publications Pvt Ltd Delhi India.
4. Lipschutz, “Data Structures” Schaum’s Outline Series, Tata McGraw-hill Education (India) Pvt. Ltd.
5. Thareja, “Data Structure Using C” Oxford Higher Education.
6. AK Sharma, “Data Structure Using C”, Pearson Education India.
7. Rajesh K. Shukla, “Data Structure Using C and C++” Wiley Dreamtech Publication.
8. Michael T. Goodrich, Roberto Tamassia, David M. Mount “Data Structures and Algorithms in C++”, Wiley India.
9. P. S. Deshpandey, “C and Data structure”, Wiley Dreamtech Publication.
10. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education.
11. Berztiss, AT: Data structures, Theory and Practice, Academic Press.
12. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with applications”, McGraw Hill.
13. Adam Drozdek “Data Structures and Algorithm in Java”, Cengage Learning

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.	**K1**
CO2	Demonstrate the construction and working of different measuring instruments for Power, energy and frequency measurements.	**K2**
CO3	Demonstrate the construction and working of different AC and DC bridges, along with their applications.	**K2**
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.	**K2**
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.	**K3**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)

K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – 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

MEASURMENT 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

BEE309 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 circuital law, nodal and mesh methods of circuit analysis and simplify the network using Graph Theory approach.	**K3**
CO2	Analyze the AC and DC circuits using Kirchhoff's law and Network simplification theorems.	**K4**
CO3	Analyze steady-state responses and transient response of DC and AC circuits using classical and Laplace transform methods.	**K4**
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.	**K4**
CO5	Synthesize one port network and analyze different filters.	**K4**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – Create

Detailed Syllabus:

UNIT I

Graph Theory:

Pre- Requisites: *Basic circuital 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 circuital 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.

BCS351 DATA STRUCTURE LAB

List of Experiments (Indicative & not limited to)

1. **Implementing Sorting Techniques:** Bubble Sort, Insertion Sort, Selection Sort, Shell , Sort, Radix Sort, Quick sort

2. **Implementing Searching and Hashing Techniques:** Linear search, Binary search, Methods for Hashing: Modulo Division, Digit Extraction, Fold shift, Fold Boundary, Linear Probe for Collision Resolution. Direct and Subtraction hashing

3. **Implementing Stacks:** Array implementation, Linked List implementation, Evaluation of postfix expression and balancing of parenthesis , Conversion of infix notation to postfix notation

4. **Implementing Queue:** Linked List implementation of ordinary queue, Array implementation of circular queue, Linked List implementation of priority queue, Double ended queue

5. **Implementing Linked List:** Singly Linked Lists, Circular Linked List, Doubly Linked Lists : Insert, Display, Delete, Search, Count, Reverse(SLL), Polynomial , Addition , Comparative study of arrays and linked list

6. **Implementing Trees:** Binary search tree : Create, Recursive traversal: preorder, post order, in order, Search Largest , Node, Smallest Node, Count number of nodes, Heap: Min Heap, Max Heap: reheap Up, reheap Down, Delete , Expression Tree, Heapsort

7. **Implementing Graphs**: Represent a graph using the Adjacency Matrix, BFS, Find the minimum spanning tree (using any method Kruskal's Algorithm or Prim's Algorithm) Self Learning Topics : Shortest Path Algorithm

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 (K_1, K_2, K_3, K_4, K_5, K_6)

K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – 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.

BEE359 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 (K_1, K_2, K_3, K_4, K_5, K_6)

K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – 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.

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.	**K3**
CO2 Design and analyze modular combinational circuits with MUX / DEMUX, Decoder & Encoder	**K4**
CO3 Design & analyze synchronous sequential logic circuits	**K4**
CO4 Analyze various logic families and design circuits using PLDs.	**K3**
CO5 Design various ADCs and DACs according to the given specifications.	**K3**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – 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.	**K4**
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.	**K2**
CO3	Evaluate the performance and characteristics of DC Machine as motor and as well as generator.	**K4**
CO4	Evaluate the performance of transformers, individually and in parallel operation.	**K4**
CO5	Demonstrate and perform various connections of three phase transformers.	**K3**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – 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 Fitggerald, 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.

BCS 409 DESIGN AND ANALYSIS OF ALGORITHM

	Course Outcome (CO)	Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Design new algorithms, prove them correct, and analyze their asymptotic and absolute runtime and memory demands.	**K4, K6**
CO 2	Find an algorithm to solve the problem (create) and prove that the algorithm solves the problem correctly (validate).	**K5, K6**
CO 3	Understand the mathematical criterion for deciding whether an algorithm is efficient, and know many practically important problems that do not admit any efficient algorithms.	**K2, K5**
CO 4	Apply classical sorting, searching, optimization and graph algorithms.	**K2, K4**
CO 5	Understand basic techniques for designing algorithms, including the techniques of recursion, divide-and-conquer, and greedy.	**K2, K3**

DETAILED SYLLABUS

Unit	Topic	Lecture
I	**Introduction:** Algorithms, Analyzing Algorithms, Complexity of Algorithms, Growth Sort, Heap Sort, Comparison of Sorting Algorithms, Sorting in Linear Time.	**08**
II	**Advanced Data Structures:** Red-Black Trees, B – Trees, Binomial Heaps, Fibonacci Heaps, Tries, Skip List	**08**
III	**Divide and Conquer** with Examples Such as Sorting, Matrix Multiplication, Convex Hull and Searching. **Greedy Methods** with Examples Such as Optimal Reliability Allocation, Knapsack, Minimum Spanning Trees – Prim's and Kruskal's Algorithms, Single Source Shortest Paths - Dijkstra's and Bellman Ford Algorithms.	**08**
IV	**Dynamic Programming** with Examples Such as Knapsack. All Pair Shortest Paths – Warshal's and Floyd's Algorithms, Resource Allocation Problem. Backtracking, Branch and Bound with Examples Such as Travelling Salesman Problem, Graph Coloring, n-Queen Problem, Hamiltonian Cycles and Sum of Subsets.	**08**
V	**Selected Topics:** Algebraic Computation, Fast Fourier Transform, String Matching, Theory of NP- Completeness, Approximation Algorithms and Randomized Algorithms	**08**

Text books:

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, “Introduction to Algorithms”, Printice Hall of India.
2. E. Horowitz & S Sahni, "Fundamentals of Computer Algorithms",
3. Aho, Hopcraft, Ullman, “The Design and Analysis of Computer Algorithms” Pearson Education, 2008.
4. LEE "Design & Analysis of Algorithms (POD)",McGraw Hill
5. Richard E.Neapolitan "Foundations of Algorithms" Jones & Bartlett Learning
6. Jon Kleinberg and Éva Tardos, Algorithm Design, Pearson, 2005.
7. Michael T Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Wiley, 2006.
8. Harry R. Lewis and Larry Denenberg, Data Structures and Their Algorithms, Harper Collins, 1997
9. Robert Sedgewick and Kevin Wayne, Algorithms, fourth edition, Addison Wesley, 2011.
10. Harsh Bhasin,”Algorithm Design and Analysis”,First Edition,Oxford University Press.
11. Gilles Brassard and Paul Bratley,Algorithmics:Theory and Practice,Prentice Hall,1995.

BCS 459 DESIGN AND ANALYSIS OF ALGORITHM LAB

Design and Analysis of Algorithm Lab

	Course Outcome (CO)	Bloom's Knowledge Level (KL)
At the end of course , the student will be able to:		
CO 1	Implement algorithm to solve problems by iterative approach.	**K2, K4**
CO 2	Implement algorithm to solve problems by divide and conquer approach	**K3, K5**
CO 3	Implement algorithm to solve problems by Greedy algorithm approach.	**K4, K5**
CO 4	Implement algorithm to solve problems by Dynamic programming, backtracking, branch and bound approach.	**K4, K5**
CO 5	Implement algorithm to solve problems by branch and bound approach.	**K3, K4**

DETAILED SYLLABUS

1. Program for Recursive Binary & Linear Search.
2. Program for Heap Sort.
3. Program for Merge Sort.
4. Program for Selection Sort.
5. Program for Insertion Sort.
6. Program for Quick Sort.
7. Knapsack Problem using Greedy Solution
8. Perform Travelling Salesman Problem
9. Find Minimum Spanning Tree using Kruskal's Algorithm
10. Implement N Queen Problem using Backtracking
11. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.
12. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.
13. Implement, the 0/1 Knapsack problem using
    a. Dynamic Programming method
    b. Greedy method.
14. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm.
15. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.
16. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.

17. Write programs to
    (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm.
    (b) Implement Travelling Sales Person problem using Dynamic programming.
18. Design and implement to find a subset of a given set S = {Sl, S2, ,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1, 2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.
19. Design and implement to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.

Note: The Instructor may add/delete/modify/tune experiments, wherever he/she feels in a justified manner It is also suggested that open source tools should be preferred to conduct the lab (C, C++ etc)

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 aswell 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 (K_1, K_2, K_3, K_4, K_5, K_6)

K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – 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 andcompound 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 to2-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.	**K2 , K3**
CO2	Design the Sequential circuits with the help of combinational circuits and feedback element.	**K3, K4**
CO3	Design data selector circuits with the help of universal Gates.	**K3, K4**
CO4	Design the counters with the help of sequential circuit and basic Gates.	**K3, K4**
CO5	Implement the projects using the digital ICs and electronics components.	**K3, K5**

KL- Bloom's Knowledge Level (K_1, K_2, K_3, K_4, K_5, K_6)
K_1 – Remember K_2 – Understand K_3 – Apply K_4 – Analyze K_5 – Evaluate K_6 – 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.