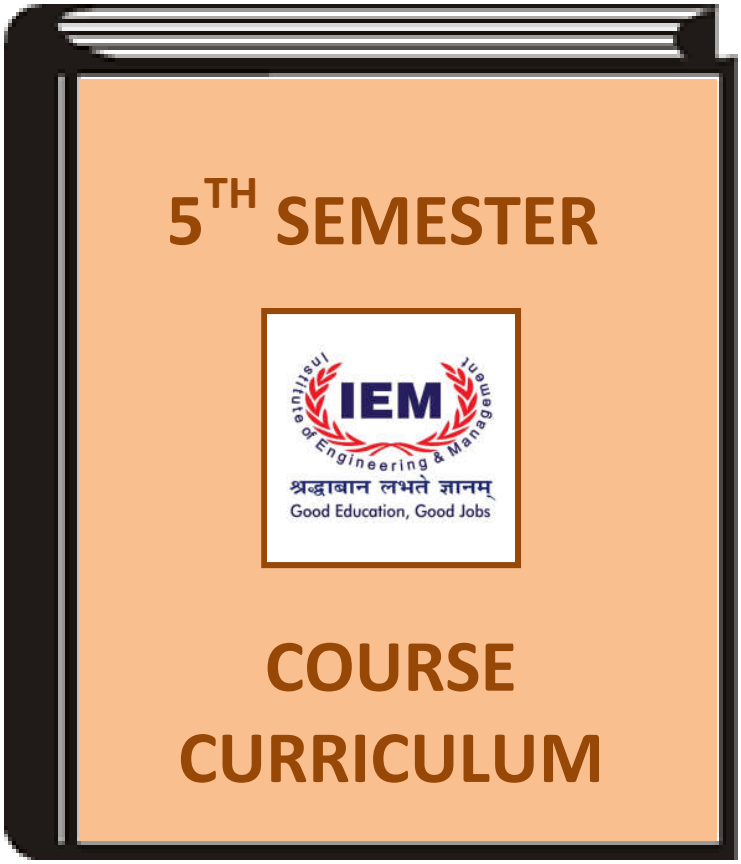
DEPARTMENT OF ELECTRICAL ENGINEERING



INSTITUTE OF ENGINEERING & MANAGEMENT

Course: EE501- ELECTRIC MACHINE II

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH**
COURSE: Electric Machine-II	SEMESTER: **4** CREDITS: **4**
COURSE CODE: **EE 501**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: Theory of Single Phase Induction motor, Synchronous machines and Special machines	CONTACT HOURS: 4 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY): **EE 591**	LABCOURSE NAME: Electric Machine-II

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
EE401	Electric Machines I	Basic Knowledge of 3 phase induction motors and dc machines	**4**

Course Objectives

1. To understand the fundamental principles of Electromagnetic energy conversion and operations and construction of Single phase induction motor, Synchronous machines and special machines.
2. To develop the understanding regarding the application of above machines in transmission, distribution and in different plants
3. To understand the different methods starting and testing of electrical machines

Course Outcomes

1. Students would be able to understand application of field theory and circuit theory in all Electrical machine.
2. Students would be able to troubleshoot the problems in the operation of Electrical machine and also learn to design suitable experiment to determine the operation parameters of machine.
3. Students would be able to identify the electrical machine required for specific application in a plant.
4. Students would be aware of modern trends in Electrical Machine and update their knowledge for the same.

Programme Outcomes addressed in this course

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	√								
CO2		√	√						
CO3				√					
CO4							√		√

Syllabus

UNIT	DETAILS	HOURS
I	**Single Phase Induction Motor:** Construction, Double revolving field theory, Cross field theory, Starting methods, Speed-Torque characteristics, Phasor diagram, Condition of Maximum torque, Determination of equivalent circuit parameters, Testing of Single phase motors, Applications. Single phase AC series motor, Compensated and uncompensated motors.	10
II	**Synchronous machines:** Construction, Types, Excitation systems, Generator & Motor modes, Armature reaction, Theory for salient pole machine, Two reaction theory, Voltage regulation (EMF, MMF, ZPF). Operating characteristics of Alternators and their rating. Power angle characteristics of Synchronous machines. Parallel operation of Alternators, Synchronous machine connected to infinite bus, effect of change of excitation and speed of prime mover. Starting of Synchronous motor, V-curve. Damper winding, Hunting. Short circuit transients.	20
III	**Special Electromechanical devices:** Principle and construction of switched Reluctance motor, Permanent magnet machines, Brushless DC machines, Hysteresis motor, Stepper motor, Tacho generators, Synchros & resolvers. AC servo motors, Principle, construction and operational characteristics of Induction generator & linear Induction motor.	10

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Construction and field winding Speed control methods	Extra Class	.4
2	Circle diagram, O-curve, V-curve. Damper winding, Stability analysis	Extra Class	4

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	DC Servo Motor	1

Web Source References

S.NO.	URL
1	http://nptel.ac.in/courses/108106072/

Books References:

1. Electrical Machinery, P.S. Bhimra, 6th Edition, Khanna Publishers.
2. Electric machines, D.P. Kothari & I.J Nagrath, 3rd Edition, Tata Mc Graw-Hill Publishing Company Limited.
3. Electric Machinery & transformer, Irving L Koskow, 2nd Edition, Prentice Hall India
4. The performance and Design of Alternating Current Machines, M.G.Say, CBS Publishers & Distributors.
5. Electric Machinery, A.E.Fitzgerald, Charles Kingsley,Jr. & Stephen D. Umans, 6th Edition, Tata McGraw Hill Edition.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

Sl. No.	Day	Module Name	Topics
1	Day 1		Overall discussion about the syllabus, Objective and importance of the subject
2	Day 2	Single Phase Induction motor	Introduction: revision of 3phase Induction motor, Basic Difference between 3 phase and single phase Induction motor.
3	Day 3		Construction and basic working principle

4	Day 4		Double Revolving field theory and cross field theory
5	Day 5		Different Starting Methods of single phase induction motor
6	Day 6		Equivalent Circuit and Phasor Daigram
7	Day 7		Torque Equation, Speed-torque characteristics, condition of maximum torque
8	Day 8		Testing of single phase motors and determination of equivalent circuit parameters
9	Day 9		Numerical problems , application of single phase motor
10	Day 10		Construction , working principle and application of single phase ac series motor
11	Day 11		Different types of ac series motors , numerical problems
12	Day 12		Introduction & Overview with live examples
13	Day 13		Armature reaction theory
14	Day 14		Basic principle of operation of synchronous generator & synchronous motor
15	Day 15		Torque, torque developed by sinusoidal flux density & mmf
16	Day 16		Peak mmf per pole of a poly-phase winding & analysis of induced voltage.
17	Day 17		Construction of Synchronous machine, challenges
18	Day 18		Construction, stator & rotor
19	Day 19		Cooling of Synchronous machine
20	Day 20		Excitation systems
21	Day 21		Emf equation of Syn. generator
22	Day 22		Linear analysis – general method
23	Day 23		Problems , concept of Synchronous Reactance
24	Day 24		Voltage Regulation, methods of voltage regulations
25	Day 25		Unsaturated reactance method, problems
26	Day 26		Saturated Syn. Reactance method, problems
27	Day 27		Z.P.F. method & problems.
28	Day 28		Operating characteristics of Alternators and their rating. Power angle characteristics of
29	Day 29		Parallel operation of Alternators
30	Day 30	Synchronous machines	Synchronous machine connected to infinite bus, effect of change of excitation and speed of prime mover.

31	Day 31		Two reaction theory , to find out direct axis & quadrature axis synchronous reactance
32	Day 32		Starting of Synchronous motor, V-curve. Damper winding,
33	Day 33		Hunting. Short circuit transients. Applications.
34	Day 34	Special Machines	Principle and construction of switched Reluctance motor
35	Day 35		Principle and construction of Permanent magnet machines, Brushless DC machines,
36	Day 36		Stepper motor,
37	Day 37		Principle, construction and operational
38	Day 38		characteristics of Induction generator & linear Induction motor.
39	Day 39		Principle and construction of Hysteresis motor,
40	Day 40		Synchros & resolvers.
41	Day 41		Construction and Working Principle of AC servo motors
42	Day 42		Construction and Working Principle of Tacho generators,

Course: EE502- POWER SYSTEM I

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH**
COURSE:**POWER SYSTEM- I**	SEMESTER: **5** CREDITS: **4**
COURSE CODE: **EE502(EE)**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **Generation, Transmission & line parameters**	CONTACT HOURS: 1 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY):**EE592**	LABCOURSE NAME: **POWER SYSTEM Lab-I**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
ES 101 ES 201	**Basic Electrical Engg. I & II**	AC systems, transformer& induction motors	**1 & 2**
EE 301	**Circuit Theory**	Network Analysis & Two Port modelling	**3**

Course Objectives

1. To study & analyse the general aspects of power system
2. To study & analyze the performance of transmission line.
3. To study & analyze the design aspect of transmission line
4. To study the different methods of power generation and its pricing policies.

Course Outcomes

1. Analyse and compute the transmission line parameters.
2. To design a transmission line considering mechanical & electrical aspects.
3. To understand the different methods of power generation and its pricing policies
4. To understand the general aspects of power system.

Programme Outcomes addressed in this course

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√	√	√					√	
CO2		√	√					√	√
CO3	√	√						√	
CO4	√	√	√	√				√	√

Syllabus

UNIT	DETAILS	HOURS
I	**Overhead transmission line:** Choice of frequency, Choice of voltage, Types of conductors, Inductance and Capacitance of a single phase and three phase symmetrical and unsymmetrical configurations. Bundle conductors. Transposition. Concept of GMD and GMR. Influence of earth on conductor capacitance. **Overhead line construction:** Line supports, Towers, Poles, Sag, Tension and Clearance, Effect of Wind and Ice on Sag. Dampers.	12
II	**Insulators:** Types, Voltage distribution across a suspension insulator string, String efficiency, Arching shield & rings, Methods of improving voltage distribution across Insulator strings, Electrical tests on line Insulators. **Corona:** Principle of Corona formation, Critical disruptive voltage, Visual critical corona discharge potential, Corona loss, advantages & disadvantages of Corona. Methods of reduction of Corona. **Cables:** Types of cables, cable components, capacitance of single core & 3 core cables, dielectric stress, optimum cable thickness, grading, dielectric loss and loss angle.	10
III	**Performance of lines:** Short, medium (nominal , T) and long lines and their representation. A.B.C.D constants, Voltage regulation, Ferranti effect, Power equations and line compensation, Power Circle diagrams.	8
IV	**Generation of Electric Power:** General layout of a typical coal fired power station, Hydro electric power station, Nuclear power station, their components and working principles, comparison of different methods of power generation. Introduction to Solar & Wind energy system. Tariff: Guiding principle of Tariff, different types of tariff. **Indian Electricity Rule-1956:** General Introduction.	10

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Indian power sector scenario, Introduction to power system – Generation, Transmission and Distribution	Extra Class	a.

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Indian power sector scenario, Introduction to power system – Generation, Transmission and Distribution	1

Web Source References

S.NO.	URL
1	http://nptel.ac.in/courses/108102047/

Books References:

1. Modern Power System Analysis, D.P. Kothari & I.J. Nagrath, 4th Edition, Tata McGraw Hill.
2. A Course in Power System, J. B. Gupta, Katson Books.
3. Electrical Power Systems, C. L. Wadhwa, New Age International Publishers.
4. Electrical Power Systems, Ashfaq Husain, CBS Publishers & Distributers.
5. Principles of Power System, V. K. Mehta, Rohit Mehta, S. Chand & company Ltd.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Module	Topic
1	**1**		**Introduction to the subject**
2	**2**	**I**	Introduction, Choice of frequency, Choice of voltage,
3	**3**		Types of conductors
4	**4**		Inductance of single phase system
5	**5**		Inductance of 3 phase symmetrical systems
6	**6**		Inductance of 3 phase unsymmetrical systems
7	**7**		Bundle conductors. Transposition
8	**8**		Resistance of a transmission line
9	**9**		Concept of GMD and GMR
10	**10**		Skin effect & Proximity effect
11	**11**		. Influence of earth on conductor capacitance

12	**12**		Numericals
13	**13**	**II**	Types of insulators,
14	**14**		Voltage distribution across a suspension insulator string, String efficiency
15	**15**		Methods of improving voltage distribution across Insulator strings
16	**16**		Arching shield & rings, , Electrical tests on line Insulators.
17	**17**		Principle of Corona formation, Critical disruptive voltage
18	**18**		Visual critical corona discharge potential
19	**19**		Corona loss, advantages & disadvantages of Corona. Methods of reduction of Corona.
20	**20**		Types of cables
21	**21**		cable components, capacitance of single core & 3 core cables
22	**22**		dielectric stress, optimum cable thickness
23	**23**		grading, dielectric loss and loss angle
24	**24**		Numerical
25	**25**	**III**	Short lines
26	**26**		medium (nominal , T) lines
27	**27**		long lines representation their representation. and A.B.C.D constants
28	**28**		Voltage regulation
29	**29**		Ferranti Effect
30	**30**	**III**	Power equations and line compensation
31	**31**		Power Circle diagrams
32	**32**		Numericals
33	**33**	**IV**	General layout of a typical coal fired power station
34	**34**		Hydro electric power station
35	**35**		Nuclear power station
36	**36**		comparison of different methods of power
37	**37**		Introduction to Solar energy systems
38	**38**		Wind energy system
39	**39**		Guiding principle of Tariff, different types of tariff
40	**40**		Numericals
41	**41**		Indian Electricity Rule-1956: General Introduction

Course: EE 503- Control System-I

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH**
COURSE: Control System-I	SEMESTER: **5** CREDITS: **4**
COURSECODE: **EE 503**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: Modeling, Control and stability analysis of Linear Time Invariant systems.	CONTACT HOURS: 4 **(weekly)**
CORRESPONDING LAB COURSE CODE (IF ANY): **EE 593**	LABCOURSE NAME : Control System –I Laboratory

Course pre-requisites

Basic knowledge of Laplace Transform technique and integro-differential equations

Course Objectives

4. **To understand the fundamental concept of modeling dynamic systems, behaviour of up to 2nd order dynamic systems under different input signals (step, ramp, parabolic, impulse) in time domain.**
5. **To learn the different stability techniques for dynamic systems even of higher order.**
6. **To understand the necessity of controller and compensator design for dynamic systems in transfer function approach.**

Course Outcomes

5. **Students will be able to build mathematical model of practical systems (Both electrical and mechanical systems).**
6. **Students would be able to analyze the dynamic system response (open loop and closed loop) under different test input signals.**
7. **Students would be able to appreciate different stability analyzing tools for a given dynamic plant transfer function.**
8. **Students would be able to understand the practical application of controller and compensator to improve any given dynamic system performance in time and frequency domain as well.**

Programme Outcomes addressed in this course

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	√	√			√				
CO2	√	√	√						
CO3		√	√		√				
CO4		√	√		√				√

Syllabus

UNIT	DETAILS	HOURS
I	**Introduction to control system:** Concept of feedback and Automatic control, Effects of feedback, Objectives of control system, Definition of linear and nonlinear systems, Elementary concepts of sensitivity and robustness. Types of control systems, Servomechanisms and regulators, examples of feedback control systems. Transfer function concept. Pole and Zeroes of a transfer function. Properties of Transfer function. **Mathematical modeling of dynamic systems:** Translational systems, Rotational systems, Mechanical coupling, Liquid level systems, Electrical analogy of Spring–Mass-Dashpot system. Block diagram representation of control systems. Block diagram algebra. Signal flow graph. Mason's gain formula. **Control system components:** Potentiometer, Synchros, Resolvers, Position encoders. DC and AC tacho-generators. Actuators. Block diagram level description of feedback control systems for position control, speed control of DC motors, temperature control, liquid level control, voltage control of an Alternator.	14
II	**Time domain analysis:** Time domain analysis of a standard second order closed loop system. Concept of un damped natural frequency, damping, overshoot, rise time and settling time. Dependence of time domain performance parameters on natural frequency and damping ratio. Step and Impulse response of first and second order systems. Effects of Pole and Zeros on transient response. Stability by pole location. Routh-Hurwitz criteria and applications. **Error Analysis:** Steady state errors in control systems due to step, ramp and parabolic inputs. Concepts of system types and error constants.	10
III	**Stability Analysis:** Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros. **Frequency domain analysis of linear system:** Bode plots, Polar plots, Nichols chart, Concept of resonance frequency of peak magnification. Nyquist criteria, measure of relative stability, phase and gain margin. Determination of margins in Bode plot. Nichols chart. M-circle and M-Contours in Nichols chart.	12
IV	**Control System performance measure:** Improvement of system performance through compensation. Lead, Lag and Lead- lag compensation, PI, PD and PID control.	4

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS
1	Modeling of Linear Time **Variant** practical systems	Tutorial Class

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Mathematical modeling of PID controller based speed-torque control of PMDC motor.	1

Web Source References

S.NO.	URL
1	http://www.nptel.ac.in/course.php

Books References:

1. Control System Engineering, I. J. Nagrath & M. Gopal. New Age International Publication.
2. Modern Control Engineering, K. Ogata, 4th Edition, Pearson Education.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Topic
1	Day 1	Introduction, Need of studying Control system in Real life. Open loop & closed loop concept. Concept of feedback and Automatic control.
2	Day 2	Effects of feedback, Objectives of control system, Definition of linear and nonlinear systems
3	Day 3	Elementary concepts of sensitivity and robustness.
4	Day 4	Transfer function concept. Properties of Transfer function, pole and zero concept.
5	Day 5	Block diagram representation of control systems. Block diagram algebra.
6	Day 6	Numerical problems and doubt clearing session.
7	Day 7	Signal flow graph. Mason's gain formula.
8	Day 8	Numerical Problem practice and doubt clearing session.
9	Day 9	Modeling of practical systems; Potentiometer, Synchros, Resolvers, Position encoders

10	Day 10	Mathematical modeling of DC and AC tacho-generators. Actuators.
11	Day 11	Block diagram level description of feedback control systems for position control, speed control of DC motors
12	Day 12	Temperature control, liquid level control, voltage control of an Alternator.
13	Day 13	Concept and necessity of Time domain analysis of Time domain analysis for dynamic systems
14	Day 14	Time domain analysis of a standard second order closed loop system
15	Day 15	Derivation of time response and error of 2^{nd} order system under step input signal.
16	Day 16	Derivation of time response and error of 2^{nd} order system under ramp input signal.
17	Day 17	Concept of un damped natural frequency, damping, overshoot, rise time and settling time.
18	Day 18	Dependence of time domain performance parameters on natural frequency and damping
19	Day 19	Numerical examples based on time response and performance parameter variation of dynamic system
20	Day 20	Error analysis of dynamic system under different input signals.
21	Day 21	Steady state errors in control systems due to step and ramp input
22	Day 22	Concepts of system types and error constants.
23	Day 23	Concept of absolute & relative stability of control system. Pole and Zero concept of a transfer function.
24	Day 24	Routh stability criterion and its different case studies.
25	Day 25	Numerical Problems and doubt clearing session.
26	Day 26	Root locus techniques, construction of Root Loci for simple systems. Effects of gain on the movement of Pole and Zeros.
27	Day 27	Numerical Problem practice, doubt clearing session.
28	Day 28	Concept of frequency domain analysis. Concept of Bode plots, Construction, rules.
29	Day 29	Gain margin and phase margin determination using Bode plot.
30	Day 30	Stability analysis using Bode Plot.
31	Day 31	Concept of polar plot. Concept of Nyquist contour.
32	Day 32	Nyquist stability criterion
33	Day 33	Different steps of drawing a complete Nyquist Plot for a given system open loop transfer function
34	Day 34	Numerical examples based on Nyquist stability analysis.
35	Day 35	Nichols chart. M-circle and M-Contours in Nichols chart.
36	Day 36	Problem practice from previous year university questions.
37	Day 37	Tutorial and remedial classes according to doubts.
38	Day 37	Tutorial and remedial classes according to doubts.

Course: EE 504A- DATA STRUCTURE AND ALGORITHM

PROGRAMME: ELECTRICAL **ENGINEERING**	DEGREE:**B. TECH**
COURSE: **DATA STRUCTURE AND ALGORITHM**	SEMESTER: **5** CREDITS: **3**
COURSECODE: **EE 504A**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: Implementation of Storage representation of structured data and various algorithm to retrieve them	CONTACT HOURS: **3(weekly)**
CORRESPONDING LAB COURSE CODE (IF ANY): EE 594	LABCOURSE NAME: **Data Structure lab**

Course pre-requisites

Basic knowledge C programming, algorithm design

Course Objectives

7. To Understand the fundamentals of Data and their representation in computer
8. To develop the understanding regarding the applications of fundamental ideas of Data Structure to store the data and apply the algorithms in modern engineering and technology.

Course Outcomes

9. Students would understand the basic use of various data structures.
10. Students would be able to design the efficient algorithm based on various data structure.
11. Students would have a clear knowledge of basic storage procedure of data elements, its functions and the limitations.
12. Students would be able to recognize, understand the algorithms and data structures used in various real life application such as Data Base Management Systems.

Programme Outcomes addressed in this course

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√	√	√					√	
CO2	√	√	√						
CO3	√		√				√	√	
CO4	√	√	√						√

Syllabus

UNIT	DETAILS	HOURS
I	**Introduction:** Importance of study of Data structure**,** Concept of data structure: Data and data structure, Abstract data type and data type. Algorithm and programs, Basic idea of pseudo-code, Algorithm efficiency and analysis, time and space analysis of algorithms-order notations. Different representation: row major, column major. Sparse matrix, its implementation and usage. Array representation of polynomials. Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and Applications.	8
II	**Stack & queue:** Stack and its implementation, (using array, using linked list) application. Queues, circular queue, dequeue, Implementation of queue- both linear and circular (using array, using linked list) applications. **Recursion:** Principle of recursion- use of stack, difference between recursion and iteration, tail recursion. Application-The Tower of Hanoi, Eight Queen Puzzle	7
III	**Nonlinear data structure:** **Trees:** Basic terminologies, forest, tree representation (using array, using linked list). Basic trees, binary tree traversal (Pre-,in-,post-order), threaded binary tree(left, right, full), non recursive traversal algorithm using threaded binary tree, expression tree. Binary search tree-operations(creation, insertion, deletion, searching), Height balanced binary tree-AVL tree (insertion, deletion with examples only). B tree operations ((insertion, deletion with examples only) **Graph:** Graph definition and concept, (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut vertex /articulation point, pendant node, clique, complete graph, connected –strongly connected component, weakly connected component-path, shortest path, isomorphism. Graph representation/storage implementation- adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity- Depth First Search (DFS), Breadth-First Search (BFS), concept of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge, application. Minimal spanning tree-Prim's algorithm (Basic idea of greedy methods)	15

IV	**Searching, Sorting:** Sorting algorithm, Bubble sort and optimization, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (Concept, of max heap, application-priority queue, radix sort. Searching, sequential search, binary search, interpolation search. Hashing, Hashing functions, collision resolution techniques.	10

Gap Analysis:

Unit of the Syllabus	**Topic(s) to be included**	**Proposed Action**	**PO Mapping**
I	Asymptotic Analysis of Algorithm and recurrence relation	Extra Class	1
II	Dynamic programming methodology	Extra Class	1
IV	Application of Data Structure in DBMS design.	Extra Class	1
IV	Implementation of Data structure using object oriented language	Extra Class	**1**

Unit of the Syllabus	Topic(s) to be included
2	Recursive vs. Iterative Solutions.
3	Add Kruskal's algorithm in MST. Graphs: Weighted Graphs: Shortest Paths. Single Source Shortest Paths - Dijkstra's Algorithm and Analysis, All Pairs Shortest Paths - Dynamic Programming Algorithm and Analysis. Reachability and Strong Connectivity. Directed Acyclic Graphs - Topological Sorting.
5(new module)	Text and String Processing: String Matching – Boyer-Moore and KMP algorithms. Text Retrieval – Tries. Compressed Tries and Suffix Tries. Text and String Processing: Text Compression – Huffman Coding.

Topics beyond syllabus/advanced topics

S. No	Description	Hours
1	Data structure using JAVA and Python	1

Web Source References

S No	URL
1	https://www.tutorialspoint.com/data_structures_algorithms/

Text Books:

1. Data structure using C, Reema Thareja, Oxford.
2. Data structure, S.Lipschutz.
3. Data structure and program design in C, Robert L Krusse, B.P.Leung

Reference Books:

1. Data structure using C++, Varsha H. Patil, Oxford

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

Unit	Day	Detail Topic	Hour
1	1	Importance of study of Data structure, Concept of data structure	1
	2	Data and data structure, Abstract data type and data type.	1
	3	Algorithm and programs, Basic idea of pseudo-code, Algorithm efficiency and analysis,	1
	4	Time and space analysis of algorithms-order notations.	1
	5	Different representation: row major, column major.	1
	6	Sparse matrix, its implementation and usage. Array representation of polynomials	1
	7	Searching algorithms	1
	8	Sorting algorithms	1
2	9	Stack and its implementation using array	1
	10	Stack and its implementation using list	1
	11	Application of stack for evaluation of POSTFIX	1
	12	Application of Stack for INFIX to POSTFIX conversion	1
	13	Queues, circular queue implementation	1
	14	Double Ended Queue implementation	1

	15	Priority Queue implementation	1
3	16	Concept of Dynamic Memory allocation, Implementation of Singly linked list	1
	17	Circular Linked List Implementation, Concept of Doubley Linked List	1
	18	Implementation of Circular Doubly List, Polynomial Handling using List.	1
	19	Row Major and Column Major arrangements of Linear Array	1
	20	Concept of Sparse Matrix and Application.	1
4	21	Principle of Recursion and related concept of Stack	1
	22	Difference between iteration and recursion, Tail Recursion	1
	23	Example Problems	1
5	24	Basic terminologies, forest, tree representation (using array, using linked list).	1
	25	Basic trees, binary tree traversal (Pre-,in-,post-order),	1
	26	threaded binary tree(left, right, full), non recursive traversal algorithm using threaded binary tree,	1
	27	Expression tree. Binary search tree-operations	1
	28	creation, insertion, deletion, searching in BST	1
	29	Height balanced binary tree-AVL tree (insertion, deletion with examples only)	1

	30	Heap and its implementation, Max heap , Min heap	1
	31	Heap Sort algorithm and its implementation	1
	32	B tree orations ((insertion, deletion with examples only)	1
	33	Fundamentals of B+ Tree	1
6	34	Concept of Graph , Various definitions	1
	35	Graph Representation in memory, storage representation (Different types of Matrices and Lists)	1
	36	Graph Traversal Algorithm , BFS, DFS	1
	37	Minimal Spanning Tree Algorithms	1
	38	Shortest Path Algorithms	1
7	39	Concept of Hashing	1
	40	Hash Functions and Applications	1
	41	Collision and their Resolution Techniques	1
	42	Examples	1

Course: EE-504C-MICROPROCESSOR & MICROCONTROLER

PROGRAMME: **Electrical Engineering**	DEGREE:**B. TECH**
COURSE: **Microprocessor & Microcontroller**	SEMESTER: **5** CREDITS: 3
COURSE CODE: **EE504C**	COURSE TYPE: **Theory**
COURSE AREA/DOMAIN: **8-bit and 16-bit microprocessor and 8-bit microcontroller Architecture, Programming**	CONTACT HOURS: 3 **(weekly)**
CORRESPONDING LAB COURSE CODE (IFANY):**EE504C**	LABCOURSE NAME: **Microprocessor & Microcontroller Lab**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION	SEM.
CS201	Basic Computation & Principles of Computer Programming	Knowledge of Programming, Computer Basic etc	**2**

Course Objectives

1. To develop an in-depth understanding of the operation of microprocessors and microcontrollers, machine language programming & interfacing techniques.

Course Outcomes

1. The student will learn the internal organization of some popular microprocessors and microcontrollers.
2. The student will learn hardware and software interaction and integration.
3. The students will learn the design of microprocessors/microcontrollers-based systems

Programme Outcomes addressed in this course

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO1	√								√
CO2	√	√	√	√					√
CO3		√	√	√	√				√

Syllabus

Introduction to Computer architecture: Architecture of a typical Microprocessor**,** Bus configuration, The CPU module, ROM & RAM families, Introduction to assembly language & machine language programming, Instruction set of typical microprocessor (e.g. 8085), Subroutine & stack, Timing diagram, Memory Interfacing, Interfacing input output- port, Interrupt & interrupt handling, Serial & parallel data transfer scheme, Programmed & interrupt driven data transfer, Direct memory access, Programmable peripheral devices, Programmable interval timer, Analog input-output using AD & DA converter.

Assembly language program of a typical Microprocessor: Use of compilers, assembler, linker & debugger.

Basic 16 bit Microprocessor (e.g. 8086): Architecture, Min-max mode.

Introduction to microcontroller: Architecture & instruction set of a typical microcontroller (e.g. PIC16F84 device), Feature of popular controller (processor 8031/8051), its programming & interfacing.

Gaps in the syllabus - to meet industry/profession requirements

S.NO.	DESCRIPTION	PROPOSED ACTIONS	PO MAPPING
1	Case studies: Traffic Light control	Extra Class	PO9

Topics beyond syllabus/advanced topics

S.NO.	DESCRIPTION	HOURS
1	Electric motor control using microcontroller.	1

Web Source References

S.NO.	URL
1	http://nptel.ac.in/courses/108107029/

Books References:

1. Microprocessor Architecture, Programming and Application with the 8085, 5th edition, R Gaonkar, Penram International.
2. Advanced Microprocessors and Peripherals, A K Ray and K M Bhurchandi, TMH.
3. The 8051 Microcontroller and Embedded Systems, M A Mazidi and J G Mazidi, Prentice Hall

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Power Point Presentation

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan

S. NO.	Day	Module	Topic
1	Day 1	I	Introduction and basic functions of a microprocessors and microcontroller; machine and assembly language
2	Day 2		8085 bus organization; registers; logic devices for interfacing
3	Day 3		Memory classification; memory map and addresses
4	Day 4		Pin-out configuration of 8085 with purpose of each pin;
5	Day 5		Functional block diagram of 8085
6	Day 6		Memory interfacing; read-write cycles
7	Day 7		Addressing the I/O devices, memory mapped I/O interfacing
8	Day 8	II	Classification of instructions, data transfer operation
9	Day 9		Arithmetic and logic operation; examples
10	Day 10		Branch operation and loop formation; examples
11	Day 11		Writing program using loop and nested loop
12	Day 12		Counter and time delay; instruction timing calculation
13	Day 13		Writing program using time delays & calculation of T-states
14	Day 14		Concept of stack memory; PUSH - POP instructions
15	Day 15		Concept of subroutine; call and return instruction
16	Day 16		Code conversion; BCD and ASCII
17	Day 17		BCD operations; addition and subtraction
18	Day 18		Writing advanced program using time delays & calculation of T-states
19	Day 19	III	Interrupt structure of 8085; vectored interrupt; concept of interrupt driven data transfer
20	Day 20		Architecture of 8259A programmable interrupt controller

21	Day 21		Programming with 8259A
22	Day 22		Direct Memory Access operation;
23	Day 23		Architecture and interfacing of 8257 with 8085
24	Day 24		Serial I/O and data communication; synchronous & asynchronous data transfer; use of SID and SOD pins of 8085
25	Day 25		Serial communication interface 8251
26	Day 26		Programmable peripheral interface 8255; architecture and operating modes; control word
27	Day 27		Programming using 8255
28	Day 28		Programmable counter/interval timer 8253
29	Day 29		Interfacing of 8253 with microprocessor
30	Day 30		Analog to digital converter; interfacing of ADC0800
31	Day 31		Digital to analog converter; interfacing of DAC ICs
32	Day 32		Keyboards & display devices interfacing using 8279
33	Day 33	IV	Architecture of general 16-bit microprocessors,
34	Day 34		8086-pin assignment, max-min mode
35	Day 35		Memory interfacing, interrupts, I/O interfacing
36	Day 36		Instruction sets, classification of instructions
37	Day 37		Addressing modes of 8086, software model
38	Day 38		Assembly language programming of 8086
39	Day 39	V	Introduction to Microcontroller; difference between microprocessor and microcontroller
40	Day 40		8051 pin description, connection,
41	Day 41		I/O ports; memory & memory organization
42	Day 42		Addressing modes & instruction set of 8051
43	Day 43		Data copy instructions, examples
44	Day 44		Arithmetic and logical instructions, examples
45	Day 45		Concept of timer and counter; formation of loop
46	Day 46		Interrupts and programming of 8051 microcontroller

Course: ES 591 ELECTRIC MACHINE – II LABORATORY

PROGRAMME: **ELECTRICAL ENGINEERING**	DEGREE: **B. TECH.**
COURSE: **Electrical machine -II Laboratory.**	SEMESTER: 5th CREDITS: **2**
COURSECODE: **ES 591**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: **1-Φ & 3- Φ Induction Motor, 3- Φ Synchronous Motor &Synchronous Generator(Alternator).**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **ES 501**	THEORY COURSE NAME:**Electric machine -II.**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
EE 401	Electrrical Machines I	Knowledge of Experiments on DC & AC machines

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom. **(L-I)**

2. **Debugging Skills:** Develop debugging capability in order to propose and apply effective engineering solutions. **(L-II)**

Laboratory Outcomes (Los) :

- **Instrumentation:** Apply appropriate instruments and handle them carefully and safely to make measurements of physical quantities or perform data analysis.**(LO – 1)**
- **Models:** Identify the strength and limitations of theoretical models and establish a relationship between measured data and underlying physical principles. **(LO – 2)**
- **Design:** Design and build a hardware part to meet desired specifications and tests it using appropriate testing strategy and/or equipments. **(LO – 3)**

After completing this course, students will be able:

- ❖ To identify the basic elements of the electrical and electronic engineering.
- ❖ The students will understand the basic operation of transformers and various electrical machines.
- ❖ To understand the basic operation of various electronic components.

Programme Outcomes addressed in this course

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√							√	
LO2	√	√			√				
LO3		√	√		√				

LIST OF EXPERIMENTS:

Electrical Machine Laboratory-I

1. Different methods of starting of a 3 phase Cage Induction Motor & their comparison [DOL, Auto transformer & Star-Delta].
2. Speed control of 3 phase squirrel cage induction motor by different methods & their comparison [voltage control & frequency control].
3. Speed control of 3 phase slip ring Induction motor by rotor resistance control.
4. Determination of regulation of Synchronous machine by
   a). Potier reactance method. b). Synchronous Impedance method.
5. Determination of equivalent circuit parameters of a single phase Induction motor.
6. Load test on single phase Induction motor to obtain the performance characteristics.
7. To determine the direct axis resistance [X_d] & quadrature reactance [X_q] of a 3 phase synchronous machine by slip test.
8. Load test on wound rotor Induction motor to obtain the performance characteristics.
9. To make connection diagram to full pitch & fractional slot winding of 18 slot squirrel cage Induction motor for 6-poles & 4-pole operation.
10. To study the performance of Induction generator.
11. Parallel operation of 3 phase Synchronous generators.
12. V-curve of Synchronous motor.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: EE491 (EE)

Days	Experiment Performed
1	To make connection diagram to full pitch & fractional slot winding of 18 slot squirrel cage Induction motor for 6-poles & 4-pole operation.
2	Different methods of starting of a 3 phase Cage Induction Motor & their comparison [DOL, Auto transformer &Star-Delta].
3	Speed control of 3 phase slip ring Induction motor by rotor resistance control.
4	Determination of equivalent circuit parameters of a single phase Induction motor.
5	Load test on single phase Induction motor to obtain the performance characteristics.
6	**1st VIVA VOCE and Pending experiment clearing.**
7	Determination of regulation of Synchronous machine by a). Potier reactance method. b). Synchronous Impedance method.
8	To study the performance of Induction generator.
9	V-curve of Synchronous motor.
10	**2nd VIVA VOCE and Pending experiment clearing.**

Course: EE 592 Power System-I LABORATORY

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH.**
COURSE: **POWER SYSTEM -I Laboratory**	SEMESTER:5 CREDITS: **2**
COURSECODE: **EE 592**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: Power generation, transmission and distribution.	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **EE502**	THEORY COURSE NAME: **POWER SYSTEM– I**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
EE301	ELECTRIC CIRCUIT THEORY	Knowledge of different types of network analysis.
EE 401	ELECTRICAL MACHINE-I	Knowledge of different types of DC machines.

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to network systems in different domains of power system like generation, transmission and distribution of power.
2. **Debugging Skills:** Develop debugging capability in order to propose and apply effective engineering solutions like synchronization of machine with infinite bus.

Laboratory Outcomes (LOs) :

- **Analyze** experimental results and effective documentation and exhibit professional behavior.
- **Understand** the concept of probability theory, distribution, and network modeling and reliability analysis.
- **Understand** breakdown phenomena.
- **Understand** the distribution system planning.

After completing this course, students will be able:

- To evaluate voltage drop and line loss calculations and design the capacitors and voltage regulating equipment to improve the power factor and voltage profile.
- Understand the distribution system planning and automation.

Programme Outcomes addressed in this course

1. An ability to design and conduct experiments, as well as to analyze and interpret data. (PO – 2)
2. An ability to identify, formulate and solve engineering problems. (PO – 5)
3. An ability to apply the knowledge of mathematics,science and engineering.(PO-1)
4. A recognition of the need for engaging in lifelong learning.(PO-8)
5.An ability to design a system or process to meet the desired result within technical and socio-economic constraints.(PO-4)

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√	√							√
LO2	√	√		√			√	√	
LO3								√	√
LO4			√	√	√			√	

LIST OF EXPERIMENTS:

Power System Laboratory-I

1. Determination of the generalized constants A.B, C, D of long transmission line.
2. Simulation of DC distribution by network analyzer.
3. Measurement of earth resistance by earth tester.
4. Dielectric strength test of insulating oil.
5. Determination of breakdown strength of solid insulating material.
6. Different parameter calculation by power circle diagram.
7. Study of different types of insulator.
8. Active and reactive power control of alternator.
9. Study and analysis of an electrical transmission line circuit with the help of PSPICE.
10. Dielectric constant, tan delta, resistivity test of transformer oil.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: EE592

Days	Experiment Performed
1	Introduction and brief description of different types of experimental set-up.
2	Study of different types of insulator.
3	Determination of the generalized constants A.B, C, D of long transmission line.
4	Determination of breakdown strength of solid insulating material.
5	Dielectric strength test of insulating oil.
6	1st VIVA VOCE and Pending experiment clearing.
7	Simulation of DC distribution by network analyzer.
8	Different parameter calculation by power circle diagram.
9	Study and analysis of an electrical transmission line circuit with the help of PSPICE.
10	Active and reactive power control of alternator.
11	2nd VIVA VOCE and Pending experiment clearing.

Course: EE 593 Control System - I LABORATORY

PROGRAMME: **ELECTRICAL ENGG.**	DEGREE:**B. TECH.**
COURSE: **Control System – I**	SEMESTER: 5 CREDITS: **2**
COURSECODE: **EE 593**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: **Idea about open loop and closed loop control strategy, TF modeling, control system stability, controller design etc.**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **EE 503**	THEORY COURSE NAME: **Control System - I**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
EE391	Electric circuit theory laboratory	Knowledge of Matlab command, basic electrical circuits, electro-mechanical system
M101, M201	Engineering Mathematics	Knowledge of Matrices computation, rank, order

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom. **(L-I)**

2. **Debugging Skills:** Develop debugging ability in order to propose and apply effective engineering solutions. **(L-III)**

Laboratory Outcomes (Los) :

- **Instrumentation:** It is required to apply suitable instruments and handle them carefully and safely to make measurements of physical quantities or perform data analysis. **(LO – 1)**
- **Models:** Software implication for designing and simulation of circuits by identify the strength and limitations of theoretical models and establish a relationship between measured data and underlying physical principles. **(LO – 2)**
- **Design:** Design and build hardware part to meet desired specifications and tests stability of system using appropriate testing strategy and/or equipments. **(LO – 4)**

After completing this course, students will be able:

- To realize the basic of transfer function modeling, open loop and closed loop control strategy etc.
- The students will understand the stability of a control system of different control engineering problems.
- To understand the domain analysis of any control strategy or plotting curves using Matlab .

Programme Outcomes addressed in this course

1. An ability to apply the knowledge of mathematics, science and engineering. **(PO-1)**
2. An ability to identify, formulate and solve engineering problems. **(PO-2)**
3. An ability to design and conduct experiments as well as to interprete data. **(PO-3)**

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√	√	√						
LO2		√	√	√					
LO3		√	√						√

LIST OF EXPERIMENTS:

Control System – I Laboratory

1. Familiarization with MAT-Lab control system tool box, MAT-Lab- simulink tool box & PSPICE
2. Determination of Step response for first order & Second order system with unity feedback on CRO & calculation of control system specification like Time constant, % peak overshoot, settling time etc. from the response.
3. Simulation of Step response & Impulse response for type-0, type-1 & type-2 system with unity feedback using MATLAB & PSPICE.
4. Determination of Root locus, Bode plot, Nyquist plot using MATLAB control system tool box for 2nd order system & determination of different control system specification from the plot.
5. Determination of PI, PD and PID controller action of first order simulated process.
6. Determination of approximate transfer functions experimentally from Bode plot.
7. Evaluation of steady state error, settling time , percentage peak overshoot, gain margin, phase margin with addition of Lead.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: EE 593

Days	Experiment Performed
1	Determination of Step response for first order & Second order system with unity feedback on CRO & calculation of control system specification like Time constant, % peak overshoot, settling time etc. from the response.
2	Simulation of Step response & Impulse response for type-0, type-1 & type-2 system with unity feedback using MATLAB & PSPICE.
3	Determination of Root locus using MATLAB control system tool box for 2nd order system & determination of different control system specification from the plot.
4	Determination of Bode plot, Nyquist plot using MATLAB control system tool box for 2nd order system & determination of different control system specification from the plot.
5	Determination of PI, PD and PID controller action of first order simulated process.
6	Evaluation of steady state error, settling time , percentage peak overshoot, gain margin, phase margin with addition of Lead.
7	VIVA VOCE and Pending experiment clearing.

Course: EE 594A - DATA STRUCTURE & ALGORITHM LABORATORY

PROGRAMME:**ELECTRICAL ENGINEERING**	DEGREE:**B. TECH**
COURSE: DATA STRUCTURE & ALGORITHM LABORATORY	SEMESTER: **5** CREDITS: **2**
COURSE CODE: EE 594A	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: **Data Structure & Algorithms**	CONTACT HOURS: 3 **(weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **EE 50A**	THEORY COURSE NAME:**Data Structure & Algorithms**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
CS201	**Basic Computation & Principles of Computer Programming**	Knowledge of C Programming Language

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to key concepts of algorithms and data structures taught in the classroom. **(L-I)**

2. **Debugging Skills:**Develop debugging capability in order to propose and apply effectiveengineering solutions. **(L-II)**

Laboratory Outcomes (Los) :

- **LO – 1 :**Apply appropriate algorithms and handle them appropriately to perform different computations.
- **LO – 2 :**Identify the strength and limitations of linear and non-linear data structuresand establish a relationship between data structure and algorithms.
- **LO – 3 :**Design and analysis different algorithmsto meet desired tasks and tests it using appropriate testingstrategy.

After completing this course, students will be able:

- ❖ To identify the different algorithmic paradigms of programming.
- ❖ To understand the basic operation of linear and non-linear data structures.

ProgrammeOutcomes addressed in this course

1. An ability to apply the knowledge of mathematics, science & engineering. **(PO – 1)**
2. An ability to identify, formulate and solve engineering problems. **(PO – 2)**
3. An ability to design and conduct experiments, as well as to analyze and interpret data. **(PO – 3)**
4. A recognition of the need for engaging in lifelong learning. **(PO – 4)**

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√	√						√	
LO2	√	√							
LO3		√	√					√	

LIST OF EXPERIMENTS:

1. Write a C program to insert an element in
   a. Beginning of an array
   b. End of an array
   c. Any position in an array
2. Write a C Program to delete an element from any position of an Array.
3. Write a C program to perform Linear Searching on an array of n elements.
4. Write a C program to perform Binary Searching on an array of n elements.
5. Write a C program to perform Bubble Sort on an array of n elements.
6. Write a C program to perform Selection Sort on an array of n elements.
7. Write a C code to implement a Stack of 10 elements Using Structure. Perform push() and pop() operation on that Stack.
8. Write a C code to evaluate a POSTFIX expression using Stack.
9. Write a C code to convert INFIX expression to POSTFIX expression using Stack.
10. Write a C code to implement a Linear Queue and perform Insertion and deletion operation.
11. Write a C code to implement a Circular Queue and perform Insertion and deletion operation.
12. Write a C code to implement a Linked list and perform following operation.
    i. Insertion at any position
    ii. insertion at the beginning
    iii. Deletion from any position
    iv. sorting nodes
    v. searching an element
13. Write a C code to implement stack and queue using linked list.
14. Write a C code to implement a Circular Linked List.
15. Write a C code to implement a Doubly Linked List and Circular Doubly List.
16. Write a C code to generate a Binary Tree and perform Inorder, Preorder and Postorder traversal.
17. Write a C code to create a binary search tree.
18. Write a C code to compute Matrix addition and multiplication.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: EE 594A

Days	Experiment Performed
1	Write a C program for Insertion & Deletion from an array.
2	Write a C program to perform Linear Searching on an array of n elements. Write a C program to perform Binary Searching on an array of n elements.
3	Write a C program to perform Bubble Sort on an array of n elements. Write a C program to perform Selection Sort on an array of n elements.
4	Write a C code to implement a Stack of 10 elements Using Structure. Perform push() and pop() operation on that Stack. Write a C code to compute Matrix addition and multiplication.
5	Write a C code to evaluate a POSTFIX expression using Stack. Write a C code to convert INFIX expression to POSTFIX expression using Stack.
6	**1st VIVA VOCE and Pending experiment clearing.**
7	Write a C code to implement a Linear Queue and perform Insertion and deletion operation. Write a C code to implement a Circular Queue and perform Insertion and deletion operation.
8	Write a C code to implement a Linked list and perform different operations.
9	Write a C code to implement stack and queue using linked list. Write a C code to implement a Circular Linked List.
10	Write a C code to implement a Doubly Linked List and Circular Doubly List.
11	Write a C code to generate a Binary Tree and perform Inorder, Preorder and Postorder traversal.
12	Write a C code to create a binary search tree.
13	**2nd VIVA VOCE and Pending experiment clearing.**

Course: EE-594C-MICROPROCESSOR & MICROCONTROLER LABORATORY

PROGRAMME: **Electrical Engineering**	DEGREE:**B. TECH.**
COURSE: **Microprocessor & Microcontroller Lab**	SEMESTER: 5 CREDITS: **2**
COURSECODE: **EE 594C**	COURSE TYPE: **Practical**
COURSE AREA/DOMAIN: **8085 register level architecture, programming on trainer kit using the basic instruction set.**	CONTACT HOURS: **3 (weekly)**
CORRESPONDING THEORY COURSE CODE (IFANY): **EE 504C**	THEORY COURSE NAME: **Microprocessor & Microcontroller**

Course pre-requisites

CODE	COURSE NAME	DESCRIPTION
CS201	Basic Computation & Principles of Computer Programming	Knowledge of Programming, Computer Basic etc.

Laboratory Educational Objectives (LEOs) :

1. **Conceptual Understanding:** Develop students' understanding through laboratory activities to solve problems related to key concepts taught in the classroom.
2. **Design:** Design and build a hardware part to meet desired specifications and tests it using appropriate projects and/or equipments.
3. **Debugging Skills:** Develop debugging capability in order to propose and apply effective engineering solutions.

Laboratory Outcomes (Los) :

After completing this course, students will be able:

1. To identify the basic elements of the microprocessor kit.
2. To understand the basic operation of various prewritten programs.
3. To develop algorithm for different types of programs

Programme Outcomes addressed in this course

PO / LO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
LO1	√								√
LO2	√	√			√				
LO3		√	√	√	√				

LIST OF EXPERIMENTS:

1. Familiarization with 8085 register level architecture and trainer kit components including the memory map.
2. Familiarization with process of storing and viewing the contents of memory as well as registers.
3. (a) Study of prewritten program on trainer kit using the basic instruction set (data transfer, load/store, arithmetic, logical)
   (b) Assignment based on that.
4. (a) Familiarization with 8085 simulator on PC
   (b) Study of prewritten program using basic instruction set (data transfer, load/store, arithmetic, logical).
   (c) Assignment based on that.
5. Programming using kit/simulator.
   (a) Lookup table
   (b) Copying a block of memory
   (c) Shifting a block of memory.
   (d) Packing and unpacking of BCD numbers.

Delivery/Instructional Methodologies

S.NO.	DESCRIPTION
1	Chalk and Talk
2	Study Material

Assessment Methodologies

S.NO.	DESCRIPTION	TYPE
1	Student Assignment	Direct
2	Tests	Direct
3	University Examination	Direct
4	Student Feedback	Indirect

Course Plan: EE 594C

Days	Experiment Performed
1	Introduction, Study of Internal architecture of 8085 microprocessor, 8085 Pin description etc.
2	Programming model of 8085 microprocessor, The 8085 Addressing Modes, Instruction Set Classification, Arithmetic , Logical Machine Control Operations, Instruction Format etc.
3	Write an assembly program to add & subtract two numbers.
4	Write an assembly program to Multiplication and Division Of Two 8 bit Numbers

5	Write an assembly program to BCD to HEX, HEX to BCD, HEX to ASCII, ASCII to HEX conversion etc.
6	Write an assembly program to Largest and Smallest Number in an array of data
7	Write an assembly program to Arrange an arrey of data in ascending or decending order, Square of a number using LookUp Table etc.
8	VIVA VOCE and Pending experiment clearing.