Jharkhand University of Technology
Ranchi, 834010

SCHEME OF COURSE STRUCTURE AND SYLLABUS

For B.Tech. 2nd Year Program in

Electrical Engineering/ Electrical & Electronics Engineering

(Effective from 2024-25)

DEPARTMENT OF ELECTRICAL ENGINEERING/ ELECTRICAL & ELECTRONICS ENGINEERING

Detailed Draft Syllabus

B.Tech. (Electrical Engineering/ Electrical & Electronics Engineering)

(III – SEMESTER)

PROBABILITY & STATISTICS

BSC-302 **(3-1-0)**

Course Outcomes:

At the end of the course, the student will be able to

CO1	Find mean and variance of a given probability distribution
CO2	Test the hypothesis for small and large samples
CO3	Find the coefficient of correlation and lines of regression
CO4	Understand the characteristics of a queuing model

Syllabus:

Random variables and their distributions:

Introduction to Probability, random variables (discrete and continuous), probability functions, density and distribution functions, mean and variance, special distributions (Binomial, Hyper geometric, Poisson, Uniform, exponential and normal), Chebyshev's inequality, parameter and statistic, estimation of parameters by maximum Likelihood Estimation method.

Testing of Hypothesis:

Testing of Hypothesis, Null and alternative hypothesis, level of significance, one-tailed and two-tailed tests, tests for large samples (tests for single mean, difference of means, single proportion, difference of proportions), tests for small samples (t-test for single mean and difference of means, F-test for comparison of variances), Chi-square test for goodness of fit, analysis of variance (one way classification with the samples of equal and unequal sizes), Karl Pearson coefficient of correlation, lines of regression.

Queuing theory:

Concepts, applicability, classification, birth and death process, Poisson queues, Characteristics of queuing models - single server (with finite and infinite capacities) model, multiple server (with infinite capacity only) model.

Text Books / Reference Books / Online Resources:

1. R. A. Johnson, Miller and Freund's "Probability and Statistics for Engineers", Pearson Publishers, 9th Edition, 2017
2. John E. Freund, Benjamin M. Perles, "Modern Elementary Statistics", 12th Edition, Pearson, 2013
3. Hamdy A. Taha, "Operations Research: An Introduction", Pearson, 2017, Tenth Edition
4. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", 12th Edition, S.Chand & Co, 2020
5. Kantiswarup, P.K.Gupta and Manmohan Singh, "Operations Research", Sultan Chand & Sons, 2014

POWER SYSTEMS – I

EEE-301 L T P -3 0 1

Course Outcomes (COs)**:** At the end of the course the student will be able to:

CO1 Understand and determine transmission line parameters and understanding of corona.

CO2 Analyze the power tariff methods and Power distribution systems

CO3 Apply shunt compensation techniques to control reactive power.

CO Understand line supporting insulators and Underground Cables.

Syllabus

Electrical Design of Overhead Line: Constants of a Transmission line, Resistance of a Transmission Line, Skin Effect, Proximity effect. Calculation of inductance and capacitance of single phase, three phase, single circuit and double circuit transmission lines, Bundled conductors.

Performance of Lines: Representation of lines, short transmission lines, medium length lines, nominal T and PI-representations, long transmission lines. The equivalent circuit representation of a long Line, A, B, C, D constants, Ferranti Effect, Power flow through a transmission line, receiving end power circle diagram, corona, calculation of potential gradient, corona loss, factors effecting corona and Methods of reducing corona.

Travelling Waves on Transmission Lines: Production of traveling waves, open circuited line, short circuited line, line terminated through a resistance, line connected to a cable, reflection and refraction at T-junction line terminated through a capacitance, capacitor connection at a T-junction, Attenuation of travelling waves.

Compensation in Power Systems: Introduction- Concepts of Load compensation Loadability characteristics of overhead lines uncompensated transmission line Symmetrical line Radial line with asynchronous load Compensation of lines.

Economics of Generation: Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariff on charge to customer.

AC Distribution: Introduction, AC distribution, Single phase, 3-phase, 3 phase 4 wire system, bus bar arrangement, Selection of site and layout of substation.

Overhead Line Insulators: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators.

Insulated Cables: Introduction, need for insulation, insulating materials, Extra high voltage cables, grading of cables, insulation resistance of a cable, Capacitance of a single core and three core cables, Overhead lines versus underground cables, types of cables.

Transmission line sag calculation: The catenary curve, Sag tension calculations, Supports at different levels, Stringing Chart.

SIGNALS & SYSTEMS

EEE-304

Course Objective

• To understand various types of signals and systems and analyze their properties using continuous and discrete transforms in time and frequency domain.

Course Outcomes

CO1: Understand the classification of signals and systems.

CO2: Evaluate LTI output using linear convolution technique.

CO3: Analyse signals and systems in time and frequency domains.

CO4: Validate time and frequency responses of various signals in LTI systems using simulations.

Syllabus

Unit 1

Introduction: Integrated approach for continuous and discrete – time cases. Signals: Classification of signals, Continuous – Discrete time, Even/Odd signals, Periodic/ Nonperiodic signals, Deterministic/Random signals, Energy/Power signals, Basic operations on signals, Basic (Continuous/Discrete) signals. Systems (Continuous/Discrete): Representation, Classification – Linear/Nonlinear, Causal/Noncausal, Time invariant/Time variant, with/ without memory, BIBO stability, Feedback system, LTI system – Response of LTI system, Convolution, Properties (Continuous/Discrete).

Unit 2

Review of Fourier series and Fourier Transforms-Applications-Case Study, Discrete Time Fourier transform and its properties. Laplace Transform analysis of systems: ROC, Inverse LT, Unilateral LT, Solving differential equation with initial conditions.

Unit 3

Sampling: Sampling theorem, Reconstruction of signal, Aliasing, Sampling of discrete time signals. z- Transform:

Definition, ROC, Inverse z-Transform, Properties, Transform analysis of LTI Systems. Interrelationship amongst different representation and Transforms.

Textbook

1. Simon Haykin, Barry Van Veen, “Signals and Systems”, Second Edition, John Wiley and Sons, 2005.

References

1. Alan V. Oppenheim, Alan S.Willsky ,S,HamidNawab, “Signals and Systems”, Prentice Hall India Private Limited,2nd Edition, 1997.

2. Michael.J.Roberts, “Fundamentals of Signals and Systems”, First Edition, Tata McGraw Hill Publishing Company Limited, 2007.

3. Rodger E.Ziemer, William.H.TranterD.Ronald Fannin, “Signals and Systems”, Fourth Edition, Pearson Education, 2004.
4. Virtual labs, NPTEL Videos, Simulation demos etc.

NETWORK THEORY

Course code – **EEE302**
L T P CR

3 0 0 3

Course Outcomes:

Cos	At the end of this course, students will be able to
CO1	**Evaluate** and **Analyse** the transient and resonant behaviour of linear time invariant circuits.
CO2	**Able** to solve the networks using graphical approach
CO3	**Evaluate** network parameters
CO4	**Analyse and Synthesize** networks using Foster & Cauer forms
CO5	**Design** of different passive filters

Module I: (10 Lectures)

Introduction to Linear Time Invariant (LTI) elements, Behaviour of R, L & C at t=0+ and t=∞, Concept of t=0-, 0 & 0+, Analysis of zero input and zero state response and complete response of transient behaviour of R-L, R-C and R-L-C, Tellegen’s Theorem, Millman’s Theorem and reciprocity theorem.

Introduction to Laplace transform (LT), poles, zeros and transfer functions. Analysis of circuits subjected to periodic and aperiodic excitations using Laplace transforms.

Module II: (5 Lectures)

Resonance: Series resonance circuit, Effect of Q on bandwidth and selectivity. Relation between bandwidth and Q, Resonance curve with the variation of L and C, Parallel resonant circuit. Mutual coupled circuits, Dot Convention in coupled circuits, Equivalent inductance, Analysis of Mutual coupled circuits.

Module III: (5 Lectures)

Graph Theory: Definition of terms. Matrices associated with graphs: incidence, reduced incidence, fundamental cut-set and fundamental tie-set matrix.

Module IV: (10 Lectures)

Definition of Network Function, Driving point impedance, Driving point admittance, Transfer impedance and admittance, Voltage and current transfer ratio, Concept of poles and zerosTwo Port Networks**:** Impedance parameters, admittance parameters, transmission parameters and hybrid parameters, Interconnections of two port networks: Series, Parallel, Cascade, Series parallel, Parallel-series.

Module V: (6 Lectures)

Hurwitz polynomial, its properties and Test, Positive real functions, Driving point immittances of L-C Network. Synthesis of L-C Network using Foster-I and Foster-II forms, Cauer-l and Cauer-ll forms, Driving point impedance and admittance of R-L and R-C Network, Synthesis using Foster-I, Foster-II, Cauer-I & Cauer-II forms.

Module Vl: (6 Lectures)

Introduction and Classifications of filters and its uses, Design of prototype Constant k and m-derived low pass filter, high pass filter, band pass filter and band stop.

Text Book:

[I]. Fundamentals of Electric Circuits — Alexander & Sadiku — Tata McGraw Hill,5th Edition.

[2]. Circuits & Networks: Analysis, Design and Synthesis- Sukhija & Nagsarkar- Oxford

Reference Book(s):

[l]. Network Analysis — M E Van Valkenburg — Pearson Education, 3rd Edition.

[2]. Network Analysis and Synthesis — Franklin F. Kuo — Wiley Student Edition.

[3]. Linear Circuits Analysis and Synthesis — A Ramakalyan — Oxford University Press.

[4]. Problems & Solutions in Electric Circuit Analysis — Sivananda & Deepa — Jaico Book.

[5]. Theory and problem of electrical circuits, Schaum's Outline Series, TMH — Joseph A. Edminister, MahmoodMaqvi.

[6]. Electric Circuits — David A.Bell — Oxford, 7th Edition, 2015.

Power Systems I Lab

EEE-301P

Course Objectives:

To equipt as power system engineers towards plan, monitor, control and protect the power system.

Course Outcomes:

CO1: Demonstrate the structure, SLD and daily load curve of power system and different types of Insulators.

CO2: Apply passive and active compensation techniques for power flow control.

CO3: Determine ABCD parameters of transmission line.

CO4: Determine the dielectric strength of transformer oil.

Syllabus:

Experiments on analysing the performance of transmission line, Ferranti **effect, dielectric** strength of transformer oil, Series and Shunt Compensation in Power Systems, DC & AC Distribution system, bus bar arrangement, Selection of site and layout of substation, Introduction & Testing of Overhead Line Insulators, Insulated Cables:

Sl.No.	Name of the Experiment
1	To find ABCD parameters of model of Transmission line.
2	To observe the Ferranti effect in a transmission line model.
3	To determine the earth resistance using megger.
4	To determine the dielectric strength of the given transformer oil.
5	To study and analyze the different types of insulators using high voltage breakdown Tester.
6	To Plot daily load curve of the Institute.
7	To determine location of fault in a cable using cable fault locator.
8	To Study the 2-wire DC Distribution Ring Distribution and calculate the various load current using TS-102.
9	To study the VAR Compensation method in a transmission line using Shunt Capacitor.
10.	To study the CT, PT's, Power Cables and Insulator strings.

Network Theory Lab

EEE-302P

List of Experiments

S No.	Name of the Experiment(To be perform minimum 10)
1	Transient response of RC circuit.
2	Transient response of RL circuit.
3	To find the resonant frequency, Band width of RLC series circuit.
4	To study and verify effect of R on frequency response of parallel resonance circuit.
5	To calculate and verify “Z” Parameters of a two port network.
6	To calculate and verify “Y” Parameters of a two port network.
7	To determine equivalent parameter of parallel connections of two port network.
8	To plot the frequency response of low pass filter and determine half-power frequency.
9	To plot the frequency response of how pass filter and determine the half-power frequency.
10	To plot the frequency response of band-pass filter and determine band-width.
11	To calculate and verify “ABCD” Parameters of a two port network.
12	To synthesize a network of a given network function and verify its response.
13	Introduction of P-Spice or other simulation software.

Data Structure with Python Program

EEE-303

Course Outcomes (COs): At the end of the course the student will be able to

CO1 Understand Abstract Data Type for stack and queue applications and understand the problem solving techniques using algorithms and procedure

CO2 Identify data structures suitable to solve problems and understand how to read, write and execute simple Python Programs

CO3 Develop and analyze algorithms for stacks, queues and Apply Python data structures – lists, tuples and dictionaries

CO4 Design and implement algorithms for binary trees and graphs

CO5 Implement sorting and searching algorithms and Develop Algorithms and Code in Python Language.

CO6 Implement symbol table using hashing techniques

Syllabus: Part I (Data Structure)

Introduction to Data Structures, Asymptotic Notations, Linear and Nonlinear Data Structures, Stack Data Structure and its Applications, Queue Data Structure and its Applications, Singly, Doubly and Circular Linked Lists, Trees and tree traversals, Binary Search Tree and its Operations, Heap Data Structure, Priority Queue, Height Balanced Trees, Direct Addressing; Introduction to Hashing, Lower Bound for Comparison based Sorting Algorithms, Insertion Sort, Merge Sort, Quick Sort, Heap Sort and Counting Sort, Radix Sort, Disjoint Set s, Introduction to Graphs and Representation of Graphs, Depth First Search (DFS), Breadth First Search (BFS),Applications of BFS and DFS, Prim's Algorithm for finding Minimum Spanning Tree (MST), Kruskal's Algorithm for finding MST, Dijkstra's Algorithm for Single Source Shortest Paths, Floydd-Warshall Algorithm for All-Pairs Shortest Path Problem.

Learning Resources:

Text Books

1. Thomas H.Cormen,Charles E.Leiserson, Ronald L. Rivestand Clifford Stein, Introduction to Algorithms, Second Edition,PHI,2009.

2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Third Edition, Pearson Education, 2006.

3. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Second Edition, Universities Press 2011.

Reference Books:

1. J. P. Tremblay and P. G. Sorenson, An Introduction to Data Structures with Application, TMH, 2017.

2. Michael T. Goodrich and Roberto Tamassia, Algorithm Design: Foundations, Analysis and Internet Examples, Second Edition, Wiley-India, 2006.

3. Sahni, S., Data Structures, Algorithms, and Applications in C++Silicon Press, 2/e, 2005.

Syllabus: Part II (Python Program)

Syllabus:

Data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments; understanding error messages; Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation Strings and text files; manipulating files and directories, OS and SYS modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab- separated). String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments- Program structure and design- Recursive functions – Introduction to classes and OOP.

Learning Resources:

Text Books

1. Kenneth A. Lambert, Fundamentals of Python: First Programs, Cengage Learning, 2012.

2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, O'Reilly Media, Publishers, 2015.

Reference Books:

1. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

2. Reema Thareja, Python Programming using Problem Solving Approach, Oxford University Press, 2017.

3. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013.

4. Mark Lutz, "Learn Python"", 5th Edition, O'reilly Media, Inc, June, 2013.

Data Structure with Python Program Lab

EEE-303P

List of Experiments: (Data Structure)

1. Write a program to implement stack using arrays and evaluate a given postfix expression

2. Write a program to implement circular queue using arrays

3. Write a program to implement double ended queue (de queue) using arrays

4. Write programs for applications based on stacks and queues.

5. Write programs to implement the following data structures and their applications (a) Single linked list (b) Double linked list

6. Write programs to implement a stack and a queue using linked lists

7. Write a program to create a binary search tree (BST) by considering the keys in given order and perform the following operations on it. (a) Minimum key (b) Maximum key (c) Search for a given key (d) Find predecessor of a node (e) delete a node with given key (f) applications of BST

8. Write a program to construct an AVL tree for the given set of keys. Also write function for deleting a key from the given AVL tree.

9. Write a program to implement hashing with (a) Separate Chaining and (b) Open addressing methods.

10. Implement the following sorting algorithms: (a) Insertion sort (b) Merge sort (c) Quick sort (d) Heap sort

11. Write programs for implementation of graph traversals by applying: (a) BFS (b) DFS

12. Write programs to find out a minimum spanning tree of graph by applying: (a) Prim's algorithm (b) Kruskal's algorithm c) any other algorithms

13. Write a program to implement Dijkstra's algorithm using priority queue.

List of Programs for Laboratory**(Python Program)**

1. Programs using sequential constructs

2. Programs using selection constructs

3. Programs using Iterative constructs

4. Programs using nested for loops

5. Programs using lists

6. Programs using tuples and dictionaries

7. Simple Python functions

8. File input and output

9. Sorting and searching programs

10. Recursion

Detailed Draft Syllabus

B.Tech. (Electrical Engineering/ Electrical & Electronics Engineering)

(IV – SEMESTER)

Electrical Machines -I

EEE-401

Syllabus

Course Outcomes (COs): At the end of the course the student will be able to:

CO1 Understand operation of DC machines, single-phase and three-phase transformers and auto transformers.

CO2 Analyze starting methods and speed control of DC machines.

CO3 Analyze parallel operation of DC generators, single-phase and three- phase transformers

CO4 Evaluate the performance of DC machines and transformers.

Syllabus:

Electromechanical Energy Conversion Principles: Principles of energy conversion, single excited and doubly excited magnetic systems, singly excited electric field systems. Constructional features of rotating electrical machines, generating emfs, emf polygon, mmf produced by distribution windings, concepts of torque production.

DC Machines: Constructional features, parts of DC machines, Simplex and multiplex lap and wave windings; Methods of excitation, characteristics of saturated and un-saturated series, shunt, cumulatively and differentially compound excited machines operating as motors and generators, applications of DC machines; Armature reaction, demagnetizing and cross magnetizing ampere-turns, compensating windings, commutation process and methods of commutation, role of inter poles and compensating winding. Problems on emf equation, torqueequation and armature reaction.

Speed Control of DC Motors: Speed control of shunt & series motors, losses in DC machinesand calculation of efficiency. Need for starters and Starters for DC series shunt and compoundmotors.

Testing of DC Motors: No-load test, load tests and regenerative tests such as Swinburne's Test, Direct load test, Hopkinson's test, Field's test and Retardation test. Calculation of efficiency based on all the above tests.

Single-Phase Two Winding Transformers: Construction, principle of operation, E.M.F. equation, phasor diagrams; Equivalent circuit, determination of equivalent circuit parameters, Predetermination of performance equivalent circuit parameters and Sumpner's test. Losses, separation of no-load losses, calculation of efficiency and regulation by direct and indirect methods, conditions for maximum efficiency. Concept of all-day efficiency. Parallel operation of transformers and Load sharing.

Auto transformer: Principle of operation, saving of copper compared to two-winding transformer and its application.

Three-Phase Transformers: Merits of three phase Transformers over three phase transformer bank Type of connections such as Delta-Delta, Delta-Star, Star-Delta, Delta-Star,V-V connection and T-T Connections. Relation between line and phase voltages and currents,Vector Groups, use of tertiary winding. Three phase to Two phase connections and vice-versa.Problems on three phase transformers

Learning Resources:

Text Books:

1. Electrical Machinery, Theory: Performance & Applications, Dr. P. S. Bimbhra, Khanna Publishers, 2021.
2. Fitzgerald and Kingsley's electric machinery by Stephen D. Umans–TMH Publishers, 7th Edition, 2020.
3. Nagarath & D.P.Kothari: Electrical Machines, TMH Publishers, 5th edition 2017.

Reference Books:

1. Theory& Performance of Electrical Machines by J.B. Gupta, S.K. Kataria & Sons, 5th Edition, 2013.
2. The Performance and Design of Direct Current Machines, A.E .Clayton & NN Hancock, CBS Publishers, 2004.
3. Electric Machines, P. S Bimbhra-2nd Edition, Khanna Publishers, 2017.

POWER SYSTEMS – II

EEE-402

L T P 3 0 1

Course Outcomes (COs): At the end of the course the student will be able to:

CO1	Illustrate the concept of stability, power angle curve, and swing equation and diagnose steady-state and transient stability of the power system.
CO2	Formulate nodal admittance (Y-bus) matrix, and develop load flow equations and find its solution.
CO3	Understand the role of per unit quantities and determine the fault currents for symmetrical and unbalanced faults
CO4	To analyze the economic aspects of power system operation and understand different methods of voltage Control.

Syllabus:

Per Unit Representation of Power Systems: The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.

Symmetrical Components: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks.

Fault Calculations: Fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, and faults with fault impedance, reactors and their location, short circuit capacity of a bus.

Load Flow Analysis: Review of the structure of power system and its components, Bus classification, formulation of Ybus matrix, power flow equations. Gauss – Seidel method, algorithm, derivation of iterarative equation, modification for PV bus, Advantages and disadvantages, acceleration factor. Newton – Raphson method, algorithm, power mismatch vector, size of Jacobian matrix and its elements. Advantages and disadvantages.

Power system Stability: Concept of power system stability and its classification. Dynamic equation of synchronous machine. Swing equation and power angle curve. Single machine infinite bus system. Large signal stability, Equal area criteria, derivation. Critical clearing angle and effect of clearing time on stability. Methods for improvement of transient stability. Introduction to Multi – machine transient stability.

Economic Operation of Power Systems: Input-output characteristics of thermal and hydro plants, Optimum generator allocations without and with transmission losses, calculation of penalty factors, incremental transmission loss, transmission loss coefficients and their calculations.

Load Frequency Control: Concept of load frequency control, load frequency control of single area system, effect of governor droop and load damping, block diagram representation of single area system, steady state frequency error, dynamic response.

Voltage Control: Introduction methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase-modifiers.

Learning Resources:

Text Books:

1. John J.Grainger , W.D. Stevenson: Power System Analysis, McGrawHill International (Indian Edition) 2017.

2. C.L. Wadhwa: Electrical Power Systems New Age International Pub. Co. 7th Edition, 2016.

3. Hadi Saadat: Power System Analysis Tata Mc Graw Hill Pub.Co. 4th Edition 2011.

Reference Books:

1. D.P. Kothari and I.J. Nagrath, Power System Engineering-- Tata McGraw-Hill Pub. Co., New Delhi, 3rd Edition, 2019.

2. W.D. Stevenson: Elements of Power system Analysis, McGraw Hill International Student 4th Edition 2015.

3. D. Das- Electrical Power Systems New Age International Pub. Co. 3th Edition, 2016.

Digital Electronics

EEE-403

Syllabus

Course Outcomes (COs)

After completion of this course, the students will be able to

CO1: Understand and apply different number systems, binary arithmetic, and various coding techniques for error detection and data representation in digital systems.

CO2: Understand and apply the principles of Boolean algebra and logic simplification techniques to design efficient combinational logic circuits.

CO3: Analyze and design combinational circuits including arithmetic and logic circuits such as adders, subtractors, multiplexers, and decoders.

CO4: Design and analyze sequential logic circuits including flip-flops, counters, and shift registers.

CO5: Develop an understanding of memory systems and data conversion systems.

Unit-1 Number system and codes – 7 hours

Introduction to Number Systems: Decimal, Binary, Octal, and Hexadecimal systems, Conversions Between Number Systems,

Signed and Unsigned Numbers: Representation of Signed Numbers (Sign Magnitude, 1's Complement, 2's Complement), Arithmetic Operations on Signed Numbers

Codes: Binary Codes, BCD (Binary-Coded Decimal), Gray Code, Excess-3 Code, Error Detection and Correction Codes, ASCII and EBCDIC

Unit-2 Boolean Algebra and Minimization Techniques – 7 hours

Boolean postulates and laws, Principle of Duality, Simplification of Boolean expressions using Boolean identities, Karnaugh map (up to 5 Variable), Logic GATES, Standard representations for logic functions (SOP, POS)

Unit-3 Combinational Circuits - 9 hours

Adders, subtractors, Code Converters, Encoders, Priority Encoders, Decoders, Multiplexers, Demultiplexers, Comparator, buffers, tri-state buffers

Unit-4 Sequential Circuits – 12 hours

Flip-Flops and Latch: SR Latch, SR, JK, D, T Flip-flops, Race-around conditions in JK Flip-flop, Master-Slave JK Flip-flop, Conversion of flip-flops.

Shift Registers: SISO, SIPO, PISO, PIPO, Universal shift register

Counters: Synchronous, Asynchronous counters, Up/Down counters, Ring Counter, Johnson Counter.

State Machines: Introduction to Moore and Mealy machines

Unit-5 Basics of Memory and Data Conversion Circuits – 7 hours

Memory Elements: RAM, ROM, PROM, EPROM, EEPROM, Flash Memory.

A/D and D/A Converters: Types of ADCs and DACs, Resolution and accuracy, Conversion techniques

Textbooks

1. "Digital Design" by M. Morris Mano and Michael D. Ciletti, 5th Edition, Pearson.
2. "Digital Fundamentals" by Thomas L. Floyd, 11th Edition, Pearson.

Reference Books

1. "Digital Logic and Computer Design" by M. Morris Mano, Prentice-Hall.
2. "Digital Electronics: Principles, Devices, and Applications" by Anil K. Maini, Wiley.
3. "Digital Logic Applications and Design" by John M. Yarbrough, Cengage Learning.

CONTROL SYSTEMS

EEE-404

Course Outcomes (COs): At the end of the course, the student will be able to

CO1	Understand and analyse electrical & electro-mechanical systems using transfer function approach
CO2	Determine transient and steady-state behaviour of dynamic systems.
CO3	Determine absolute and relative stability of dynamic systems using time & frequency domain analyses
CO4	Design compensators for linear control systems to derive the specified steady-state and dynamic responses

Syllabus:

Introduction: System, control system, types of control systems, Transfer Function, open-loop and closed loop systems, types of feedback, feedback and its effects.

Modelling of Physical Systems: Mathematical modelling of Electrical and Electro-mechanical elements, D.C. motors. Block diagram illustration.

Techniques to Develop Transfer Function of Systems: Introduction, Block diagramreduction technique and signal flow graph, Mason's gain formula.

Time Domain Analysis of Control Systems: Introduction- time domain indices, steadystate error constants, concept of BIBO stability, absolute stability. Routh- Hurwitz Criterion.

Root Locus Techniques: Introduction, Root loci theory, Application to system stabilityanalysis. Illustration of the effect of addition of zero and pole.

Frequency Domain Analysis of Control Systems: Introduction, Bode plots, Frequencydomain indices, application of Bode plots, Polar plots. P, PI & PID controllers.

State-Space Representation of Dynamic Systems: State-Variables, State-Variablerepresentation of Electrical Systems.

23EEE213	INTRODUCTION TO MACHINE LEARNING	L-T-P-C: 3-1-0-4

Course Objective

To understand the idea of learning by machines, training, classification, and prediction techniques.

Course Outcomes

CO1: Understand the basic concepts of optimization for learning.
CO2: Design microcontroller frameworks for classification problems.
CO3: Develop prediction models using regression.
CO4: Analyse modern tools for real world scenarios.

CO-PO Mapping:

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	-	-	-	-	2	2	3
CO2	3	3	3	2	3	-	-	-	-	-	-	-	2	2	3
CO3	3	3	3	2	3	-	-	-	-	-	-	-	2	2	3
CO4	3	3	3	2	3	-	-	-	-	-	-	-	2	2	3

Syllabus

Unit 1

Introduction to optimization, gradient decent, types of machine learning problems – classification, regression, and reinforcement. Supervised and Un-supervised learning. Concept of training, testing and validation. Exploratory data analysis and pre-processing, Principal Component Analysis for dimensionality reduction.

Unit 2

Regression models and implementation – Linear regression, Logistic Regression, SVR, Random Forest. Performance measurements of models: MSE, Mean absolution deviation (MAD), R-squared -coefficient of determination.

Unit 3

Classification models and implementation – Naïve Bayes, KNN, SVM, Decision trees, Neural Networks - Perceptron. Performance measurements of models: Accuracy, Confusion matrix, F1-score, ROC curve and AOC, Log loss. K-Means clustering.

Textbook:

1 Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Third Edition, 2022.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning (Information Science and Statistics)", 2016

References:

1. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, "An Introduction to Statistical Learning", Springer, Second Edition, 2017.

ELECTRICAL MACHINES –I LAB
EEE-401P

Course Objectives:
• Illustrate operating principles, characteristics and performance of various DC machines and transformers.
• Select suitable starting technique and perform the speed control of DC motors.
• Develop the equivalent circuit of transformers and analyse the performance characteristics.
• Analyse the various configurations of transformers and perform parallel operation
Course Outcomes:
CO1: Understand the performance characteristics of DC machines
CO2: Analyze the speed control of DC motors
CO3: Analyze the performance characteristics of transformer
CO4: Demonstrate the Parallel operation of transformer and three phase transformer connections
Syllabus
DC Generator: OCC, Internal and External Characteristics. DC motor: Speed control, Swinburn's test, Load test. - Transformers: OC & SC tests, Sumpner's test, Parallel operation, Load test, Three-phase transformer connections -Separation of Losses.

Textbook:
1. D. P. Kothari, B S Umre, "Laboratory Manual For Electrical Machines", second edition, I K International, 2017.
Digital Electronics
References:
1. Kothari D.P. and Nagrath I.J., "Electric Machines", Tata McGraw-Hill Publishing Company Limited, New Delhi 2004.
2. Stephen J. Chapman, "Electric Machinery Fundamentals", 4th edition, McGraw Hill Education Pvt. Ltd, 2010

CONTROL SYSTEMS LAB
EEE-404P

Syllabus
Lab Practice: Experiments in modelling, design and analysis of controllers using Simulation / Hardware.

DIGITAL ELECTRONICS LAB
EEE-403P

Course Outcome:

After completion of this course, the students will be able to

CO1: identify appropriate equipment and components for the experiment and work effectively in a team.

CO2: construct decoder, multiplexer, adder and subtractor circuits with appropriate instruments and precaution

CO3: realize RS-JK and D flip flop, universal register with gates, multiplexer and flip-flops and asynchronous and synchronous up down counters

CO4: validate the operation of code conversion circuit –BCD to Excess 3 & vice versa, 4 bit parity generator & comparator circuits.

LIST OF EXPERIMENTS:

1. Realization of basic gates using Universal logic gates.
2. Code conversion circuits- BCD to Excess-3 & vice-versa.
3. .4-bit parity generator & comparator circuits.
4. Construction of simple Decoder & Multiplexer circuits using logic gates.
5. Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.
6. Construction of simple arithmetic circuits-Adder, Subtractor.
7. Realization of RS-JK & D flip-flops using Universal logic gates.
8. Realization of Universal Register using JK flip-flops & logic gates.
9. Realization of Universal Register using multiplexer & flip-flops.
10. Construction of Adder circuit using Shift Register & full Adder.
11. Realization of Asynchronous Up/Down counter
12. Realization of Synchronous Up/Down counter
13. Design of Sequential Counter with irregular sequences.
14. Realization of Ring counter & Johnson’s counter.
15. Familiarization with A/D and D/A circuits