GEETHANJALI INSTITUTE OF SCIENCE & TECHNOLOGY:NELLORE
(AUTONOMOUS)

NELLORE–524317 (A.P) INDIA

B.TECH IN ELECTRICAL AND ELECTRONICS ENGINEERING
(ACCREDITATED BY NBA)
COURSE STRUCTURE AND SYLLABI
UNDER RG 22 REGULATIONS

DEPARTMENT VISION

To make the department as a hub of technological excellence, transforming the future Electrical Engineers into innovative, ethical and responsible professionals.

DEPARTMENT MISSION

M1: Adopting effective result oriented techniques that deliver quality education in a learning environment striving to enhance the intellectual capabilities and skills of the learners.

M2: Providing adequate infrastructure for technical skill development and encourage research in order to meet Industrial demands.

M3: Promoting industry interface and exposure, positive values of integrity, ecological awareness, and societal accountability among the Engineering aspirants.

M4: Empowering undergraduates, guiding them towards bright professional prospects through personality development and life skill-based activities.

PROGRAMME EDUCATIONAL OBJECTIVES:

Graduates of B.Tech., in Electrical and Electronics Engineering program shall able to

PEO1: Acquiring professional expertise in several kinds of industrial, societal, and pragmatic uses

PEO2: Pursuing higher studies, research and development, with other innovative skills and being creative striving in the fields of engineering, science, and technology, proceeding on multiple career paths.

PEO3: Exhibit excellence in Multi-Disciplinary collaborations by showcasing unique interpersonal competencies and ethical practices.

PEO4: Engage in lifelong learning and adapt to the perpetually evolving trends in profession and societal needs.

Program Outcomes

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering Fundamentals, and an engineering specialization to the solution of complexengineering problems.
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyzecomplex engineering problems reaching substantiated conclusions using first Principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, Societal, and environmental considerations.
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and Research methods including design of experiments, analysis and interpretation of data,and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, andmodern engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations.
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to Assess societal, health, safety, legal and cultural issues and the consequentresponsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate theknowledge of, and need for sustainable development
PO8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilitiesand norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or Leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective Presentations, and give and receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of theengineering and management principles and apply these to one's own work, as a Member and leader in a team, to manage projects and in multidisciplinaryenvironments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability toengage in independent and life-long learning in the broadest context of technological Change.

Program Specific Outcomes

PSO1: Capability to exhibit expertise and experience in accurately evaluating the origins and impact of electrical systems, processes, and technologies, in this present digital era.

PSO2: Conceive, identify, and execute ideas for electrical industry applications by employing MATLAB / SciLAB.

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B.TECH Electrical and Electronics Engineering

Course Structure (RG22)

Semester 0

Induction Program: 3weeks
(Common for All Branches of Engineering)

S.No	CourseNo	CourseName	Category	L-T-P-C
1		Physical Activities--Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2		Career Counseling	MC	2-0-2-0
3		Orientation to all branches—career options, tools, etc.	MC	3-0-0-0
4		Orientation on admitted Branch – corresponding labs, tools and platforms	EC	2-0-3-0
5		Proficiency Units & Productivity Tools	ES	2-1-2-0
6		Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7		Remedial Training in Foundation Courses	MC	2-1-2-0
8		Human Values & Professional Ethics	MC	3-0-0-0
9		Communication Skills—focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10		Concepts of Programming	ES	2-0-2-0

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B.TECH Electrical and Electronics Engineering

Course Structure (RG22)

Semester - 1 (Theory-4, Lab-5)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	22A0001T	Linear Algebra and Calculus	3	0	0	3
2	BSC	22A0006T	Chemistry	3	0	0	3
3	ESC	22A0201T	Fundamentals of Electrical Circuits	3	0	0	3
4	ESC	22A0518T	C Programming & Data Structures	3	0	0	3
5	BSC (Lab)	22A0011P	Chemistry Lab	0	0	3	1.5
6	ESC (Lab)	22A0202P	Fundamentals of Electrical Circuits Lab	0	0	3	1.5
7	ESC (Lab)	22A0519P	C Programming & Data Structures Lab	0	0	3	1.5
8	ESC (Lab)	22A0304P	Engineering Workshop	0	0	3	1.5
9	ESC (Lab)	22A0502P	IT Workshop	0	0	3	1.5
			Total credits				**19.5**

Category	Credits
Basic Science Course (BSC)	7.5
Engineering Science Course (ESC)	12
Total	19.5

LINEAR ALGEBRA & CALCULUS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0001T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**BSC**

Course Objectives:

- This course will illuminate the students in the concepts of calculus and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Syllabus		**Total Hours:45**
Unit - I	**Matrices**	**9 Hrs**

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Applications: Finding the current in electrical circuits Eigen values and Eigenvectors and their properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of amatrix.

Unit - II	**Mean Value Theorems**	**9 Hrs**

Rolle's Theorem (Without Proof), Lagrange's mean value theorem (Without Proof), Cauchy's mean value theorem (Without Proof), related problems, Taylor's and Maclaurin theorems with remainders (without proof) - related problems, Taylor's and Maclaurin series (without proof) Expansions of functions by Taylors and Maclaurin's series.

Unit - III	**Multivariable Calculus**	**9 Hrs**

Partial derivatives, total derivatives, chain rule, change of variables, Jacobians, maxima andminima of functions of two variables, method of Lagrange multipliers.

Unit - IV	**Multiple Integrals**	**9 Hrs**

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

Unit - V	**Beta and Gamma functions**	**9 Hrs**

Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Course Outcomes (CO):

On completion of this course, student will be able to

- Solving the system of linear equations, find the eigen values and eigenvectors and use this information to facilitate the calculation of matrix characteristics.
- Translate the given function as series of Taylor's and Maclaurin's with remainders, analyze the behavior of functions by using mean value theorems.
- Acquire the Knowledge maxima and minima functions of several variables. Utilize Jacobian ofa coordinate transformation to deal with the problems in change of variables.
- Apply multiple integration techniques in evaluating areas and volumes bounded by the region.
- Understand beta and gamma functions and its relations, conclude the use of special function in evaluating definite integrals.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal , 44/e, Khanna Publishers, 2017.
2. Linear Algebra & Calculus by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham and M.V.S.S.N.Prasad S. Chand publication.
3. Engineering Mathematics III by N.P. Bali, Dr. K.L. Sai Prasad, University Science Press.

Reference Books:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India
2. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
3. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N.
Prasad, S. Chand Publications.

CHEMISTRY
(Common to CSE,AI&ML,CS,ECE,EEE,DS)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0006T	3: 0:0:0	3	CIE: 30 SEE:70	3Hours	BSC

Course Objectives:

Student will be able to

- To familiarize engineering chemistry and its applications
- To train the students on the principles and applications of electrochemistry and polymers
- To introduce instrumental methods

	Syllabus	Total Hours: 48 Hrs
Unit- I	**Structure and Bonding**	**9Hrs**

Planck's quantum theory,dual nature of matter,Schrodinger wave equation, significance of Ψ and Ψ^2, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO, etc. π-molecular orbital's of butadiene and benzene, calculation of bond order.

Unit-II	Modern Engineering materials	10Hrs

Coordination compounds: Crystal field theory – salient features – splitting of d-orbital's in octahedral and tetrahedral geometry.
Basic concept, band diagrams for conductors, semiconductors and insulators, Effect of doping on band structures.
Super capacitors: Introduction, Basic concept-Classification – Applications.
Nano chemistry: Introduction, classification of nano materials, properties and applications of Fullerenes, andcarbon nanotubes.

Unit-III	Electrochemistry and Applications	10Hrs

Electrodes – concepts, reference electrodes (Calomel electrode, Ag/AgCl electrode and glass electrode);Electro chemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), conductometric titrations (acid-base titrations).
Primary cells: Zinc-air battery, Secondary cells: lead acid and lithium-ion batteries- working of the batteries including cell reactions, Fuel cells: hydrogen-oxygen, methanol -oxygen fuel cells – working principle of the cells.

Unit-IV	Polymer Chemistry	10Hrs

Introduction to polymers, functionality of monomers, Types of polymerization-addition, condensation and copolymerization with specific examples and mechanisms of polymerization.
Plastics - Thermoplastics and Thermosetting, Preparation, properties and applications of – PTFE, Bakelite, Calculation of molecular weight of polymer by weight average and number average method, Polydispersity Index.
Elastomers–Buna-S, Buna-N–preparation, properties and applications.
Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications.
Biodegradable polymers: polylactic acid, poly dioxanone, starch, cellulose.

Unit-V	Instrumental Methods and its applications	9Hrs

EMR spectra, Beer-Lambert's law, Basic Principle, Instrumentation and applications of UV-visible spectrophotometer and FTIR, Chromatography-Introduction**,** Principle and instrumentation of Gas Chromatography (GC),retention time, TLC, R_f factor.

Course Outcomes (CO):

After completion of the course, students will be able to

- Describe Planck's quantum theory, dual nature of matter, Schrodinger equation, molecular orbital Theory and molecular orbital energy level diagram of different molecules
- Explain Crystal field theory, splitting in octahedral and tetrahedral geometry and the magnetic behaviour, Oxidation state, coordination and colour of complexes.
- Explain the principle of Band diagrams of conductors, superconductor, semiconductors and insulator and nonmaterial
- Discuss the principles of electrochemistry in potentiometry, conductometry, battery and electrochemical sensors
- Explain polymerization and the preparation, properties, and applications of thermoplastics &thermosetting, elastomers, & conducting polymers
- Discuss the different applications of analytical instruments

Textbooks:

1. P. C. Jain & Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.
2. K. N. Jayaveera, G. V. Subba Reddy and C. Ramachandriah, Engineering Chemistry, Mc.Graw Hill Publishers, New Delhi.
3. Energy scenario beyond2100,by S.Muthu Krishna Iyer.

Reference Books:

1. J. D. Lee, Concise Inorganic Chemistry, Oxford University Press, 5th edition 2010.
2. Skoog and West, Principles of Instrumental Analysis, Thomson, 6th edition, 2007.
3. Peter Atkins, Julio de Paula and James Keelar, Atkins' Physical Chemistry, Oxford University Press, 10th edition, 2010.

FUNDAMENTALS OF ELECTRICAL CIRCUITS

(common to EEE&ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0201T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**BS**

Course Objectives: Student will be able to

1. Basic characteristics of R, L, C parameters, their Voltage and Current Relations and Various combinations of these parameters.
2. Basics of Magnetic circuits
3. Network Topology and concepts like Tree, Cut-set , Tie-set, Loop, Co-Tree
4. The Single Phase AC circuits and concepts of real power, reactive power, complex power, phase angle and phase difference.
5. Network theorems and their applications

UNIT - I	**Introduction to Electrical Circuits**	**10 Hrs**

Electrical Circuits: Circuit Concept – Types of elements - Source Transformation-Voltage – Current Relationship for Passive Elements. Kirchhoff's Laws – Network Reduction Techniques- Series, Parallel, Series Parallel, Star-to-Delta or Delta-to-Star Transformation,. Nodal Analysis, Mesh Analysis, Examples.

Learning Outcomes:

At the end of this unit, the student will be able

1. To know about Kirchhoff's Laws in solving series, parallel, non-series-parallel configurations in DC networks
2. To know about voltage source to current source and vice-versa transformation in their representation
3. To understand analysis of Nodal and Mesh analysis for different circuits.

UNIT - II	**Introduction to Magnetic Circuits**	**8 Hrs**

Magnetic Circuits: Faraday's Laws of Electromagnetic Induction-Concept of Self and Mutual Inductance-Dot Convention-Coefficient of Coupling-Composite Magnetic Circuit-Analysis of Series and Parallel Magnetic Circuits

Learning Outcomes:

At the end of this unit, the student will be able to

1.To understand Faraday's laws

2.To distinguish analogy between electric and magnetic circuits

3. To understand analysis of series and parallel magnetic circuits

UNIT - III	**Graph theory**	**9 Hrs**

Definitions – Graph – Tree, Basic Cutset and Basic Tieset Matrices for Planar Networks – F-Loop and F-Cutset Methods of Analysis of Networks & Independent Voltage and Current Sources , formulation and solution of Network equilibrium equations -Duality & Dual Networks.

Learning Outcomes:

At the end of this unit, the student will be able

1. To understand basic graph theory definitions which are required for solving electrical circuits

2.To understand about loop current method
3. To understand about nodal analysis methods
4. To understand about principle of duality and dual networks
5. To identify the solution methodology in solving electrical circuits based on the topology

UNIT - IV	Single Phase A.C Circuits	11 Hrs

R.M.S, Average Values and Form Factor for Different Periodic Wave Forms – Sinusoidal Alternating Quantities – Phase and Phase Difference – Complex and Polar Forms of Representations, Steady State Analysis of R, L and C (In Series, Parallel and Series Parallel Combinations) with Sinusoidal Excitation - Phasor diagrams - Concept of Power Factor-Concept of Reactance, Impedance, Susceptance and Admittance-Apparent Power, Active and Reactive Power, Examples.Resonance.

Learning Outcomes:

At the end of this unit, the student will be able

1. To understand fundamental definitions of 1-ϕ AC circuits
2. To distinguish between scalar, vector and phasor quantities
3. To understand voltage, current and power relationships in 1-ϕ AC circuits with basic elements R, L, and C.
4. To understand the basic definitions of complex immittances and complex power
5. To solve 1-ϕ AC circuits with series and parallel combinations of electrical circuit elements R, L and C.

UNIT - V	Network Theorems	10 Hrs

Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power Transfer, Millmann's, Tellegen's, and Compensation Theorems for D.C and Sinusoidal Excitations.

Learning Outcomes:

At the end of this unit, the student will be able

1. To know that electrical circuits are 'heart' of electrical engineering subjects and network theorems are main part of it.
2.To distinguish between various theorems and inter-relationship between various theorems
3. To know about applications of certain theorems to DC circuit analysis
4. To know about applications of certain theorems to AC network analysis
5. To know about applications of certain theorems to both DC and AC network analysis

Course Outcomes (CO): After completion of the course, students will be able to

- Explain types of networks and Network Reduction Techniques
- Analyze Magnetic Circuits and Coupled circuits.
- Analysis of electrical networks using graph theory and duality and dual networks
- Analyze RLC circuits with AC Excitation
- Analyze the power, voltage and current for different network configurations.
- Apply theorems for finding the solutions of network problems

Textbooks:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.
3. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018

Reference Books:

1. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
2. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
3. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
4. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

C-PROGRAMMING & DATA STRUCTURES
Common to(ECE,EEE,ME,CE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0518T	**3: 0:0:0**	**3**	**CIE: 30 SEE:70**	**3Hours**	**ESC**

Course Objectives:

This course will enable students to:

- Illustrate the basic concepts of C programming language.
- Choose a suitable C-construct to develop C code for a given problem.
- Illustrate the fundamental concept of data structures and Arrays
- Emphasize the importance of data structures in developing and implementing efficient algorithms
- Illustrate a variety of data structures such as linked structures, stacks, queues, trees, and graphs

Syllabus		Total Hours:45
Unit - I	**Introduction to C Language**	**9Hrs**

Structure of C program, C Tokens, Data types, Operators, Precedence and Associativity of operators, Expressions and its evaluation, control structures – sequence, selection and Iteration statements, unconditional control structures – break, goto, continue. Arrays: Introduction to arrays, types of arrays, applications of arrays, Programming examples

Unit - II	**Strings, Functions and Pointers**	**9Hrs**

String: Declaring and Initializing string, Printing and reading strings, string manipulation functions, String input and output functions, array of strings, Programming examples
Functions: Defining function, user defined functions, standard functions, passing array as argument to function, recursion
Pointers: declaring and initializing pointers, pointers and arrays, pointer to pointer, pointer arithmetic, dynamic memory allocation,
Structures and Unions

Unit - III	**Data Structures**	**9Hrs**

Introduction to Data Structures: Definitions, Concept of Data Structures, Overview of Data Structures, Implementation of Data Structures

Linked Lists: Definition, Single Linked List, Circular Linked List, Double Linked List, Circular Double Linked List, Applications of Linked List

Unit - IV	**Stacks & Queues**	**9Hrs**

Stacks: Introduction, Definition, Representation of Stack, Operations on Stacks, Applications of Stacks

Queues: Introduction, Definition, Representation of Queues, Operations on Queues, Various Queue Structures, Applications of Queues

Unit - V	**Trees ,Graphs ,Searching and Sorting**	**9Hrs**

Trees: Basic Terminologies, Definition and Concepts, Binary Tree, Representation of Binary Tree, operations on Binary Tree, Binary Search Tree, Heap Tree

Graphs: Introduction, Graph Terminologies, Representation of graphs, Operations on Graphs, Graph, Graph Traversal Techniques: BFS and DFS

Searching and Sorting – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

Course Outcomes(CO):

On completion of this course, student will be able to

- Illustrate and explain the basic computer concepts and programming principles of C language(L2)
- Select the best selection and loop construct for solving given problem(L2)
- Develop C programs to demonstrate the applications of derived data types such as arrays, pointers, strings.(L2)

- Implement basic operations on stack and queue using array representation(L2)
- Use linked structures, trees, and Graphs in writing programs(L2)
- Demonstrate different methods for traversing Graphs and Trees (L2)

Text Books:

1. C Programming & Data Structures – Behrouz A. Fourazan, Richard F. Gilberg.
2. Programming with C – Byron Gottfried, Third edition, Scham's Outlines
3. C Programming : A Problem Solving Approach- Behrouz A. Fourazan , E.V.Prasad, Richard F. Gilberg
4. Classic Data Structures , Second Edition, Debasissamanta, PHI
5. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S.Sahni and Susan Anderson Freed, Universities Press

Reference Books:

1. Let us C,YashwantKanetkar, 6th Edition , BPB
2. C Programming and Data Structures, P.Padmanabham, Third Edition, BS Publications
3. C Programming, E.Balagurusamy, 3rd edition, TMHPublishers
4. Programming in C, Ashok N. Kamthane, AmitKamthane, Pearson
5. Data Structures: A Pseudo code Approach with C, 2nd Edition, R.F.Gilberg and B. A. Forouzan, Cengage Learning.
6. "Data Structures and Algorithm Analysis in C" by Weiss
7. "Data Structure Through C" by Yashavant P Kanetkar

E-resources:

https://www.geeksforgeeks.org/c-programming-language/
http://en.cppreference.com/w/c
https://onlinecourses.nptel.ac.in/noc19_cs42/
https://www.linuxtopia.org/online_books/programming_books/gnu_c_programming_tutorial/index.html
https://codeforwin.org/

CHEMISTRY LAB (Common to CSE,AI&ML,CS,ECE,EEE,DS)					
Course Code	**L:T:P: S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0011P	**0:0:3:0**	**1.5**	**CIE:30 SEE:70**	**3H**	**BSC**

Course Objectives:

This course will enable students to:

- Theobjectiveofthelaboratorysessionsistoenablethelearnerstogethands-onexperienceontheprinciples discussed in theory sessions and to understand the applications of these concepts in engineering.

Syllabus	**Total Hours: 48**

List of Experiments

1. Conduct metric titration of strong acid vs. strong base,
2. Determination of cell constant and conductance of solutions
3. Potentiometry - determination of redox potentials and emfs
4. pH metric titration of strong acid vs. strong base
5. Determination of Strength of an acid in Pb-Acid battery
6. Preparation of a polymer
7. Verification of Lambert-Beer's law
8. Preparation of Nanomaterials
9. Separation of organic mixtures by Thin Layer chromatography
10. Identification of simple organic compounds by IR.
11. Estimation of Ferrous Iron by Dichrometry.
12. Determination of Copper by EDTA method.

(**Any 10 experiments from the above list)**

Course Outcomes:

On completion of this course, the students are able to:

- Determine the cell constant and conductance of solutions and the strength of an acid by conductometry
- Synthesize of advanced polymer materials
- Measure the strength of an acid present in secondary battery and Ferrous ion using volumetric analysis
- Determine the potentials and EMFs of solutions by Potentiometry
- Identify some organic and inorganic compounds by instrumental methods
- Synthesize of nanomaterials by simple methods

Text Book(s):

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Jain & Jain. Engineering Chemistry: Dhanapathrai Publications., 2015.
3. S.S.Dara, Experiments and Calculations in Engineering Chemistry: S-Chand Publications, Revised edition, 2008.

Reference Book(s):

1. S.K. Bhasin and Sudha Rani, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi, 2nd edition.
2. Sunitha Rattan, "Experiments in Applied Chemistry", S.K. Kataria& Sons, New Delhi, 2nd edition.

FUNDAMENTALS OF ELECTRICAL CIRCUITS LABORATORY
(Common to EEE & ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0202P	0:0:3:0	1.5	CIE:30 SEE:70	3H	ESC

Course Objectives:

This course will enable students to:

1. Remember, understand and apply various theorems and verify practically.
2. Understand and analyze active, reactive power measurements in three phase balanced & un balanced circuits

Syllabus	Total Hours: 48

List of Experiments

1. Verification of Kirchhoff's current law and voltage law using hard ware
2. Verification of mesh analysis using hard ware and digital simulation.
3. Verification of nodal analysis using hard ware
4. Determination of average value, rms value, form factor, peak factor of sinusoidal wave, square wave using hard ware
5. Analyse Series and Parallel RLC circuits.
6. Verification of Series and Parallel Resonance
7. Verification of Thevenin's and Norton's Theorems
8. Verification of Superposition Theorem
9. Maximum Power Transfer Theorem for DC and AC circuits
10. Verification of Compensation Theorem for DC circuits
11. Verification of Reciprocity, Millmann's Theorems for DC circuits
12. Determination of Self, Mutual Inductances and Coefficient of Coupling

(**Any 10 experiments from the above list)**

Course Outcomes:

On completion of this course, the students are able to:

- Analyze network parameters and types of networks
- Analyze RLC circuits and coupled circuits.
- Analyze Resonance for different circuits.
- Apply theorems for finding the solutions of network problems
- Apply Maximum power transfer theorems for finding the solutions of DC & AC Networks
- Analyze coupled circuits.

Text Book(s):

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.
3. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018

Reference Book(s):

1. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
2. 2. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
3. 3. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
4. 4. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

C-PROGRAMMING & DATA STRUCTURES LAB
(Common to ECE, EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0519P	0:0:3:0	1.5	CIE:30 SEE:70	3Hours	ESC

Course Objectives:

This course will enable students to:

- Work with an IDE to create, edit, compile, run and debug programs
- Use of conditional expressions and looping statements to solve problems associated with conditions and repetitions.
- Design & develop of C programs using arrays, strings, pointers & functions.
- Exploring basic data structures such as stacks and queues.
- Introduces variety of data structures such as hash linked list, trees and graphs.
- Introduces searching and sorting algorithms

Syllabus | **Total Hours: 48**

List of Experiments

1. 1. a) Write an algorithm to calculate and display the volume of a CUBE having its height (h=10cm), width (w=12cm) and depth (8cm).

b) Write an algorithm to calculate area and Circumference of a circle.

c) Write an algorithm to calculate simple interest for a given P, T, and R (SI = P*T*R/100)

2.a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program that uses functions to perform the following:

i) Addition of Two Matrices ii) Multiplication of Two Matrices

3 a) Write a C program that uses functions to perform the following operations:

i) To insert a sub-string in to a given main string from a given position.

ii) To delete n characters from a given position in a given string.

4 a) Write a C program to find sum and average of three numbers.

b) Write C program to evaluate each of the following equations

5a) Write a program in C to print individual characters of string in reverse order.

b) Write a program in C to compare two strings without using string library functions.

c) Write a C program to determine if the given string is a palindrome or not

6 . a) Write C program to find GCD of two integers by using recursive function.

b) Write C program to find GCD of two integers using non-recursive function

7 .Write C programs that implement stack (its operations) using

i) Arrays ii) Pointers

8. Write C programs that implement Queue (its operations) using

i) Arrays ii) Pointers

9. Write a C program that uses Stack operations to perform the following:

i) Converting infix expression into postfix expression

ii) Evaluating the postfix expression

10. Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

11. Write a C program that uses functions to perform the following operations on Doubly linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

12. Write a C program that uses functions to perform the following operations on circular linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

13 .Write a C program that uses functions to perform the following:

i) Creating a Binary Tree of integers

ii) Traversing the above binary tree in preorder, inorder and postorder.

14. Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

i) Linear search ii) Binary search

15 .Write a C program that implements the following sorting methods to sort a given list of integers in ascending order i) Bubble sort ii) Selection sort iii) Insertion sort

Course Outcomes:

On completion of this course, the students are able to:

- Use conditional and iterative statements for writing the C programs(L2)
- Make use of different data-structures like arrays, strings, structures for solving problems.(L2)
- Use basic data structures such as arrays, Stacks and Queues
- Programs to demonstrate fundamental algorithmic problems including Tree Traversals, Graph traversals
- Use various searching and sorting algorithms.
- Use linked structures, trees, and Graphs in writing programs

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)
3. Classic Data Structures , Second Edition, Debasissamanta, PHI Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S.Sahni and Susan Anderson Freed, Universities Press

Reference Books:

1. C Programming and Data Structures, P.Padmanabham, Third Edition, BS Publications
2. C Programming, E.Balagurusamy, 3rd edition, TMHPublishers
3. .Programming in C, Ashok N. Kamthane, AmitKamthane, Pearson
4. Data Structures: A Pseudo code Approach with C, 2nd Edition, R.F.Gilberg and B. A. Forouzan, Cengage Learning.
5. "Data Structures and Algorithm Analysis in C" by Weiss
6. "Data Structure Through C" by Yashavant P Kanetkar

"Problem Solving in Data Structures and Algorithms Using C: The Ultimate Guide to Programming Interviews" by Hemant Jain

Engineering Workshop Lab (Common to All Branches of Engineering)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0304P	**0:0:3:0**	**1.5**	**CIE:30 SEE:70**	**3Hours**	**ESC**

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Syllabus	**Total Hours: 48**

List of Experiments

Wood Working:

Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint

b) Mortise and Tenon joint

c) CornerDovetail joint or Bridle joint

Sheet Metal Working:

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray

b) Conical funnel

c) Elbow pipe

d) Brazing

Fitting:

Familiarity with different types of tools used in fitting and do the following fitting exercises

a)V-fit

b) Dovetail fit

c) Semi-circular fit

d) Bicycle tire puncture and change of two wheeler tyre

Electrical Wiring:

Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series

b) Two-way switch

c) Godown lighting

d) Tube light

e) Three phase motor

f) Soldering of wires

Course Outcomes(CO):

On completion of this course, student will be able to

- Apply wood working skills in real world applications.(l3)
- Build different objects with metal sheets in real world applications.(l3)
- Apply fitting operations in various applications.(l3)
- Apply different types of basic electric circuit connections.(l3)
- Use soldering and brazing techniques.(l2)

Note: In each section a minimum of three exercises are to be carried out.

IT WORKSHOP LAB
(Common to ECE, EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0502P	0:0:3:0	1.5	CIE:30 SEE:70	3Hours	ESC

Course Objectives:

- To make the students know about the internal parts of a computer, assembling and dissembling a computer from the parts, preparing a computer for use by installing the operating system
- To provide Technical training to the students on Productivity tools like Word processors Spreadsheets, Presentations and LAteX
- To learn about Networking of computers and use Internet facility for Browsing and Searching

Syllabus	Total Hours: 48

List of Experiments

Preparing your Computer

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: Operating system features: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process. Networking and Internet

Task 5: Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc. should be done by the student. The entire process has to be documented.

Task 6: Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating email account.

Task 7: Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc. Productivity tools

Task 8: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered, Image Manipulation tools.

Task 9: Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

Task 10: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet

Task 11: LateX: Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

Course Outcomes:

On completion of this course, the students are able to:

- Disassemble and Assemble a Personal Computer and prepare the computer ready to use.
- Prepare the Documents using Word processors and Prepare spread sheets for calculations. using excel and also the documents using LAteX.
- Prepare Slide presentations using the presentation tool.
- Interconnect two or more computers for information sharing.
- Access the Internet and Browse it to obtain the required information.

Text Books:

1. Introduction to Computers, Peter Norton, McGraw Hill
2. MOS study guide for word, Excel, Powerpoint& Outlook Exams, Joan Lambert, Joyce Cox, PHI.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. Networking your computers and devices, Rusen, PHI

Reference Books:

1. Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH
2. Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY
(AUTONOMOUS)
NELLORE – 524137 (A.P) INDIA

B.TECH Electrical and Electronics Engineering

Course Structure (RG22)

Semester - 2 (Theory-5, Lab-3)							
Sl. No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	BSC	22A0002T	Differential Equations and Vector Calculus	3	0	0	3
2	BSC	22A0003T	Applied Physics	3	0	0	3
3	HSC	22A0013T	Communicative English	3	0	0	3
4	ESC	22A0401T	Electronic Devices & Circuits	3	0	0	3
5	ESC	22A0302T	Engineering Drawing	1	0	4	3
6	HSC (Lab)	22A0014P	Communicative English Lab	0	0	3	1.5
7	BSC (Lab)	22A0008P	Applied Physics Lab	0	0	3	1.5
8	ESC (Lab)	22A0402P	Electronic Devices & Circuits Lab	0	0	3	1.5
			Total credits				**19.5**

Category	Credits
Basic Science Course (BSC)	7.5
Engineering Science Course (ESC)	7.5
Humanities and Social Science Course (HSC)	4.5
Total	19.5

Differential Equations & Vector Calculus					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0002T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**BSC**

Course Objectives:

To enlighten the learners in the concept of differential equations and multivariable calculus, to furnishthe learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

Syllabus		**Total Hours:45**
Unit - I	**Linear Differential Equations of Higher Order (Constant Coefficients)**	**9 Hrs**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskean, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Mass spring system.

Unit - II	**Partial Differential Equations**	**9 Hrs**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants
and arbitrary functions, solutions of first order equations using Lagrange's method. Non linearequations of first order – Type I, II, III, IV.

Unit - III	**Applications of Partial Differential Equations**	**9 Hrs**

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation (Without Derivation), Solutions one Dimensional Wave equation by the method of separation of variables
and related Problems.

Unit - IV	**Vector Differentiation**	**9 Hrs**

Scalar and vector point functions, vector operator del, del applies to scalar point functions-Gradient, del applied to vector point functions-Divergence and Curl, vector identities.

Unit - V	**Vector Integration**	**9 Hrs**

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

Course Outcomes (CO):

On completion of this course, student will be able to

- Solve the linear differential equations with constant coefficients by appropriate method.
- Apply a range of techniques to find solutions of standard partial differential equations.
- Calcify the PDE, learn the applications of PDEs
- Apply del to Scalar and vector point functions, illustrate the physical interpretation ofGradient, Divergence and Curl.
- Apply Green's, Stokes and Divergence theorem in evaluation of double and triple integrals.

Textbooks:

1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.
2. Differential Equations & Vector Calculus by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganathamand M.V.S.S.N.Prasad S. Chand publication.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B.V.Ramana, "Higher Engineering Mathematics", Mc Graw Hill publishers.
3. Engineering Mathmatic I & II, by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham andM.V.S.S.N.Prasad S. Chand publication.

Applied Physics (Common to ECE, EEE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0003T	**3:0:0:0**	**3**	**CIE:30 SEE:70**	**3H**	**BSC**

Prerequisite: Student should know about fundamental and basic principles in physics

Course Objectives:

This course will enable students to:

- To make a bridge between the physics in school and engineering courses.
- To impart the knowledge in basic concepts of the optical phenomenon like interference, diffraction andpolarization.
- To understand the mechanisms of emission of light, the use of lasers as light sourcesfor low and highenergy applications, study of propagation of light wave through optical fibers along with engineering applications.
- To open new avenues of knowledge and understanding the basic concepts of dielectric and magneticmaterials and its application in the emerging micro devices.
- Evolution of band theory to distinguish materials, basic concepts and transport phenomenon of chargecarriers in semiconductors.
- To identify the importance of semiconductors in the functioning of electronic devices.
- To enlighten the concepts related to superconductivity which leads to their fascinating applications.
- To impart knowledge in basic concepts of electromagnetic waves

Syllabus	Total Hours:48
Unit - I Wave Optics	**10**

Interference- Principle of superposition – Interference of light – Types of Interference – Path difference – Phase difference – Conditions for sustained interference- Interference in thin films (Reflection Geometry) – Colors in thin films – Newton's Rings – Determination of wavelength and refractive index of liquid.

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to singleslit, double slit and N-slits (qualitative) – Grating spectrum**.**

Polarization- Introduction – Types of polarization – Polarization by reflection, refraction and double refraction - Nicol's Prism - Half wave and Quarter wave plates with applications.

Unit –II Lasers and Fiber optics	10

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Ruby laser
– He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Propagation Losses (qualitative) – Applications

Unit –III Dielectric and Magnetic Materials	**10**

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction –Basic definitions – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro – Hysteresis – Soft and Hard magnetic materials

Unit –IV Semiconductors and Superconductors	**10**

Semiconductors- Introduction – Classification of crystalline solids – Intrinsic semiconductors – Intrinsic Density of charge carriers- Intrinsic conductivity-Intrinsic Fermi level- Extrinsic semiconductors– p-type and ntype- Drift and diffusion currents – Einstein's equation – Formation of p-n junction diode – Direct and indirect band gap semiconductors – Hall effect – Hall coefficient – Applicationsof Hall effect.

Superconductors- Introduction – Properties of superconductors – Meissner effect – Type I and TypeII superconductors – BCS theory – Josephson effects (AC and DC) – High T_C superconductors – Applications of superconductors**.**

Unit –V Electrostatics and Electromagnetic Waves	**8**

Electrostatics -Introduction- Electric charge-Coulomb's law-Electric filed-- Electric field due to linear charge-Gauss' law- statement and its proof- Derivation of Coulomb's law from Gauss law.
Electromagnetic Waves- Introduction-Divergence and Curl of Electric and Magnetic Fields- Stokes' theorem for curl- Maxwell's Equations (Quantitative)- Electromagnetic wave propagation (Non-conducting medium (dielectric medium)) -Poynting's Theorem.

Course Outcomes:

On completion of this course, the students are able to:

- Describe the importance of Interference, Diffraction and Polarization and the engineering applications as well (L2)
- Demonstrate the properties of lasers and fibre optics to various applications in science and technology (L2)
- Explain the fundamental concepts and theory related to dielectric and magnetic materials (L1)
- Illustrate the functioning of semiconductors in electronic devices (L2)
- Discuss the principles and theory related to superconductors and explore their technological applications(L2)
- Explain the electromagnetic wave propagation and its power in non-conducting medium (L2)

Text Books:

1. Engineering Physics – Dr. M.N. Avadhanulu & Dr. P.G. Kshirsagar, S. Chand and Company
2. Engineering Physics – B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. Applied Physics for Engineers- K.Venkataramanan, R. Raja, M. Sundararajan(Scitech) [3,5] 2014

Reference Books:

1. Engineering Physics – Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. Engineering Physics – K. Thyagarajan, McGraw Hill Publishers
3. Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press
4. David J.Griffiths, "Introduction to Electrodynamics"- 4/e, Pearson Education,2014
5. Semiconductor physics and devices- Basic principle – Donald A, Neamen, Mc Graw Hill

E-resources:

- https://www.textbooks.com/Catalog/MG5/Applied-Physics.php
- https://edurev.in/courses/9596_Electromagnetic-Theory-Notes--Videos--MCQs--PPTs
- https://libguides.ntu.edu.sg/c.php?g=867756&p=6226561
- https://bookauthority.org/books/best-applied-physics-books
- https://www.electronicsforu.com/resources/16-free-ebooks-on-material-science/2

COMMUNICATIVE ENGLISH

(Common to all Branches of Engineering)

Course Code	L:T: P: S	Credits	Exam marks	Exam Duration	Course Type
22A0013T	3: 0: 0: 0	3	CIE:30 SEE:70	3 Hours	HSC

Course Objectives:

- Facilitate effective **listening skills** for better comprehension of academic lectures and English spoken by native speakers
- Help improve **speaking skills** motivating the learners to participate in activities such as role plays, discussions and structured talks/oral presentations
- Focus on appropriate **reading skills** for comprehension of various academic texts and authentic materials
- Impart effective strategies for good **writing skills** in summarizing, writing well organized essays, drafting formal letters and designing well structured reports
- Broaden the knowledge base of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

Syllabus		Total Hours:48
Unit - I	**On the Conduct of Life: William Hazlitt**	**9 Hrs**

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text Scanning to look for specific pieces of information.
Reading for Writing: Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph.
Grammar and Vocabulary: Parts of Speech,
Content words and function words;
Word order in sentences;
Basic sentence structures;
Types of questions - Wh- questions.

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Unit - II	**The Brook: Alfred Tennyson**	**9Hrs**

Listening: Answering a series of questions about main idea and supporting ideas after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics followed by short structured talks.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Paragraph writing (specific topics) using suitable cohesive devices; mechanics of writing - punctuation, capital letters.
Grammar and Vocabulary: Use of Articles and zero Article
Prepositions
Punctuation, capital letters
Cohesive devices – linkers

Unit - III	The Death Trap: Saki	11 Hrs

Listening: Listening for global comprehension and summarizing what is listened to.
Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed
Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.
Writing: Paragraph Writing , Summarizing
Grammar and Vocabulary: Verbs - Tenses
Subject-Verb agreement
Direct & Indirect speech

Unit - IV	Ponnuthayi – Bama	10 Hrs

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Read and Interpret graphic Information to reveal trends/patterns/relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters/Report Writing
Grammar and Vocabulary: Adjectives and Adverbs; Comparing and Contrasting
Voice - Active & Passive Voice.

Unit - V	My Beloved Charioteer- Shasi Deshpande	9 Hrs

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts- without the use of PPT slides
Reading: Reading for Comprehension
Writing: Writing structured essays on specific topics using suitable claims and evidences.
Grammar and Vocabulary: Identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Course Outcomes (CO):

On completion of this course, student will be able to

- Retrieve the knowledge of basic grammatical concepts
- Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English
- Apply grammatical structures to formulate sentences and correct word forms
- Analyze discourse markers to speak clearly on a specific topic in informal discussions
- Evaluate listening /reading texts and to write summaries based on global comprehension of these texts.
- Create and develop coherent paragraph interpreting graphical description.

Textbooks:

1) Language and Life: English Skills for Engineering Students - Orient Black Swan

Reference Books:

1. 1. Bailey, Stephen. Academic Writing: A Handbook for International Students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Raymond Murphy's English Grammar in Use Fourth Edition (2012) E-book
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

5. Oxford Learners Dictionary, 12th Edition, 2011
6. Norman Lewis Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary (2014)

Web links:

www.englishclub.com

www.easyworldofenglish.com

www.languageguide.org/english/

www.bbc.co.uk/learningenglish

www.eslpod.com/index.html

Electronic Devices and Circuits (Common to ECE, EEE)					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0401T	**3:0:0**	**3**	**CIE:30 SEE:70**	**3 Hours**	**ESC**

Course Objectives:

- To understand the basic principles of all semiconductor devices.
- To be able to solve problems related to diode circuits, and amplifier circuits.
- To analyze diode circuits, various biasing and small signal equivalent circuits of amplifiers.
- To be able to compare the performance of BJTs and MOSFETs.
- To design rectifier circuits and various amplifier circuits using BJTs and MOSFETs.

Syllabus

Unit –I

Diodes: Introduction, The Ideal Diode – current voltage characteristic, rectifier, diode logic gates, Terminal Characteristics of Junction Diodes– forward bias, reverse bias, and breakdown regions. **Applications:** Rectifiers – Half wave, Full wave rectifier and Bridge rectifier. Filters - Inductor, Capacitor, L-section and π-Filters, Zener Diodes– Zener diode Characteristics, Voltage shunt regulator, Diode as switch, Clipping and Clamping Circuits– limiter circuit, the clamped capacitor, voltage doubler, Special Diode Types– UJT, Schottky barrier diode, Varactor diode, photo diode, light emitting diode(LED), Problem Solving.

Unit –II

Bipolar Junction Transistors (BJTs): Physical Operation - simplified structure and modes of operation, Operation of the npn, and pnp transistors: cutoff, active, and saturation modes, V-I Characteristics- of different configurations - graphical representation of transistor characteristics, dependence of collector current on collector voltage, the Early Effect, Basic BJT Amplifier Configurations - Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, Problem Solving.

Unit –III

MOS Field-Effect Transistors (MOSFETs): Introduction, Device Structure and Physical Operation – device structure, operation with zero gate voltage, creating a channel for current flow, operation for different drain to source voltages, the P-channel MOSFET,CMOS, V-I characteristics– i_D - v_{DS} characteristics, i_D – v_{GS} characteristics, finite output resistance in saturation, characteristics of the p-Channel MOSFET, MOSFET Circuits at DC, Applying the MOSFET in Amplifier Design – voltage transfer characteristics, biasing the MOSFET to obtain linear amplification, the small signal voltage gain, graphical analysis, the Q-point. Problem solving.

Unit –IV

Biasing of BJT's & MOSFET's: Biasing of BJT's – load line, operating point, fixed bias, self bias, voltage divider bias circuits, Bias compensation, Thermal runaway, condition for Thermal stability, Biasing of MOSFET's - Fixed bias, Self bias, Voltage divider bias circuits, Problem solving.

Unit –V

MOSFET Small Signal Operation Models– the dc bias, separating the DC analysis and the signal analysis, Small signal equivalent circuit models, the transconductance, the T equivalent circuit model, Basic MOSFET Amplifier Configurations– three basic configurations, characterizing amplifiers, common source(CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower, the amplifier frequency response, Problem solving.

Text Books:

1. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits – Theory and

Applications", 6th Edition, Oxford Press, 2013.

2. Donald A Neamen, "Electronic Circuits – analysis and design", 3rd Edition, McGraw Hill (India), 2019.

References:

1. J. Milliman and C Halkias, "Integrated electronics", 2nd Edition, Tata McGraw Hill, 1991.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits," 9th Edition, Pearson, 2006.

Course Outcomes:

After the completion of the course students will able to

- Understand principle of operation, characteristics and applications of Semiconductor diodes.
- Design the diode applications such as rectifiers, clippers and clampers.
- Understand principle of operation, characteristics and applications of Bipolar Junction Transistor and MOSFETs.
- Design amplifiers using BJTs, and MOSFETs.
- Solve the problems related to Semiconductor diodes, BJTs, and MOSFETs.
- Analyze performance of diode applications, biasing circuits of BJTs, MOSFETs and their applications.

Engineering Drawing
(Common to All Engineering Branches)

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0302T	1:0:4	3	CIE:30 SEE:70	3 Hours	ESC

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.

Syllabus		Total Hours:50
Unit-I	**Introduction to Engineering Drawing**	**10Hrs**

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance-Conventions in drawing-lettering - BIS conventions.

a) Draw the Conic sections including Ellipse, Parabola, Hyperbola, and the Rectangular hyperbola using general methods,

b) Draw the Cycloid, Epicycloids, and Hypocycloid

c) Draw the Involutes of circle, square, pentagon, and hexagon

Unit-II	**Projections of points, lines and planes**	**10Hrs**

Projections of points, lines, and planes: Projection of points in any quadrant, lines inclined to one and both planes, finding true lengths, finding true inclinations, angle made by line. Projections of regular plane surfaces using rotating plane method.

Unit-III	**Projections of Solids**	**10Hrs**

Projections of solids: Projections of regular solids inclined to one and boththe principle planes using auxiliary views method.

Unit-IV	**Sections of solids**	**10Hrs**

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

Unit-V	**Development of surfaces**	**10Hrs**

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

Course Outcomes(CO):

On completion of this course, student will be able to

- Draw various curves applied in engineering. (l2)
- Show projections of solids and sections graphically. (l2)
- Draw the development of surfaces of solids. (l3)

Textbooks:

1. K.L.Narayana&P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
2. N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

ReferenceBooks:

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009
2. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000
3. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009
4. K.C.John, Engineering Graphics, 2/e, PHI, 2013
5. Basant Agarwal &C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

COMMUNICATIVE ENGLISH LAB

(Common to all Branches of Engineering)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0014P	0:0:3:0	1.5	CIE:30 SEE:70	3H	HSC

Course Objectives

This course will enable students to:

- Students will be exposed to a variety of self instructional, learner friendly modes of language learning
- Students will learn better pronunciation through sounds, stress, intonation and rhythm
- Students will be trained to use language effectively to face interviews, group discussions, public speaking
- Students will be initiated into greater use of the computer in resume preparation, report writing, format making etc.

List of Experiments — **Total Hours: 48**

1. Phonetics
2. Describing objects/places/persons
3. Role Play or Conversational Practice
4. JAM
5. Etiquettes of Telephonic Communication
6. Group Discussions
7. Debates
8. Oral Presentations
9. Interviews Skills
10. Reading comprehension
11. E-mail Writing
12. Resume Writing

Course Outcomes:

On completion of this course, the students are able to:

- Listening and repeating the sounds of English Language
- Understand the different aspects of the English language proficiency with emphasis on LSRW skills
- Apply communication skills through various language learning activities
- Analyze the English speech sounds, syllable division, stress, rhythm, intonation for better Listening and Speaking Comprehension.
- Evaluate and exhibit acceptable etiquette essential in social and professional settings
- Create awareness on mother tongue influence and neutralize it in order to Improve fluency in spoken English.

Suggested Software: Walden InfoTech / Young India Films

Reference Books:

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.

2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.

3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.

4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.

5. A Textbook of English Phonetics for Indian Students by T. Balasubramanyam

Online Learning Resources/Virtual Labs:

www.esl-lab.com

www.englishmedialab.com

www.englishinteractive.net

APPLIED PHYSICS LAB

(Common to ECE, EEE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0008P	0:0:3:0	1.5	CIE:30 SEE:70	3H	BSC

Course Objectives:

This course will enable students to:

- Understands the concepts of interference, diffraction and their applications.
- Understand the role of optical fiber parameters in communication.
- Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
- Illustrates the magnetic and materials applications.
- Apply the principles of semiconductors in various electronic devices

Syllabus	Total Hours: 48

Note: In the following list, out of 12 experiments, any 2 experiments must be performed in a virtual mode

List of Experiments

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of dispersive power of prism.
5. Determination of wavelength of LASER light using diffraction grating.
6. Determination of particle size using LASER.
7. To determine the numerical aperture of a given optical fiber and hence to find itsacceptance angle
8. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
9. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
10. To determine the resistivity of semiconductor by Four probe method
11. To determine the energy gap of a semiconductor
12. Determination of Hall voltage and Hall coefficient of a given semiconductor using HallEffect.

Course Outcomes:

On completion of this course, the students are able to:

- Determine the radius of a curvature and / or thickness of thin wire using microscope with the helpof interference concept (L2)
- Evaluate the wavelength of various colors of grating and also dispersive power of prism by spectrometer using the principle of diffraction (L2)
- Evaluate wavelength of light source and particle size with He-Ne laser using the principle of diffraction Estimate the numerical aperture of a given optical fiber and hence to find its acceptance angle (L2)
- Estimate the dielectric constant of a given material (L2)
- Examine the hysteresis loss of the magnetic material by B- H curve and Estimate the magnetic field of a circular coil carrying current along the axis (L2)
- Measure the type of conductivity ,hall voltage and hall coefficient of a given semiconductor usinghall effect and also measure the energy band gap of a given semiconductor material (L2)

Text Books:

1. Engineering Practical Physics B Mallick S Panigrahi, 1st, Edition, Cengage Learning Publishers

2. A Text book of Engineering Physics Practical, Dr. Ruby Das, Dr. Rajesh Kumar, C. S. Robinson, Prashant Kumar Sah, UNIVERSITY SCIENCE PRESS (An Imprint of Laxmi Publications Pvt. Ltd.)

Reference Books:

1. S. Balasubramanian, M.N. Srinivasan "A Text book of Practical Physics"- S ChandPublishers, 2017

E-resources:

http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

https://www.scribd.com/doc/81569075/Physics-Lab-Manual

http://www.mlritm.ac.in/assets/img/Lab%20manual%20Physics.pdf

https://bmsit.ac.in/public/assets/pdf/physics/studymaterial/Physics%20lab%20manual_cbcs%20%20-%20kavichintu.pdf

ELECTRONIC DEVICES AND CIRCUITS LAB
(Common to ECE, EEE)

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0402P	0:0:3	1.5	CIE:30 SEE:70	3 Hours	PC

Course Objectives:

- To verify the theoretical concepts practically from all the experiments.
- To analyse the characteristics of Diodes, BJT, MOSFET.
- To design the amplifier circuits from the given specifications.
- To Model the electronic circuits using tools such as PSPICE/Multisim.

Syllabus

LIST OF EXPERIMENTS: (**Conduct all experiments**).

Note: All the experiments shall be implemented using both Hardware and Software.

1. Design a half wave rectifier with and without filters for the given specifications, and verify the results experimentally for different load conditions, also Calculate ripple factor with relevant graphs.
2. Design a full wave rectifier with and without filters for the given specifications, and verify the results experimentally for different load conditions, also Calculate ripple factor with relevant graphs
3. Verify the operation of various clipping and clamper circuits using PN junction diode experimentally.
4. Design a voltage regulator using Zener diode and verify load regulation characteristics.
5. Analyze the input and output characteristics of BJT in Common Emitter configuration experimentally.
6. Analyze the input and output characteristics of BJT in Common Base configuration experimentally.
7. Design voltage- divider bias/self-bias circuit using BJT and verify experimentally.
8. Design a small signal amplifier using BJT (common emitter) for the given specifications also calculate Bandwidth.
9. Analyze the output and transfer characteristics of MOSFET in Common Source Configuration experimentally.
10. Design self-bias circuit using MOSFET and verify experimentally.
11. Verify the operation of a switch using CMOSFET/JFET/BJT experimentally.
12. Design a small signal amplifier using MOSFET (common source) for the given specifications also calculate Bandwidth.

Tools / Equipment Required: Software Tool like Multisim/ Pspice or Equivalent,
DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

Course Outcomes:

After the completion of the course students will able to

- Understand the operation and characteristics of basic electronic devices.
- Design the Diode applications like Rectifiers, Clippers and Clampers for the given specifications**.**
- Analyze the Characteristics of Diodes, BJTs, MOSFETs.
- Design BJT based amplifiers for the given specifications.
- Design MOSFET based amplifiers for the given specifications
- Simulate Diode, BJT and MOSFET applications in PSPICE /Multisim.

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY(AUTONOMOUS)
NELLORE – 524137 (A.P) INDIA

B.TECH Electrical and Electronics Engineering
Course Structure (RG22)

Semester-3(Theory-5,Lab-3, SC -1, MC-1)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	BSC	22A0015T	Complex Variables & Numerical methods	2	1	0	3
2	HSC	22A0021T	Universal Human Values	3	0	0	3
3	PCC	22A0207T	Electrical Circuit Analysis & Synthesis	2	1	0	3
4	ESC	22A0412T	Analog & Digital Electronics	2	1	0	3
5	PCC	22A0208T	DC Machines & Transformers	2	1	0	3
6	PCC	22A0219T	Electrical Power Generating Systems	2	1	0	3
7	PCC (Lab)	22A0209P	Electrical Circuits &Simulation Lab	0	0	3	1.5
8	ESC (Lab)	22A0413P	Analog & Digital Electronics Lab	0	0	3	1.5
9	PCC (Lab)	22A0210P	DC Machines & Transformers Lab	0	0	3	1.5
10	SC	22A0517P	**Skill Oriented Course:** Electrical work shop	1	0	2	2
11	MC	22A0027M	**Mandatory Course:** Environmental Science	2	0	0	0
			Total credits				**27.5**

Category	Credits
Basic Science Course (BSC)	3
Engineering Science Course (ESC)	4.5
Professional Core Courses(PCC)	15
Humanities & Social Sciences Elective (HSSC)	3
Skill oriented Course (SC)	2
Total	**27.5**

COMPLEX VARIABLES AND NUMERICAL METHODS (EEE, ECE, ME)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0015T	**2: 1:0:0**	**3**	**CIE: 30 & SEE:70**	**3 Hours**	**BSC**

Course Objectives:

This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables, various numerical methods for interpolating the polynomials, evaluation of integral equations and solution of differential equations,.

Unit -I	**ANALYTIC FUNCTIONS AND CONFORMAL MAPPING**	**9Hrs**

Differentiation, Analytic functions, Cauchy-Riemann equations (both Cartesian and polar), Harmonic functions, and Harmonic conjugate, Potential functions.

Unit -II	**COMPLEX INTEGRATION**	**10Hrs**

Line integrals, Cauchy's theorem (without proof), Cauchy's integral formula (without proof), Generalized Cauchy's integral formula (without proof), Complex Power Series: Taylor's series and Laurent's series (without proof), zeros of an analytic functions, Singularities: Types of singularities, pole of order

Unit -III	**RESIDUE THEOREM**	**10Hrs**

Residues and evaluation of residues at poles, Cauchy's Residue theorem (without proof), Evaluation of integrals using residue theorem, Evaluation of improper and real integrals of the type:

(i) $\int_{0}^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$ (ii) $\int_{-\infty}^{\infty} f(x)dx$

Unit-IV	**INTERPOLATION-NUMERICAL DIFFERENTIATION & INTEGRATION**	**9Hrs**

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Numerical Differentiation & Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

Unit-V	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**10Hrs**

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand functions of Complex variable and its properties, analyticity &conformal mappings of complex functions.
- Understand the integration of complex functions; apply Cauchy's integral theorem and Cauchy's integral formula, singularities of complex functions.
- Evaluate improper integrals of complex functions using Residue theorem.
- Derive interpolating polynomials using interpolation formulae and evaluate the differentiation and integration numerically.
- Solve differential and integral equations numerically.

Textbooks:

1. Higher Engineering Mathematics, B.S. Grewal, Khanna publishers.
2. Engineering Mathematics Volume III by T.K.V. Iyengar, B. Krishna Gandhi, S. Ranganatham and M.V.S.S.N.Prasad, S.Chand Publications.
3. Introductory Methods of Numerical Analysis by S. S. Sastry, PHI Learning Pvt. Ltd., New Delhi.

ReferenceBooks:
1. Engineering Mathematics, Volume - III, E. Rukmangadachari & E. Keshava Reddy, Pearson Publisher. 2. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S. Ranganatham and M.V.S.S.N. Prasad, S. Chand Publications. 3. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley India

UNIVERSAL HUMAN VALUES (Common to all branches of Engineering)					
Course Code	**L:T:P:S**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0021T	**3:0:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**HSC**

Course Objectives:

Student will be able to,

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature /existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

UNIT-I	COURSE INTRODUCTION-NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION	10Hrs

Purpose and motivation for the course, recapitulation from Universal Human Values-I

Self-Exploration–what is it?- Its content and process; 'Natural Acceptance' and Experiential Validation – as the process for self-exploration

Continuous Happiness and Prosperity – A look at basic Human Aspirations

Right understanding, Relationship and Physical Facility-the basic requirements for fulfillment of aspirations of every human being with the incorrect priority

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

UNIT-II	UNDERSTANDING HARMONY IN THE HUMAN BEING- HARMONY IN MYSELF!	9Hrs

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

Understanding the needs of Self ('I') and 'Body'- happiness and physical facility Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I'

Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one' sown life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT-III	UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN – HUMAN RELATIONSHIP	10Hrs

Understanding values in human – human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

Understanding the meaning of Trust; Difference between intention and competence

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Visualizing a universal harmonious order in society – Undivided Society, Universal Order-from family to world family.

Include practice sessions to reflection relationships in family, hostel and institute as extended family, real life examples, teacher – student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT-IV	UNDER THE NATURE AND EXISTENCE HOLE EXISTENCE AS COEXISTS	9Hrs

Understanding the harmony in the Nature
Inter connectedness and mutual fulfillment among the four order so nature – recyclability and self-regulation in nature
Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
Holistic perception of harmony at all level so existence.
Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resource sand role of technology etc.

UNIT-V	IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS	10Hrs

Natural acceptance of human values Definitiveness of Ethical Human Conduct
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
Competence in professional ethics :
a. Ability to utilize the professional competence for augmenting universal human order
b. Ability to identify the scope and characteristics of people friendly and eco – friendly production systems,
c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
Case studies of typical holistic technologies, management models and production systems Strategy for transition from the present state to Universal Human Order:
a. At the level of individual : as socially and ecologically responsible engineers, technologists and managers
b. At the level of society: as mutually enriching institutions and organizations
Sump.
Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg.To discuss the conduct as an engineer or scientist etc.

Course Outcomes (CO):

On completion of this course, student will be able to

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to the recommitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Textbooks:

1. RR Gaur, R Asthana, GP Bagaria, "A Foundation Course in Human Values and Professional Ethics",
2. Revised Edition, Excel Books, NewDelhi, 2019. ISBN978-93-87034-47-1
3. R R Gaur, R Asthana, GP Bagaria,"Teachers' Manual for A Foundation Course in Human Values and Professional Ethics",2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-53-2

ReferenceBooks:.

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak,1999.
2. A.N.Tripathi, "HumanValues", New Age Intl.Publishers, NewDelhi, 2004. The Story of Stuff (Book).
3. Mohandas Karamchand Gandhi "The Story of My Experiments with Truth"
4. E.FSchumacher. "SmallisBeautiful" Slowis Beautiful – Cecile Andrews
J C Kumarappa "Economy of Permanence" Pandit Sunderlal "Bharat Mein Angreji Raj" Dharampal, "Rediscovering India"
Mohandas K.Gandhi, "Hind Swaraj or Indian Home Rule"
India Wins Freedom-Maulana Abdul Kalam Azad
Vivekananda – Romain Rolland (English)
Gandhi – Romain Rolland (English)

ELECTRICAL CIRCUIT ANALYSIS & SYNTHESIS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0207T	**2: 1:0:0**	**3**	**CIE: 30 & SEE:70**	**3Hours**	**PCC**

Course Objectives :

Student will be able to

1. To know the current locus diagrams for electrical circuits
2. To know the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
3. Knowing how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations
4. Identify the properties and characteristics of network functions
5. To know the analysis & design of two-port networks
6. Synthesize passive one-port networks using standard Foster and Causer forms

UNIT- I	**THREE PHASE A.C. CIRCUITS**	**10Hrs**

Introduction - Analysis of Balanced Three Phase Circuits – Phase Sequence- Star and Delta Connection - Relation between Line and Phase Voltages and Currents in Balanced Systems - Measurement of Active and Reactive Power in Balanced and Unbalanced Three Phase Systems. Analysis of Three Phase Unbalanced Circuits - Loop Method - Star Delta Transformation Technique – for balanced and unbalanced circuits - Measurement of Active and reactive Power – Advantages of Three Phase System.

UNIT-II	**LOCUS DIAGRAMS AND NETWORKS FUNCTIONS**	**8Hrs**

Locus diagrams: Locus diagrams of RL, RC, RLC circuits.

Network Functions: The concept of complex frequency, physical interpretation, transform impedance, series and parallel combination of elements, terminal ports, network functions for one port and two port networks, poles and zeros of network functions, significance of poles and zeros, properties of driving point functions and transfer functions, necessary conditions for driving point functions and transfer functions, time domain response from pole zero plot.

UNIT-III	**NETWORK SYNTHESIS**	**10Hrs**

Identification of network synthesis, Brune's positive and real function (PRF), properties of PRF, testing of driving point functions, even and odd function, one terminal pair network driving point synthesis with LC elements, RC elements, Foster and Cauer form.

UNIT-IV	**TRANSIENT ANALYSIS**	**10Hrs**

D.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for D.C Excitation - Initial Conditions in network - Initial Conditions in elements - Solution Method Using Differential Equation and Laplace Transforms - Response of R-L & R-C Networks to Pulse Excitation

A.C Transient Analysis: Transient Response of R-L, R-C, R-L-C Series Circuits for Sinusoidal Excitations - Solution Method Using Differential Equations and Laplace Transforms.

UNIT-V	**TWO PORT NETWORKS**	**10Hrs**

Two Port Network Parameters – Impedance – Admittance - Transmission and Hybrid Parameters and their Relations - Concept of Transformed Network - Two Port Network Parameters Using Transformed Variables.

Course Outcomes (CO): After completion of the course, students will be able to

- Illustrate the locus diagram for series and parallel circuits
- Understand the analysis of three phase balanced and unbalanced circuits and to measure active and reactive powers in three phase circuits.
- To get knowledge about how to determine the transient response of R-L, R-C, R-L-C series circuits for D.C and A.C excitations
- Apply two-port network analysis in the design and analysis of filter and attenuator networks
- Describe the properties and characteristics of network functions and verify the mathematical constraints for their physical realization.
- Synthesize passive one-port networks using standard Foster and Causer forms

Textbooks:

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.
3. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018

ReferenceBooks:

1. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
2. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
3. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
4. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

ANALOG AND DIGITAL CIRCUITS

Course Code	L: T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0412T	2:1:0	3	CIE:30 & SEE:70	3 Hours	ESC

Course Objectives:

- To familiarize various types of feedback amplifiers and oscillators.
- To introduce the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To understand and implement the working of basic digital circuits.

UNIT –I	AMPLIFIERS	10Hrs

Multistage Amplifiers: Classification of amplifiers, different coupling schemes used in amplifiers, frequency response and analysis of two stage RC coupled Amplifier, principles of Darlington amplifier, Cascode amplifier

Feedback Amplifiers: Concepts of Feedback, Classification of Feedback Amplifiers, General Characteristics of Negative-Feedback Amplifiers, Analysis of a feedback Amplifiers - Voltage – Series, Current-Series, Current-shunt and Voltage – shunt.

Oscillators: Conditions for oscillations, Phase - shift Oscillator, Wien Bridge Oscillator, L-C Oscillators (Hartley and Colpitts).

UNIT –II	741 OP-AMP	10Hrs

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, features of 741 Op-Amp, Block diagram of Op-Amp, Modes of Operation - Inverting, Non-Inverting, and Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Sample and hold circuits, Comparator and its applications, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT-III	IC-555 & IC 565 APPLICATIONS	8Hrs

IC-555 & IC 565 Applications: Introduction To Active Filters, Characteristics Of Band Pass, Band Reject And All Pass Filters, Analysis Of 1st Order LPF& HPF Butterworth Filters, Waveform Generators - Triangular, Saw-Tooth, Square Wave, IC555 Timer - Functional Diagram, Monostable And Astable Operations, Applications, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications.

UNIT –IV	DATA CONVERTERS	10Hrs

Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT –V	DIGITAL ELECTRONICS	10Hrs

Classification of Integrated Circuits, Combinational Logic ICs - Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoder, Encoder, Priority Encoder, Multiplexer, De-multiplexer, Parallel Binary Adder/ Subtractor, Magnitude Comparator.

Sequential: Familiarity with commonly available 74XX & CMOS 40XX Series ICs - All Types of Flip-flops, conversion of Flip-flops, Synchronous Counter, Decade Counter, Shift Register.

Text Books:

1. Millman, Halkias and Jit, "Electronic Devices and Circuits", 4 th Edition, Mc Graw Hill Education (India) Private Ltd., 2015.
2. Salivahanan and N. Suresh Kumar, "Electronic Devices and Circuits", 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2017
3. Linear Integrated Circuits – D. Roy Chowdhury, New Age International (p) Ltd, 2nd Edition,2003.
4. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 2003.
5. Digital fundamentals – Floyd and Jain, Pearson Education,8th Edition ,2005.

References:

1. J. Milliman, C. C. Halkias and Chetan Parikh, “Integrated Electronics”, 2nd Edition, Mc Graw Hill, 2010.
2. Op Amps & Linear Integrated circuits-Concepts and Applications James M.Fiore,Cengage Learning/Jaico,2009.
3. Operational Amplifiers with linear integrated circuits by K.Lal kishore-Pearson,2009.
4. Digital design principles and practices-John.F.Wakerly 3/e,2005.

Course Outcomes:

After the completion of the course students will able to

1. List various types of feedback amplifiers and oscillators.
2. List out the characteristics of Linear and Digital ICs.
3. Discuss the various applications of linear & Digital ICs.
4. Solve the application-based problems related to linear and digital ICs.
5. Design the circuits using either linear ICs or Digital ICs from the given specifications.
6. Able to design and implement digital logic circuits.

DC MACHINES & TRANSFORMERS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0208T	**2: 1:0:0**	**3**	**CIE: 30 & SEE:70**	**3Hours**	**PCC**

Course Objectives :

Student will be able to

1. Study the magnetic materials, electromechanical energy conversions, principle and operation of DC machines and transformers and starters.
2. Understand the constructional details of DC machines and Transformers
3. Analyze the performance characteristics of DC machines and transformer
4. Identify the properties and characteristics of network functions
5. To know the analysis & design of two-port networks
6. Classify and design different types of filters and study their characteristics

UNIT- I	**INTRODUCTION TO MACHINES.**	**10Hrs**

Principles of electromechanical energy conversion: Energy in magnetic system, field energy and mechanical force, multiply-excited magnetic field systems. Constructional details of DC machine, principle of operation of DC generator, armature windings and its types, emf equation,

UNIT-II	**DC GENERATORS CHARACTERISTICS**	**9Hrs**

armature reaction, effect of brush lead, demagnetizing and cross magnetizing ampere turns, compensating windings, commutation: emf induced in a coil undergoing commutation, methods of improving commutation OCC and load characteristics of different types of generators. Parallel operation of DC Generators: DC shunt and series generators in parallel, equalizing connections.

UNIT-III	**DC MOTORS**	**10Hrs**

Force on conductor carrying current, back emf, Torque and power developed by armature, speed Control of DC motors, Necessity of starters, constructional details of starters, characteristics of DC motors, Losses in DC machines, condition for maximum efficiency, Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test, Fields test.

UNIT-IV	**SINGLE PHASE TRANSFORMERS**	**10Hrs**

Principle, construction and operation of single- emf equation -phase transformers, equivalent circuit, phasor diagrams , Magnetizing current, harmonics in magnetization current, losses and efficiency Testing - open circuit and short circuit tests, voltage regulation, Sumpner's test, separation of hysteresis and eddy current losses. Parallel operation of single-phase transformers.

UNIT-V	**THREE PHASE TRANSFORMERS**	**9Hrs**

Three-phase transformer – construction, types of connection and their comparative features, Phase conversion - Scott connection, Tap-changing transformers - No-load and on-load tap changing of Transformers, Three-winding transformers- Cooling of transformers.
Autotransformers - construction, principle, applications and comparison with two winding transformer.

Course Outcomes (CO): After completion of the course, students will be able to

- Understand the concepts of magnetic circuits.
- Understand the construction, operation and armature windings of a DC generator
- Understand the operation of a DC motors.
- Analyze speed control of DC motors, testing methods and parallel operation of DC machines
- Analyse single phase transformers circuits.
- Analyse three phase transformers circuits.

Text books:
1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011. 2. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education,2010.
Reference Books:
1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education,2013. 2. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers,2004. 3. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.Online Learning Resources:
Online Learning Resources:
https://onlinecourses.nptel.ac.in/noc21_ee71/preview https://onlinecourses.nptel.ac.in/noc21_ee24/preview

ELECTRICAL POWER GENERATING SYSTEMS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0219T	**2: 1:0:0**	**3**	**CIE: 30 & SEE:70**	**3Hours**	**PCC**

Course Objectives :

Student will be able to

1. Structure, essential components and their layout in thermal power station
2. Selection of site for thermal power station
3. Selection of site for hydro power generation
4. Various aspects and issues involved in Nuclear power generation
5. Electric power generation from renewable energy sources as sun, wind and ocean
6. Cost of generation and tariff methods

UNIT- I	**THERMAL POWER GENERATING SYSTEMS**	**10Hrs**

Block Diagram of Thermal Power Station (TPS) showing paths of Coal, Steam, Water, Air, Ash and Flue Gasses - Brief Description of TPS Components: Economizers, Boilers, Super Heaters, Turbines, Condensers, Chimney and Cooling Towers

UNIT-II	**HYDRO & NUCLEAR POWER GENERATING SYSTEMS**	**9Hrs**

Hydro Power: Selection of Site, Classification, Layout, Description of Main Components.
Nuclear Power: Nuclear Fission and Chain Reaction.- Nuclear Fuels.- Principle of Operation of Nuclear Reactor.-Reactor Components: Moderators, Control Rods, Reflectors and Coolants.- Radiation Hazards: Shielding and Safety Precautions.- Types of Nuclear Reactors and Brief Description of PWR, BWR and FBR.

UNIT-III	**SOLAR & WIND POWER GENERATING SYSTEMS**	**10Hrs**

Solar Power Generation: Role and Potential of Solar Energy Options, Principles of Solar Radiation, Flat Plate and Concentrating Solar Energy Collectors, Different Methods of Energy Storage – PV Cell- V-I Characteristics.
Wind Power Generation: Role and potential of Wind Energy Option, Horizontal and Vertical Axis Wind Mills-Performance Characteristics- Power- Speed & Torque- Speed Characteristics-Pitch & Yaw Controls – Power Electronics Application – EconomicAspects.

UNIT-IV	**BIOGAS & GEOTHERMAL POWER GENERATING SYSTEMS**	**10Hrs**

Biogas Power Generation: Principles of Bioconversion, Types of Biogas Digesters – Characteristics of Bio-Gas- Utilization- Economic and Environmental Aspects.
Geothermal and Ocean Power Generation: Principle of Geothermal Energy Methods of Harnessing-Principle of Ocean Energy-Tidal and Wave Energy- Mini Hydel Plants Economic Aspects.

UNIT-V	**ECONOMIC ASPECTS OF POWER GENERATION**	**9Hrs**

Load Curve, Load Duration and Integrated Load Duration Curves-Load Demand, Diversity, Capacity, Utilization and Plant Use Factors- Numerical Problems. Costs Of Generation and their Division Into Fixed, Semi-Fixed and Running Costs. Tariff Methods: Desirable Characteristics of a Tariff Method.- Flat Rate, Block-Rate, Two-Part, Three –Part, and Power Factor Tariff Methods and Numerical Problems.

Course Outcomes (CO): After completion of the course, students will be able to

- Estimate the coal requirement, cost per kWh generation and number of units generated for thermal power station
- Estimate the required flow of river water, cost of generation and number of units generated in hydel power generation
- Determine the load capacity of the plant and Plot the load curve,load duration curve.
- Assess the theory and practices of conventional and non-conventional power generation method.
- Explain various factors like load factor, plant factor.
- Evaluate the tariffs to be charged for the consumers.

Textbooks:
1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A.Chakraborti, Dhanpat Rai & Co. Pvt. Ltd., 1999. 2. Electric Power Generation Distribution and Utilization by C.L Wadhwa, New Age International (P) Ltd., 2005. 3. Non Conventional Energy Sources by G.D. Rai, Khanna Publishers, 2000.
ReferenceBooks:
1. Renewable Energy Resources – John Twidell and Tony Weir, Second Edition, Taylor and Francis Group, 2006. 2. Electrical Power Generation, Transmission and Distribution by S.N.Singh., PHI, 2003. 3. Principles of Power Systems by V.K Mehta and Rohit Mehta S.CHAND& COMPANY LTD., New Delhi 2004. 4. Wind Electrical Systems by S. N. Bhadra, D. Kastha & S. Banerjee – Oxford University Press, 2013.
Online Learning Resources:
https://www.digimat.in/nptel/courses/video/108102047/L01.html

ELECTRICAL CIRCUITS & SIMULATION LABORATORY					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0209P	**0:0:3:0**	**1.5**	**CIE: 30 & SEE:70**	**3Hours**	**PCC**

Course Objectives:

Student will be able to

1. Understand and analyze active, reactive power measurements in three phase balanced &unbalanced circuits.
2. Understand and analyze various current locus diagrams
3. Apply and experimentally analyze two port network parameters
4. Simulation of various circuits using PSPICE software.

List of Experiments:

1. Measurement of Active Power for Star Connected Balanced and Unbalanced Loads
2. Measurement of Reactive Power for Star Connected Balanced Loads
3. Measurement of 3-Phase Power by Two Wattmeter Method for Unbalanced Loads
4. Measurement of Active Power for Delta Connected Balanced Loads
5. Measurement of Reactive Power for Delta Connected Balanced Loads
6. Locus Diagram of RL Series Circuits: a) Variable 'R' and Fixed 'L' b) Variable 'L' and Fixed 'R'
7. Locus Diagram of RC Series Circuits: a) Variable 'R' and Fixed 'C' b) Variable 'C' and Fixed 'R'
8. Determination of Z Parameters
9. Determination of Y Parameters
10. Transmission Parameters
11. Hybrid Parameters
12. Simulation of DC Circuits
13. Simulation of AC Circuits
14. DC Transient Response

(**Any 10 experiments from the above list)**

Course Outcomes:

At the end of the course, students should be able to

1. Understand 3 phase balanced and unbalanced, star and delta connected supply and load
2. Measure reactive power in 3-phase circuit using different methods
3. Analyze the two-port network
4. Design and analyze the both ac and dc circuits by simulation

Text Book(s):

1. Fundamentals of Electric Circuits Charles K. Alexander and Matthew. N. O. Sadiku, Mc Graw Hill, 5th Edition, 2013.
2. Engineering circuit analysis William Hayt and Jack E. Kemmerly, Mc Graw Hill Company, 7th Edition, 2006.
3. Circuit Theory Analysis & Synthesis A. Chakrabarti, Dhanpat Rai & Sons, 7th Revised Edition, 2018

Reference Book(s):

1. Network Analysis M.E Van Valkenberg, Prentice Hall (India), 3rd Edition, 1999.
2. 2. Electrical Engineering Fundamentals V. Del Toro, Prentice Hall International, 2nd Edition, 2019.
3. 3. Electric Circuits- Schaum's Series, Mc Graw Hill, 5th Edition, 2010.
4. 4. Electrical Circuit Theory and Technology John Bird, Routledge, Taylor & Francis, 5th Edition, 2014.

ANALOG AND DIGITAL ELECTRONICS LAB					
Course Code	**L: T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0413P	**0:0:3**	**1.5**	**CIE:30 & SEE:70**	**3 Hours**	**ESC**

Course Objectives:

- To learn basic techniques for the design of analogue circuits, digital circuits and fundamental concepts used in the design of systems.
- To design and analyse multistage amplifiers, feedback amplifiers and OP AMP based circuits.
- To implement simple logical operations using combinational logic circuits.
- To design combinational logic circuits and sequential logic circuits.

Syllabus

MINIMUM TWELVE EXPERIMENTS MUST CONDUCT: (Six from each part A & B)

PART -A:

1. Design and simulate two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.
2. Design and simulate Darlington amplifier. Determine Gain and Bandwidth from its frequency response curve.
3. Design and simulate voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.
4. Design RC Phase shift oscillator/ Wien bridge oscillator for the given specifications. Determine the frequency of oscillation.
5. Design IC 555 Timers – Monostable Operation Circuits.
6. Design Active Low pass, High pass Butterworth (Second Order).
7. Design inverting and non-inverting amplifiers for the given specifications using OP-AMP and verify the same experimentally.
8. Design practical differentiator and integrator circuits using OP-AMP for the given specifications and verify the same practically.

PART -B:

1. To study basic gates (AND, OR, NOT) and verify their truth tables.
2. Realization of Boolean Expressions using Gates
3. Design a 3 – bit Adder / Subtractor
4. Design and realization a 4 – bit Gray to Binary and Binary to Gray Converter
5. Design and construct basic flip-flops R-S, J-K, J-K Master slave flip-flops using gates and verify their truth tables
6. Design and implementation of Mod-N synchronous counter using J-K flip-flops.
7. Design and implementation of i) Ring counter and ii) Johnson counter using 43-bit shift register
8. Verify the functionality of Universal shift Register(74LS194/195)

Equipment required for Laboratories:

1. RPS
2. CRO
3. Function Generator
4. Multi Meters
5. Bread Boards
6. Components: - IC741, IC555, IC566, IC1496, IC723, 7805, 7809, 7912 and other essential components.

7. Analog IC Tester

Course Outcomes:

After the completion of the course students will able to

1. Analyse various amplifier circuits.
2. Design multistage amplifiers.
3. Design Feedback and Oscillator Circuits.
4. Design OPAMP based analog circuits.
5. Understand working of logic gates.
6. Design and implement Combinational and Sequential logic circuits.

DC MACHINES & TRANSFORMERS LAB					
Course Code	**L: T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0210P	**0:0:3**	**1.5**	**CIE:30 & SEE:70**	**3 Hours**	**PCC**

Course Objectives:

To conduct various experiments on

- DC motors and DC Generators.
- The speed control techniques of DC motors..
- To conduct various experiments for testing on 1-phase transformers.

List of Experiments:

Minimum ten experiments from the following list are required to be conducted

1. Magnetization characteristics of DC shunt generator. Determination of critical field Resistance and critical speed.
2. Load test on DC shunt generator. Determination of characteristics.
3. Brake test on DC shunt motor. Determination of performance curves.
4. Swinburne's test on DC shunt motor, Predetermination of efficiency.
5. Speed control of DC shunt motor (Armature control and Field control method).
6. Hopkinson's tests on DC shunt machines. Predetermination of efficiency.
7. OC and SC test on single phase transformer
8. Parallel operation of single phase transformers.
9. Sumpner's test on single phase transformers.
10. Load test on DC long shunt compound generator. Determination of Characteristics.
11. Load test on DC short shunt compound generator. Determination of Characteristics.
12. Separation of losses in DC shunt motor.
13. Separation of losses of single phase transformer

Course Outcomes:

After the completion of the course students will able to

1. Able to conduct and analyse load test on DC shunt generator.
2. Able to understand and analyze magnetization characteristics of DC shunt generator.
3. Able to understand and analyze speed control techniques and efficiency of DC machines
4. Able to understand to predetermine efficiency and regulation of single-phase Transformers

References:

D. P. Kothari and B. S. Umre, Laboratory Manual for Electrical Machines, I.K International Publishing House Pvt. Ltd., 2017

ELECTRICAL ENGINEERING WORK SHOP (SKILL)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0517P	**1: 0:2:0**	**2**	**CIE: 30 & SEE:70**	**3Hours**	**SC**

Course Objectives:

1. To know about different tools, abbreviations and symbols in Electrical Engineering
2. To learn about types of measuring instruments to measure electrical quantities
3. To gain knowledge on different types of earthing and earth resistance
4. To study different types of wiring.

Course Outcomes (CO):

On completion of this course, student will be able to

1. Demonstrate knowledge on different tools, abbreviations and symbols used in Electrical Engineering
2. Measure different electrical quantities using measuring instruments
3. Demonstrate how to trouble shoot the electrical equipment's (like fan, grinder, Motor, etc.)
4. Do wiring and Earthing for residential houses
5. Identification of color code and Measurement of wire guages using guage meter.

Syllabus	**Total Hours:48**

1. Study of Introduction to Electrical tools, symbols and abbreviations
2. Study of types of sizes of wires and making "T" joint and straight joint for wires
3. Measurements of Electrical quantities (like Voltage, Current, Power, Power factor in RLC circuits)
4. Study of measurements of Energy (using Single phase and Three phase Energy meter) by connecting different loads
5. Study of earthing and measurement of earth resistance
6. Study and performance of residential wiring (using Energy meter, Fuses, Switches, Indicator, Lamps, etc.)
7. Study of various electrical gadgets (CFL and LED)
8. Study of PV Cell
9. Assembly of choke or small transformer
10. Study of trouble shooting of electrical equipments (fan, iron box, mixer-grinder, etc.)
11. Introduction to basics of Electronic components: Solder practice, Multi meter, Power supply
12. Measurement of wire guages using guage meter
13. Identification of color code, resistors, ICs, Transistors, capacitors, diodes, SCRs, IGBTs etc.

Reference Books:

1. 1. Lab manual of Electrical Engineering by TTTI, Chennai

ENVIRONMENTAL STUDIES

(Common to CSE,AI&ML,ECE,EEE,ME)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0027M	2: 0:0:0	0	CIE: 30 & SEE:70	3Hours	MC

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life.
- To save earth from the inventions by the engineers.

UNIT - I	MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES AND NATURAL RESOURCES	6Hrs

Definitions , components of Environment, Scope and Importance –Need for Public Awareness

Renewable and non-renewable resources –Forest resources – Use and over – exploitation, deforestation,– Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

UNIT - II	ECOSYSTEMS	6Hrs

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers– Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem

a. Grassland ecosystem.

b. Desert ecosystem

UNIT - III	BIODIVERSITY AND ITS CONSERVATION	8Hrs

Introduction Definition: genetic, species and ecosystem diversity – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values — India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching ,Endangered and endemic species

of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT - IV	ENVIRONMENTAL POLLUTION	6Hrs

Definition, Cause, effects and control measures of :

a. air pollution

b. water pollution

c. noise pollution

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

UNIT - V	SOCIAL ISSUES AND THE ENVIRONMENT	6Hrs

From Unsustainable to Sustainable development – Urban problems related to energy –Environment Protection Act. – Air (Prevention and Control of Pollution) act

Definition, Cause, effects and control measures of :

Global warming

Acid rain

Ozone layer depletion

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain –Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Course Outcomes (CO):

- Recognize the knowledge about environment, natural resources and different techniques involved in its conservation.
- Describe the information about different eco-systems and its functions.
- Explain the different types of bio-diversity along with values and conservation methods.
- Predict various environmental pollutions and able to design the environmental friendly process in engineering.
- Apply the sustainable development concepts in life, society and industry.

Text Books:

1. Text book of Environmental Studies for Undergraduate Courses- Erach Bharucha for University Grants Commission, Universities Press.
2. Environmental Studies- Kaushik & kaushik, New Age Pubilishers.

Reference Books:

1. Environmental studies- R.Rajagopalan, Oxford University Press
2. Comprehensive Environmental studies- J.P.Sharma, Laxmi publications.

GEETHANJALI INSTITUTE OF SCIENCE AND TECHNOLOGY(AUTONOMOUS)
NELLORE – 524137 (A.P) INDIA

B.TECH Electrical and Electronics Engineering
Course Structure (RG22)

Semester- 4(Theory-5,Lab-3, SC -1, MC-1)							
Sl.No.	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	**C**
1	BSC	22A0019T	Transforms & Probability Distributions	2	1	0	3
2	PCC	22A0211T	Engineering Electromagnetic	2	1	0	3
3	PCC	22A0212T	AC Motors & Synchronous machines	2	1	0	3
4	PCC	22A0213T	Control Systems Engineering	2	1	0	3
5	PCC	22A0214T	Power Electronics	2	1	0	3
6	PCC (Lab)	22A0215P	AC Motors & Synchronous Machines Lab	0	0	3	1.5
7	PCC (Lab)	22A0216P	Control Systems & Simulation Lab	0	0	3	1.5
8	PCC (Lab)	22A0217P	Power Electronics & Simulation Lab	0	0	3	1.5
9	SC	22A0029P	**Skill Oriented Course:** Python programming	1	0	2	2
10	MC	22A0030T	**Mandatory Course:** Constitution of India	2	0	0	0
			Total credits				**21.5**
Community Service 6-8 Weeks(Mandatory) during summer vacation							

Category	Credits
Basic Science Course (BSC)	3
Professional Core Courses(PCC)	16.5
Skill Oriented Course (SC)	2
Total	**21.5**

TRANSFORMS & PROBABILITY DISTRIBUTIONS
(Common to EEE , ME)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0019T	2: 1:0:0	3	CIE: 30 & SEE:70	3Hours	BSC

Course Objectives:

Our emphasis will be more on conceptual understanding and application of Fourier series,Fourier, Z and Laplace transforms and random variables and probability distributions.

UNIT - I	LAPLACE TRANSFORMS	9Hrs

Definition-Laplace transform of standard functions-existence of Laplace Transform – Inverse transform – First shifting Theorem, Transforms of derivatives and integrals – Unit step function – Second shiftingtheorem – Dirac's delta function – Convolution theorem – Laplace transform of Periodic function.
Differentiation and integration of transform – Application of Laplace transforms to ordinary differentialequations of first and second order.

UNIT - II	FOURIER SERIES	10Hrs

Determination of Fourier coefficients (Euler's) – Dirichlet conditions for the existence ofFourier series – functions having discontinuity-Fourier series of Even and odd functions – Fourier series in an arbitrary interval – Half-range Fourier sine and cosine expansions- Parseval's formula- Complex form of Fourier series.

UNIT - III	FOURIER TRANSFORMS	9Hrs

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inversetransforms – convolution theorem.

UNIT - IV	Z TRANSFORMS	10Hrs

Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and finalvalue theorems. Convolution theorem – Solution of difference equations by z-transforms.

UNIT - V	RANDOM VARIABLES & PROBABILITY DISTRIBUTIONS	10Hrs

Random variables (discrete and continuous), Probability density functions, properties Discrete distribution: Binomial, Poisson approximation to the binomial distribution and their properties.Continuous distribution: Normal distribution and their properties.

Course Outcomes (CO):Student will be able to

- Understand the concept of Laplace transforms, find the Laplace transforms of differentfunctions and apply Laplace transforms to solve Differential Equations.
- Find the Fourier series expression for the different periodic functions.
- Find Fourier Sine and cosine integrals. Understand Fourier transforms. Apply propertiesof Fourier transforms.
- Understand Z transforms, apply Z transforms, to solve difference equations.
- Explain the notion of random variable, distribution functions, apply Binomial,Poisson distribution and normal distributions for real data to compute probabilities.

Text Books:
3. B.S.Grewal , “Higher Engineering Mathematics”, Khanna publishers. 4. Mathematics II by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham andM.V.S.S.N.Prasad S. Chand publication. 5. Probability & Statistics by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham andM.V.S.S.N.Prasad S. Chand publication.
Reference Books:
3. B.V.Ramana, “Higher Engineering Mathematics”, Mc Graw Hill publishers. 4. Mathematical Methods by T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham andM.V.S.S.N.Prasad S. Chand publication. 5. Mathematical Foundations of Statistics by K. C. Kapoor & Gupta, S. Chand Publications.

ENGINEERING ELECTROMAGNETICS (EEE)					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0211T	**2: 1:0:0**	**3**	**CIE: 30 & SEE:70**	**3Hours**	**PCC**

Course Objectives: Student will be able to

1. To understand the basic principles of electrostatics.
2. To understand the principles of dielectrics, conductors and magnetic potentials.
3. To understand the basic principles of magneto statics for time invariant and time varying fields.

UNIT - I	**ELECTROSTATICS**	**12 Hrs**

Electrostatic Fields - Coulomb's Law - Electric Field Intensity (EFI) due to Line, Surface and Volume charges- Work Done in Moving a Point Charge in Electrostatic Field-Electric Potential - Potential Gradient - Gauss Law- Application of Gauss Law-Maxwell's First Law – Numerical Problems.

Laplace and Poisson Equations - Solution of Laplace Equation in one Variable. Electric Dipole - Dipole Moment - Potential and EFI due to Electric Dipole - Torque on an Electric Dipole in an Electric Field – Numerical Problems.

UNIT - II	**CONDUCTORS AND DIELECTRICS**	**8 Hrs**

Behaviour of Conductors in an Electric Field-Conductors and Insulators – Electric Field Inside a Dielectric Material – Polarization – Dielectric Conductors and Dielectric Boundary Conditions – Capacitance-Capacitance of Parallel Plate, Spherical & Co-axial capacitors – Energy Stored and Energy Density in a Static Electric Field – Current Density – Conduction and Convection Current Densities – Ohm's Law in Point Form – Equation of Continuity – Numerical Problems.

UNIT - III	**MAGNETO STATICS**	**10 Hrs**

Static Magnetic Fields – Biot-Savart Law – Oersted's experiment – Magnetic Field Intensity (MFI) due to a Straight, Circular &Solenoid Current Carrying Wire – Maxwell's Second Equation. Ampere's Circuital Law and its Applications Viz., MFI Due to an Infinite Current Carrying Filament – Maxwell's Third Equation – Numerical Problems.

Lorentz Force Equation –Force on a Current Element and Straight and Long Current Carrying Conductor in a Magnetic Field - Force Between two Straight and Parallel Current Carrying Conductors – Magnetic Dipole and Dipole moment –Torque on a Current Loop Placed in a Magnetic Field – Numerical Problems.

UNIT - IV	**MAGNETIC POTENTIAL**	**8 Hrs**

Scalar Magnetic Potential and Vector Magnetic Potential and its Properties - Vector Magnetic Potential due to Simple Configuration – Vector Poisson's Equations.

Self and Mutual Inductances – Neumann's Formulae – Determination of Self Inductance of a Solenoid and Toroid , Mutual Inductance Between a Straight Long Wire and a Square Loop Wire in the Same Plane – Energy Stored and density in a Magnetic Field – Numerical Problems.

UNIT - V	**TIMEVARYING FIELDS**	**10 Hrs**

Faraday's Law of Electromagnetic Induction – It's Integral and Point Forms – Maxwell's Fourth Equation. Statically and Dynamically Induced E.M.F's – Simple Problems – Modified Maxwell's Equations for Time Varying Fields – Displacement Current.

Poynting Theorem – Poynting Vector and its Significance**.**

Course Outcomes (CO): After completion of the course, students will be able to

- Acquires the Knowledge to understand basic principles, concepts and fundamental laws of electric fields.
- Describe static electric fields, their behavior in different media and associated Maxwell's equations.
- Acquires the Knowledge to understand basic principles, concepts and fundamental laws of magnetic fields.
- Describe static magnetic fields, their behavior in different media and associated Maxwell's equations.
- Acquires the knowledge to understand time- varying fields and interaction between electricity and magnetism.
- Understand the Concepts Calculation of Poynting vector & Theorem.

Textbooks:
1. Sadiku, Kulkarni, “Principles of Electromagnetics”, 6th Edition, Oxford University Press, 2015. 2. William.H.Hayt, “Engineering Electromagnetics”, Mc Graw Hill, 2010.
Reference Books:
1. K.A. Gangadhar and P.M. Ramanathan, “Electomagnetic Field Theory”, 8th Reprint, Khanna Publications, 2015. 2. J.D.Kraus, “Electromagnetics”, 5th Edition, Mc Graw Hill Inc, 1999.

AC MOTORS & SYNCHRONOUS MACHINES					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0212T	**2: 1:0:0**	**3**	**CIE: 30 & SEE:70**	**3Hours**	**PCC**

Course Objectives:

The students will be able to,

1. Understand the fundamentals of AC machines, know equivalent circuit performance characteristics.
2. Understand the methods of starting of Induction motors.
3. Understand the methods of starting of Synchronous motors.
4. Understand the parallel operation of Alternators.
5. Understand the various starting methods of single phase induction motor and its applications.

UNIT-I	**FUNDAMENTALS OF AC MACHNIE WINDINGS**	**10Hrs**

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; full-pitch coils, fractional short pitched coil, concentrated winding, distributed winding, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidal distributed winding, winding distribution factors. Comparison between the concentrated and distributed winding.

UNIT - II	**INDUCTION MACHINES**	**10Hrs**

Operating principle, Construction, Types (squirrel cage and slip-ring), Starting and Maximum Torque, Equivalent circuit, Phasor Diagram, Torque-Slip Characteristics, power flow in induction machines, Losses and Efficiency, No load and blocked rotor test, Circle diagram, performance characteristics, Numerical problems. Methods of starting, braking and speed control for induction motors, Doubly-Fed Induction Machines, crawling and cogging.

UNIT - III	**SYNCHRONOUS GENERATORS**	**8Hrs**

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation, EMF, MMF, ZPF and ASA methods. Operating characteristics of synchronous machines, Salient pole machine - two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization.

UNIT - IV	**SYNCHRONOUS MOTOR**	**10Hrs**

Principle of operation, methods of starting, Phasor diagram of synchronous motor, variation of current and power factor with excitation, V and inverted V curves, Hunting and use of damper bars, Synchronous condenser and power factor correction, Excitation.

UNIT - V	**SINGLE PHASE INDUCTION MOTOTR AND SPECIAL MACHINES**	**10Hrs**

Constructional features double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and its applications, capacitor start and run single phase motors, reluctance single phase motors, stepper motors, Universal motor ,BLDC motors

Course Outcomes (CO): After completion of the course, students will be able to

CO1: Understand the basics of ac machine windings.

CO2: Analyze the phasor diagrams of induction machine and methods of starting of Induction motors

CO3: Understand the synchronous machine, parallel operation of alternators, synchronization and load division of synchronous generators.

CO4: Apply the concepts to determine V and inverted V curves and power circles of synchronous motor.

CO5: Analyze the various types of single phase induction motor and its applications.

CO6: Understand the concept of special machines.

Textbooks:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
2. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

Reference Books:

1. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
2. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
3. A. S. Langsdorf, "Alternating current machines", McGraw Hill Education, 1984.
4. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

Online Learning Resources:

- **https://onlinecourses.nptel.ac.in/noc21_ee13/preview**

CONTROL SYSTEMS ENGINEERING					
Course Code	**L:T:P**	**Credits**	**Exam. Marks**	**Exam Duration**	**Course Type**
22A0213T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**PCC**

Course Objectives:

Student will be able to,

1. Merits and demerits of open loop and closed loop systems; the effect of feedback
2. The use of block diagram algebra and Mason's gain formula to find the overall transfer function
3. Transient and steady state response, time domain specifications and the concept of Root loci
4. Frequency domain specifications, Bode diagrams and Nyquist plots
5. State space modelling of Control system

UNIT-I	**CONCEPT OF CONTROLSYSTEM**	**10Hrs**

A**) Classification of control systems** - Open loop and closed loop control systems, Differences, Examples of control systems- Effects of feedback, Feedback Characteristics. Mathematical models Principle of operation of DC and AC Servo motor, Transfer function of DC servo motor - AC servo motor, Synchros .

B)Transfer Function Representation: Block diagram algebra, Determining the Transfer function from Block Diagrams, Signal flow graphs(SFG) - Reduction using Mason's gain formula Transfer function of SFG's.

UNIT –II	**TIME RESPONSE ANALYSIS**	**8Hrs**

Step Response - Impulse Response - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants.

UNIT –III 10Hrs	**STABILITY ANALYSIS IN TIME DOMAIN**	**10Hrs**

A)Stability Analysis in S-Domain: The concept of stability – Routh-Hurwitz's stability criterion – qualitative stability and conditional stability – Limitations of Routh-Hurwitz's stability

B)**Root Locus Technique:** Concept of root locus - Construction of root locus, Effects of adding poles and zeros to G(s)H(s) on the root loci.

UNIT –IV Unit –IV 10Hrs	**FREQUENCY RESPONSE ANALYSIS**	**10Hrs**

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram-Stability Analysis from Bode Plots. Polar Plots-Nyquist Plots- Phase margin and Gain margin-Stability Analysis.

Compensation techniques – Lag, Lead, Lag-Lead Compensator design in frequency Domain.

UNIT-V Unit –V 9Hrs	**STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS**	**10Hrs**

Concepts of state, state variables and state model, state models - differential equations & Transfer function models - Diagonalization, Transfer function from state model, Solving the Time invariant state Equations- State Transition Matrix and its Properties. System response through State Space models. The concepts of controllability and observability, Duality between controllability and observability.

Text Books:

1. Modern Control Engineering by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th edition, 2010.
2. Control Systems Engineering by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th edition, 2007.

References:

1. Control Systems Principles & Design by M.Gopal, 4th Edition, Mc Graw Hill Education, 2012.
2. Automatic Control Systems by B. C. Kuo and Farid Golnaraghi, John wiley and sons, 8th edition, 2003.
3. Feedback and Control Systems, Joseph J Distefano III, Allen R Stubberud& Ivan J Williams, 2nd Edition, Schaum's outlines, Mc Graw Hill Education, 2013.
4. Control System Design by Graham C. Goodwin, Stefan F. Graebe and Mario E. Salgado, Pearson, 2000.
5. Feedback Control of Dynamic Systems by Gene F. Franklin, J.D. Powell and Abbas Emami-Naeini, 6th Edition, Pearson, 2010.

1.

Course Outcomes:

After the completion of the course students will able to

- Understand the concepts of control systems feedback effect, mathematical modelling, time response.
- Apply the concepts of Block diagram reduction, Signal flow graph method for obtaining mathematical and Root locus, Bode, Nyquist, Polar plots for stability calculations.
- Apply the concept of controllability and observability and demonstrate the use of these techniques.
- Analyse time response analysis, error constants, and stability characteristics of a given mathematical model using different methods.
- Design and develop different compensators, controllers and their performance evaluation for various conditions. Implement them in solving various engineering applications.

POWER ELECTRONICS					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0214T	**2: 1:0:0**	**3**	**CIE: 30 & SEE:70**	**3Hours**	**PCC**

Course Objectives:

Student will be able to

1. Understand the differences between signal level and power level devices.
2. Analyze controlled rectifier circuits.
3. Analyze the operation of DC-DC choppers.
4. Analyze the operation of voltage source inverters.

UNIT - I	**POWER SEMICONDUCTOR DEVICES**	**10Hrs**

Power Diode, Power BJTs, Power MOSFETs, IGBTs, GTOs and their characteristics. Basic principle of operation of SCR, Static characteristics, two transistor model of SCR, SCR/GTO Turn on and SCR/GTO turn off characteristics.

Series and parallel operations of Thyristors, di/dt protection and dv/dt protection of SCRs, Thyristor firing circuits. Driver Circuits for MOSFET and IGBT.

UNIT - II	**PHASE CONTROLLED AC/DC RECTIFIERS**	**10Hrs**

1-PHASE CONTROLLED AC/DC RECTIFIERS: Principle of phase angle control: Single phase full converter with R-L & R-L-E load, Single phase dual converter, Single phase semi-controlled converter with R-L & R-L-E load.

3-PHASE CONTROLLED AC/DC RECTIFIERS: Three phase Full wave converter with R-L & R-L-E load, Three phase dual converter, Three phase semi-controlled rectifier with R-L & R-L-E load. Active rectifier

UNIT - III	**AC VOLTAGE CONTROLLERS & CYCLO CONVERTERS**	**8Hrs**

AC voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti parallel – With R and RL loads – modes of operation of Triac – Triac with R and RL loads – RMS load voltage, current and power factor - wave forms – Numerical problems.

Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and stepdown cyclo converters with Resistive and inductive load, Principle of operation, Waveforms, output voltage equation.

UNIT - IV	**DC – DC CONVERTERS**	**10Hrs**

Linear Power Supplies versus Switch Mode Power Supplies, Principle of operation of Flyback Converter continuous conduction mode only, Applications Principle of step down chopper, Generation of duty cycle, Step down converters with and without back e.m.f loads, Principle of step up operation, buck-boost converter-continuous conduction mode ,Converter classifications.

UNIT - V	**DC – AC CONVERTERS**	**10Hrs**

Single phase half bridge inverter, Single phase full bridge inverter, Three phase voltage source inverters (180 and 120 degree conduction modes), Applications -UPS, Grid connected Inverter.

Voltage Control Techniques of Inverters: Single Pulse Width Modulation, Multiple Pulse-width Modulation, Sinusoidal Pulse width Modulation.

Course Outcomes (CO): After completion of the course, students will be able to

- Understand different types of power semiconductor devices and their characteristics
- Distinguish between uncontrolled and Phase controlled Rectifiers..
- Analyze AC voltage controllers
- Understand the concept of Cyclo Converters
- Analyze the steady state operation of DC – DC Choppers

- illustrate the operation of various DC-AC Inverters

Textbooks:

1. . M. H. Rashid, “Power Electronics: Circuits, Devices and Applications”, 2nd edition, Prentice Hall of India, 1998
2. P.S.Bimbhra,”Power Electronics”, 4th Edition, Khanna Publishers, 2010.
3. M. D. Singh & K. B. Kanchandhani, “Power Electronics”, Tata Mc Graw Hill Publishing Company, 1998.

Reference Books:

1. Ned Mohan, Power Electronics: A First Course, John Wiley & Sons, Inc, 1
st edition (18 November 2011)
2. P S Bimbhra, Power Electronics, Khanna Publishers, Fourth Edition, 2010.
3. Robert W Erickson, Dragan Maksimovic ,Fundamentals of Power Electronics ,Springer
Publications, Second Edition,2004

Web References:

Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay.
https://nptel.ac.in/courses/108/101/108101038/

AC MOTORS & SYNCHRONOUS MACHINES LAB					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0215P	**0: 0:3:0**	**1.5**	**CIE: 30 & SEE:70**	**3Hours**	**PCC**

Course Objectives:

Student will be able to

1. Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
2. Predetermine regulation of a three-phase alternator by synchronous impedance & m.m.f methods.
3. Predetermine the regulation of Alternator by Zero Power Factor method Xd and Xq determination of salient pole synchronous machine.
4. Evaluate and analyze V and inverted V curves of 3 phase synchronous motor..

LIST OF EXPERIMENTS

Any Eight of the Experiments in Power Electronics Lab

1. No-load & Blocked-rotor tests on Squirrel cage Induction motor.
2. Load test on three phase slip ring Induction motor.
3. Speed control of three phase induction motor
4. Rotor resistance starter for slip ring induction motor
5. Load test on single phase induction motor.
6. Determination of Equivalent circuit of a single phase induction motor.
7. Predetermination of Regulation of a three phase alternator by synchronous impedance &m.m.f methods.
8. Predetermination of Regulation of three-phase alternator by Z.P.F. method.
9. Determination of Xd and Xq of a salient pole synchronous machine by slip test.
10. V and inverted V curves of a 3-phase synchronous motor.

Course Outcomes (CO): After completion of the course ,students will be able to

- Analyze and apply load test, no-load and blocked-rotor tests for construction of circle diagram and equivalent circuit determination in a single phase induction motor.
- Predetermine regulation of a three-phase alternator by synchronous impedance &m.m.f methods.
- Predetermine the regulation of Alternator by Zero Power Factor method Xd and Xq determination of salient pole synchronous machine.
- Evaluate and analyze V and inverted V curves of 3 phase synchronous motor

ReferenceBooks:

1. D. P.Kothari and B. S. Umre, “Laboratory Manual for Electrical Machines” I.K International Publishing House Pvt. Ltd, 2017.
2. D.R. Kohli and S.K. Jain, “A Laboratory Course in Electrical Machines” NEM Chand & Bros

Web References:

Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical

1. http://vem-iitg.vlabs.ac.in/
2. http://em-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Electrical Engineering
3.http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/Sadhya/experimentlist.html

CONTROL SYSTEMS & SIMULATION LAB

Course Code	L:T:P	Credits	Exam. Marks	Exam Duration	Course Type
22A0216P	0:0:3	1.5	CIE:30 & SEE:70	3 Hours	PCC

Course Objectives:

Student will be able to

1. Determination of transfer functions of various systems and control of it by different methodologies.
2. To provide knowledge in the analysis and design of controllers and compensators.
3. The characteristics of servo mechanisms which are helpful in automatic control systems.
4. To know the stability analysis using MATLAB.

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Syllabus

LIST OF EXPERIMENTS: (**Conduct all experiments**).

Note: All the experiments shall be implemented using both Hardware and Software.

s / Equipment Required:

1. Time response of Second order system(Step, ramp and impulse response)
2. Characteristics of Synchros
3. Characteristics of AC servo motor
4. Characteristics of DC servo motor
5. Transfer function of DC motor and DC genatrator
6. Programmable logic controller – Traffic control systems
7. Temperature controller using PID
8. Characteristics of magnetic amplifiers
9. Lag and Lead compensation - Magnitude and phase plot
10. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using Soft Tools
11. Design of PID Controller for first order and second order systems
12. Stability analysis using bode plot using MATLAB
13. Stability analysis using root locus using MATLAB
14. Stability analysis using nyquist plot using MATLAB

Course Outcomes:

After the completion of the course students will able to,

1. After the completion of this course student able solve the control system problems by using
2. The programs through MATLAB. Determination of transfer function useful to design the systems.
3. Introducing of MATLAB in control systems solutions

POWER ELECTRONICS & SIMULATION LAB					
Course Code	**L:T:P:S**	**Credits**	**Exam Marks**	**Exam Duration**	**Course Type**
22A0217P	**0: 0:3:0**	**1.5**	**CIE: 30 & SEE:70**	**3Hours**	**PCC**

Course Objectives:

Student will be able to

1. Understand and analyze various characteristics of power electronic devices with gate firing circuits and forced commutation techniques.
2. Analyze the operation of single-phase half & fully-controlled converters and inverters with different types of loads.
3. Analyze the operation of DC-DC converters, single-phase AC Voltage controllers, cyclo converters with different loads.
4. Create and analyze various power electronic converters using PSPICE software..

LIST OF EXPERIMENTS

Any Eight of the Experiments in Power Electronics Lab

1. Study of Characteristics of SCR, MOSFET & IGBT
2. Gate firing circuits for SCR's: (a) R triggering (b) R-C triggering
3. Single Phase AC Voltage Controller with R and RL Loads
4. Single Phase fully controlled bridge converter with R and RL loads
5. Forced Commutation circuits (Class A, Class B, Class C, Class D & Class E)
6. DC Jones chopper with R and RL Loads
7. Single Phase Parallel, inverter with R and RL loads
8. Single Phase Cycloconverter with R and RL loads
9. Single Phase Half controlled converter with R load
10. Three Phase half controlled bridge converter with R-load
11. Single Phase series inverter with R and RL loads
12. Single Phase Bridge converter with R and RL loads
13. Single Phase dual converter with RL loads

Any two simulation experiments with PSPICE/PSIM

14. PSPICE simulation of single-phase full converter using RLE loads and single-phase AC voltage controller using RLE loads.
15. PSPICE simulation of resonant pulse commutation circuit and Buck converters and chopper.
16. PSPICE simulation of single phase Inverter with PWM control

Course Outcomes (CO): After completion of the course, students will be able to

- Determine firing angle for SCR. (L3)
- Analyze the performance of AC-DC converters. (L4)
- Analyze the performance of DC-DC converters. (L4)
- Analyze the performance of DC-AC converters. (L4)
- Simulate and analyze power electronic converters using various simulation tools. (L4)
- Analyze various power electronic converters using PSPICE software(L2)

Textbooks:

1. O.P. Arora, "Power Electronics Laboratory: Theory, Practice and Organization (Narosa series in Power and Energy Systems)", Alpha Science International Ltd., 2007.
2. M.H.Rashid, "Simulation of Electric and Electronic circuits using PSPICE", M/s PHI Publications.
3. PSPICE A/D user's manual – Microsim, USA.
4. PSPICE reference guide – Microsim, USA.
5. MATLAB and its Tool Books user's manual and – Mathworks, USA

ReferenceBooks:

1. Ned Mohan, Power Electronics: A First Course, John Wiley & Sons, Inc, 1 st edition (18 November 2011)
2. P S Bimbhra, Power Electronics, Khanna Publishers, Fourth Edition, 2010.

Web References:
Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical 1. Engineering, IIT Bombay. https://nptel.ac.in/courses/108/101/108101038/ 2.https://www.ni.com/enin/search.html?q=&ps=10&pg=1&sn=catnav%3Asup.dwl.pdl%2Cn25%3Aapsw 3. https://www.synopsys.com/verification/virtual-prototyping/saber/saber-rd.html 4. https://rnd.iitb.ac.in/research-glimpse/public-domain-general-purpose-circuit-simulator

PYTHON PROGRAMMING (SKILL)
(Common to CS, DS, EEE,ME and ECE)

Course Code	L:T:P:S	Credits	Exam Marks	Exam Duration	Course Type
22A0029P	1: 0:2:0	2	CIE: 30 & SEE:70	3Hours	SC

Course Objectives:

This course will enable students to:

1. Acquire programming skills in core Python
2. To understand the importance of Object-oriented Programming
3. Develop the skill of designing graphical-user interfaces (GUI) in Python.
4. Develop the ability to write database applications in Python.

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand various data types like lists, tuples, strings etc.
- Able to create practical and contemporary applications using Functions
- Explore the use of Object-oriented concepts to solve Real-life problems
- Utilize Python packages in developing software applications
- Solve mathematical problems using Python programming language

Syllabus

Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements

Python Data Structures: Lists, Dictionaries, Tuples.

Strings: Creating strings and basic operations on strings, string testing methods.

Functions: Defining a function- Calling a function- Types of functions-Function Arguments-Anonymous functions- Global and local variables

OOPS Concepts; Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

Modules and Packages: Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages

Working with Data in Python: Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

Tasks:

1:OPERATORS

a. Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.
b. Read your name and age and write a program to display the year in which you will turn 100 years old.
c. Read radius and height of a cone and write a program to find the volume of a cone.
d. Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

2:CONTROL STRUCTURES

a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if…elif…else statement.
b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.
c. Write a Program to find the sum of a Series 1/1! + 2/2! + 3/3! + 4/4! +…….+ n/n!. (Input :

n = 5, Output : 2.70833)

d. In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

3: LIST

a. Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).
b. Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)
c. Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).
d. Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

4: TUPLE

a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]
b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test_list = [(“GFG”, “IS”, “BEST”), (“GFg”, “AVERAGE”), (“GfG”,), (“Gfg”, “CS”)], Output : [(„GFG“, „IS“, „BEST“)]).
c. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

5: SET

a. Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x).
b. Write a program to perform union, intersection and difference using Set A and Set B.
c. Write a program to count number of vowels using sets in given string (Input : “Hello World”, Output: No. of vowels : 3)
d. Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input : S1 = "aacdb", S2 = "gafd", Output : "cbgf").

6: DICTIONARY

a. Write a program to do the following operations:
    i. Create a empty dictionary with dict() method
    ii. Add elements one at a time
    iii. Update existing key“s value
    iv. Access an element using a key and also get() method
    v. Deleting a key value using del() method
b. Write a program to create a dictionary and apply the following methods:
    i. pop() method
    ii. popitem() method
    iii. clear() method
c. Given a dictionary, write a program to find the sum of all items in the dictionary.
d. Write a program to merge two dictionaries using update() method.

7: STRINGS

a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.

c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country)
d. Write a program to read a string and count how many times each letter appears. (Histogram).

8: USER DEFINED FUNCTIONS

a. A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
b. Write a function merge_dict(dict1, dict2) to merge two Python dictionaries.
c. Write a fact() function to compute the factorial of a given positive number.
d. Given a list of n elements, write a linear_search() function to search a given element x in a list.

9: BUILT-IN FUNCTIONS

a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
b. Write a program to demonstrate the working of built-in trignometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.
c. Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
d. Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

10. CLASS AND OBJECTS

a. Write a program to create a BankAccount class. Your class should support the following methods for
   i) Deposit
   ii) Withdraw
   iii) GetBalanace
   iv) PinChange
b. Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).
c. Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee_info() method and also using dictionary (_dict_).
d. Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

11. FILE HANDLING

a. Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform the following operations:
   i. Count the sentences in the file.
   ii. Count the words in the file.
   iii. Count the characters in the file.
b. Create a new file (Hello.txt) and copy the text to another file called target.txt. The target.txt file should store only lower-case alphabets and display the number of lines copied.
c. Write a Python program to store N student's records containing name, roll number and branch. Print the given branch student's details only.

Reference Books:

2. Reema Thareja, "Python Programming - Using Problem Solving Approach", Oxford Press, 1st Edition, 2017.
3. Michael H Goldwasser, David Letscher, "Object Oriented Programming in Python", Prentice Hall, 1st Edition, 2007.
4. Yashavant Kanetkar, Aditya Kanetkar, "Let us Python", BPB publication, 1st Edition, 2019.
5. Ashok Kamthane, Amit Kamthane, "Programming and Problem Solving with Python",

McGraw Hill Education (India) Private Limited, 2018.
6. Taneja Sheetal, Kumar Naveen, “Python Programming – A modular approach”, Pearson, 2017

Web Reference:

1. https://realpython.com/python3-object-oriented-programming/
2. https://python.swaroopch.com/oop.html
3. https://python-textbok.readthedocs.io/en/1.0/Object_Oriented_Programming.html
4. https://www.programiz.com/python-programming/
5. https://www.geeksforgeeks.org/python-programming-language/

CONSTITUTION OF INDIA
(Common to all branches of Engineering)

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0030T	2:0:0:0	-	CIE:30 & SEE:70	3Hours	MC

Course Objectives:

Student will be able to

1. To Enable the student to understand the importance of constitution
2. To understand the structure of executive, legislature and judiciary
3. To understand philosophy of fundamental rights and duties
4. To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
5. To understand the central-state relation in financial and administrative control

UNIT-I	INTRODUCTION TO INDIAN CONSTITUTION	6Hrs

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

UNIT-II	UNION GOVERNMENT AND ITS ADMINISTRATION STRUCTURE OF THE INDIAN UNION	6Hrs

Union Government and its Administration Structure of the Indian Union - Federalism - CentreState relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

UNIT-III	STATE GOVERNMENT AND ITS ADMINISTRATION	8 Hrs

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions.

UNIT-IV	LOCAL ADMINISTRATION	6Hrs

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Pachayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO,Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

UNIT-V	ELECTION COMMISSION	6Hrs

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissioner ate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Course Outcomes (CO):

On completion of this course, student will be able to

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy

Textbooks:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice – Hall of India Pvt. Ltd.. New Delhi

2. Subash Kashyap, "Indian Constitution", National Book Trust3. R RGaur,RAsthana,GP

ReferenceBooks:

1. H.M.Sreevai, “Constitutional Law of India”, 4th edition in 3 volumes
2. J.A. Siwach, “Dynamics of Indian Government & Politics”
3. M.V. Pylee, “Indian Constitution”, Durga Das Basu, Human Rights in ConstitutionalLaw, Prentice – Hall of India Pvt. Ltd.. New Delhi
3. J.C. Johri, Indian Government and Politics Hans
5. M.V. Pylee, “Indian Constitution)

E-RESOURCES:

1. nptel.ac.in/courses/109104074/8 2.
nptel.ac.in/courses/109104045/ 3.
nptel.ac.in/courses/101104065/ 4.
www.hss.iitb.ac.in/en/lecture-details
5. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

B.TECH Electrical and Electronics Engineering
Course Structure (RG22)

Semester-5 (Theory-5, Lab-2, SC -1, MC-1)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PCC	22A0218T	Electrical Measurement & Instrumentation	2	1	0	3
2	PCC	22A0435T	Digital Signal Processing	2	1	0	3
3	PCC	22A0222T	Electrical Power Transmission System	2	1	0	3
4	PEC	22A0223T 22A0221T 22A0220T	**Professional Elective-I**: 1. Power Electronics & Drives 2. Renewable Energy Sources 3. Programmable Logic Controller & Its Applications	3	0	0	3
5	OEC		**Open Elective-I** :	3	0	0	3
6	PCC (Lab)	22A0224P	Electrical Measurement & Instrumentation Lab	0	0	3	1.5
7	PCC (Lab)	22A0442P	Digital Signal Processing Lab	0	0	3	1.5
8	SC	22A0242P	**Skill Advaned Course:** Mat lab applications in electrical engineering Lab	1	0	2	2
9	MC	22A0031M	**Mandatory Course:** Intellectual Property Rights & Patents	2	0	0	0
Community Service 2 Months (Mandatory) after second year (to be evaluated during Semester - 5)				0	0	0	1.5
			Total credits				**21.5**

Open Elective Course – I

S.No	Course Code	Course Name	Offered by the Dept.
1	22A0149T	Building Materials	CE
2	22A0430T	Principles Of Communication Systems	ECE
3	22A0512T	Database Management Systems	CSE
4	22A0321Ta	Automobile Engineering	ME
5	22A0321Tb	Fundamentals Of Drone Technology	

Category	Credits
Professional Core Courses(PCC)	12
Professional Elective Courses(PEC)	3
Open Elective Courses (OEC)	3
Skil Advanced Course (SC)	2
Summer Internship	1.5
Total	**21.5**

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0218T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PCC

Course Objectives:

The objectives of the course are to make the students learn about:

- To study the principle of operation and working of different types of instruments for measurement of Electrical Quantities.
- To study the working principle of operation of different types of instruments for measurement of power and power factor.
- To understand the principle of operation and working of various types of bridges for measurement of parameters –resistance, inductance, capacitance and frequency.
- To understand the principle of operation and working of transducers.

Syllabus — **Total Hours: 48Hrs**

Unit-I	MEASURING INSTRUMETS	9Hrs

Classification – Ammeters and Voltmeters – PMMC, Dynamometer, Moving Iron Types – Expression for the Deflecting Torque and Control Torque – Errors and their Compensation, Extension of range – Numerical examples

Digital Voltmeters-Successive Approximation, Ramp, and Integrating Type.

Unit-II	MEASUREMENT OF POWER, POWER FACTOR AND ENERGY	10Hrs

Single Phase Dynamometer Wattmeter, LPF and UPF, Double Element and Three Elements, Expression for Deflecting and Control Torques; P.F. Meters: Dynamometer and Moving Iron Type – 1-ph and 3-ph Power factor Meters. Single Phase Induction Type Energy Meter – Driving and Braking Torques – Errors and their Compensation, Three Phase Energy Meter – Numerical examples

Unit -III	INSTRUMENT TRANSFORMERS, POTENTIOMETERS, AND MAGNETIC MEASUREMENTS	10Hrs

Current Transformers and Potential Transformers – Ratio and Phase Angle Errors – Methods for Reduction of Errors-Design Considerations.

DC Potentiometers: Principle and Operation of D.C. Crompton's Potentiometer –Standardization – Measurement of unknown Resistance, Currents and Voltages. A.C. Potentiometers: Polar and Coordinate types- Standardization

Determination of B-H Loop Methods of Reversals - Six Point magnetic measurement Method

Unit -IV	D.C & A.C BRIDGES	10Hrs

Method of Measuring Low, Medium and High Resistances – Sensitivity of Wheatstone's Bridge – Kelvin's Double Bridge for Measuring Low Resistance, Measurement of High Resistance – Loss of Charge Method.

Measurement of Inductance - Maxwell's Bridge, Anderson's Bridge.

Measurement of Capacitance and Loss Angle – DeSauty Bridge. Wien's Bridge – Schering Bridge – Numerical Examples

Unit -V	CRO AND SENSORS	9Hrs

Cathode Ray Oscilloscope- Cathode Ray Tube-Time Base Generator-Horizontal and Vertical Amplifiers – Applications of CRO – Measurement of Phase, Frequency, Current and Voltage-Lissajous Patterns.

Capacitive and Inductive displacement sensors, Electromagnetism in sensing, Flow, Level sensors, Position and Motion sensors, Pressure sensors and Temperature sensors

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Able to Understand the working of various instruments and equipments used for the measurement of various electrical engineering parameters like voltage, current, power, phase etc.
- Able to analyze the varieties of problems and issues coming up in the vast field of electrical measurements.

- Able to solve the varieties of problems and issues coming up in the vast field of electrical measurements.
- Analyse the different operation of extension range ammeters and voltmeters, DC bridge for measurement of parameters
- Analyse the different operation of extension range ammeters and voltmeters AC bridge for measurement of parameters
- Understand The Effectiveness Of Transducere

Textbooks:

1. Electrical Measurements and measuring Instruments by E.W. Golding and F.C.Widdis, fifth Edition, Wheeler Publishing.
2. Modern Electronic Instrumentation and Measurement Techniques by A.D. Helfrick and W.D. Cooper, PHI, 5th Edition, 2002.

A.K.Sawhney, "A course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Co.,201

Reference Books:

1. 1 Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co.Publications.
2. Electrical and Electronic Measurements and instrumentation by R.K.Rajput, S.Chand.
3. Electrical Measurements by Buckingham and Price, Prentice – Hall
4. Electrical Measurements by Forest K. Harris. John Wiley and Sons
5. Electrical Measurements: Fundamentals, Concepts, Applications by Reissland, M.U, New Age International (P) Limited, Publishers.

Electrical and Electronic Measurements by G.K.Banerjee, PHI Learning Private Ltd, New Delhi–2

DIGITAL SIGNAL PROCESSING

(Common to ECE and EEE)					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0435T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**PCC**

Course Objectives:

The objectives of the course are to make the students learn about:

- To describe discrete time signals and systems.
- To teach importance of FFT algorithm for computation of Discrete Fourier Transform.
- To expose various implementations of digital filter structures.
- To present FIR and IIR Filter design procedures.
- To outline need of Multi-rate Processing

Syllabus		**Total Hours: 48Hrs**
Unit-I	**INTRODUCTION TO DISCRETE TIME SIGNALS AND SYSTEMS**	**10Hrs**

Introduction to digital signal processing, review of discrete-time signals and systems, analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

Unit-II	**8086 PROGRAMM DISCRETE FOURIER TRANSFORM & FAST FOURIER TRANSFORM ING**	**9Hrs**

Discrete Fourier Transform - Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT.

Fast Fourier Transform - Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

Unit -III	**IIR FILTERS**	**10Hrs**

IIR Filters-Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods , Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realization.

Unit -IV	**FIR FILTERS**	**10Hrs**

FIR Filters-Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.

Unit -V	**MULTI RATE DIGITAL SIGNAL PROCESSING**	**9Hrs**

Multi rate Digital Signal Processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Frequency domain characterization of Interpolator and Decimator; Applications..

Course Outcomes(CO):

After the completion of the course students will able to:

- Understand the basic concepts of discrete time signals and systems.
- Formulate difference equations for the given discrete time systems
- Apply FFT algorithms for determining the DFT of a given signal
- Compare FIR and IIR filter structures
- Design digital filter (FIR & IIR) from the given specifications
- Understand the concept of multi rate DSP and applications of DSP

Textbooks:

- Digital Signal Processing, Principles, Algorithms, and Applications, John G. Proakis, Dimitris G. Manolakis, Pearson Education, 2007.
- Discrete Time Signal Processing, A.V.Oppenheim and R.W. Schaffer, PHI.

Reference Books:
• Digital Signal Processing – A practical approach, S.K.Mitra, 2nd Edition, Pearson Education, New Delhi, 2004. • Digital Signal Processing, Schaum's Outline series, MH Hayes, TATA Mc-Graw Hill, 2007. Fundamentals of Digital Signal Processing using Matlab, Robert J. Schilling, Sandra L. Harris, Thomson, 2007.
Web References:
https://www.youtube.com/watch?v=MS3qJq2jvu0

ELECTRICAL POWER TRANSMISSION SYSTEMS

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0222T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PCC

Course Objectives:

The objectives of the course are to make the students learn about:
Calculate the capacitance of Transmission lines, Learning the Mathematical Solutions to estimate regulation and efficiency of all types of lines. Learning the Types of insulators. Understand the Grading of Cables

Syllabus — **Total Hours: 48Hrs**

Unit-I	TRANSMISSION LINE PARAMETERS	10Hrs

Types of conductors - calculation of resistance for solid conductors - Calculation of inductance for single phase and three phase, single and double circuit lines, concept of GMR & GMD, symmetrical and asymmetrical conductor configuration with and without transposition. Calculation of capacitance for 2 wire and 3 wire systems, effect of ground on capacitance, capacitance calculations for symmetrical and asymmetrical single and three phase, single and double circuit lines.

Unit-II	MODELING OF TRANSMISSION LINES	10Hrs

Classification of Transmission Lines - Short, medium and long line and their model - representations - Nominal-T, Nominal-Pie and A, B, C, D Constants. Mathematical Solutions to estimate regulation and efficiency of all types of lines- Long Transmission Line-Rigorous Solution, evaluation of A,B,C,D Constants, Interpretation of the Long Line Equations – Representation of Long lines – Equivalent T and Equivalent – π, Numerical Problems. – Surge Impedance and surge Impedance loading - wavelengths and Velocity of propagation – Ferranti effect, Charging current.

Unit -III	PERFORMANCE OF TRANSMISSION LINES	8Hrs

Types of Insulators, String efficiency and Methods for improvement, Numerical Problems – Voltage Distribution, Calculation of string efficiency, Capacitance grading and Static shielding. Corona - Description of the phenomenon, factors affecting corona, critical voltages and power loss, Radio Interference. Sag and Tension Calculations with equal and unequal heights of towers, Effect of Wind and Ice on weight of Conductor, Numerical Problems - Stringing chart and sag template and its applications

Unit -IV	POWER SYSTEM TRANSIENTS	10Hrs

Types of System Transients - Travelling or Propagation of Surges - Attenuation, Distortion, Reflection and Refraction Coefficients - Termination of lines with different types of conditions - Open Circuited Line, Short Circuited Line, T-Junction.

Unit -V	UNDERGROUND CABLES	10Hrs

Types of Cables, Construction, Types of Insulating materials, Calculations of Insulation resistance and stress in insulation, Numerical Problems. Capacitance of Single and 3-Core belted cables, Numerical Problems. Grading of Cables - Capacitance grading, Numerical Problems, Description of Inter-sheath grading.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Understand the transmission line parameters.
- Model a given transmission line.
- Understand the design of transmission line and Insulators.
- Estimate the performance of a given transmission line.
- Analyze the effect of over voltage on transmission line.
- Analyze underground cables and cable performance.

Textbooks:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar, A.Chakrabarthy, Dhanpat Rai & Co Pvt. Ltd.
2. Electrical power systems - by C.L.Wadhwa, New Age International (P) Limited, Publishers,1998.

Reference Books:

1. Power system Analysis-by John J Grainger William D Stevenson, TMC Companies, 4th edition
2. Power System Analysis and Design by B.R.Gupta, Wheeler Publishing.
3. Power System Analysis by Hadi Saadat – TMH Edition..
4. Modern Power System Analysis by I.J.Nagaraj and D.P.Kothari, Tata McGraw Hill, 2nd Edition.
5. Transmission of Electric Power by S. Sivanagaraju.

Online Learning Resources:

- **https://onlinecourses.nptel.ac.in/noc21_ee13/preview**

PROGRAMMABLE LOGIC CONTROLLER & ITS APPLICATIONS

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0220T	3:0:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- PLC and its basics, architecture, connecting devices and programming
- Implementation of Ladder logic for various Industrial applications
- Designing of control circuits for various applications
- PLC logic and arithmetic operations.

Syllabus — **Total Hours: 48Hrs**

Unit-I	INTRODUCTION	10Hrs

PLC Basics: PLC System, I/O Modules and Interfacing, CPU Processor, Programming Equipment, Programming Formats, Construction of PLC Ladder Diagrams, Devices Connected To I/O Modules. PLC Programming: Input Instructions, Outputs, Operational Procedures, Programming Examples Using Contacts and Coils. Drill Press Operation.

Unit-II	LOGIC GATES AND IT'S APPLICATIONS	10Hrs

Digital Logic Gates, Programming in the Boolean Algebra System, ConversionExamples. Ladder Diagrams for Process Control: Ladder Diagrams & SequenceListings, Ladder Diagram Construction and Flowchart for Spray Process System

Unit -III	REGISTERS	9Hrs

PLC Registers: Characteristics of Registers, Module Addressing, Holding Registers,Input Registers, Output Registers. PLC Functions: Timer Functions & IndustrialApplications, Counter Function & Industrial Applications, Arithmetic Functions, NumberComparison Functions, Number Conversion Functions.

Unit -IV	DATA HANDLING FUNCTIONS	9Hrs

Data Handling Functions: SKIP, Master Control Relay, Jump, Move, FIFO, FAL, ONS,CLR & Sweep Functions and Their Applications. Bit Pattern and Changing a Bit ShiftRegister, Sequence Functions and Applications, Controlling of Two-Axis & Three AxisRobots With PLC, Matrix Functions.

Unit -V	ANALOG PLC	10Hrs

Analog PLC Operation, Types of PLC Analog Modules and Systems, PLC AnalogSignal Processing, BCD or Multibit data Processing, Analog output applicationexamples, PID Modules, PID Tuning, Typical PID Functions, PLC Installation,Troubleshooting and Maintenance.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Understand different types of Devices to which PLC input and output modules are connected
- Understand various types of PLC registers and create ladder diagrams from process control descriptions.
- Use different types PLC functions, Data Handling Function
- Develop a coil and contact control system to operate a basic robot and analog PLC operations
- Implementation of PLC in analogue operations, arithmetic, logic functions.
- Understand the PID module, installation procedure and maintenance

Textbooks:

3. Programmable Logic Controllers- Principles and Applications by John W. Webb & Ronald A. Reiss, Fifth Edition, ELSEVIER Ltd., 2009.

2. Programmable Logic Controllers 5th Edition, William Bolton, Newnes, ELSEVIER Ltd., 2009

Reference Books:
1. Programmable Logic Controllers: An Emphasis on design & application, Kelvin T. Erickson, Dogwood Valley Press,
Web References:
https://www.youtube.com/watch?v=MS3qJq2jvu0

RENEWABLE ENERGY SOURCES					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0221T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**PEC**

Course Objectives:

The objectives of the course are to make the students learn about:
It introduces solar energy its radiation, collection, storage and application. It also introduces the Wind energy, Biomass energy, Geothermal energy and ocean energy as alternative energy sources.

Syllabus		**Total Hours:48**
Unit-I	**PRINCIPLES OF SOLAR RADIATION**	**10Hrs**

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Unit-II	**SOLAR ENERGY COLLECTION AND APPLICATIONS**	**10Hrs**

Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.

Unit -III	**WIND AND BIO-MASS ENERGY**	**8Hrs**

Sources and potentials, horizontal and vertical axis windmills, performance characteristics Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, and economic aspects.

Unit -IV	**GEOTHERMAL AND OCEAN ENERGY**	**10Hrs**

Resources, types of wells, methods of harnessing the energy, potential in India Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants and their economics

Unit -V	**DIRECT ENERGY CONVERSION**	**10Hrs**

Direct Energy Conversion: Direct Energy Conversion (DEC), Need for DEC, Types of DEC - Fuel Cells, working of hydrogen fuel cell Magneto Hydro Dynamic Energy Conversion (MHD elementary treatment only), Working Principle, Advantages and Disadvantages

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
- Estimate the solar energy, Utilization of solar energy, Principles involved in solar energy collection and conversion of it to electricity generation
- Understand the concept of Wind and Biomass energy resources and their classification, types Plants- applications
- Acquire the knowledge on Geothermal energy and it's harnessing methods
- Illustrate ocean energy and explain the operational methods of their utilization
- Describe the concept of direct energy conversion and their types and working principle

Textbooks:

1. Non-Conventional Energy Sources by G.D. Rai, Khanna Publishers
2. Renewable Energy Resources – Twidell & Wier, CRC Press(Taylor & Francis)

Reference Books:

1. Renewable energy resources by Tiwari and Ghosal, Narosa.
2. Renewable Energy Technologies by Ramesh & Kumar, Narosa.
3. Non-Conventional Energy Systems by K Mittal, Wheeler
4. Renewable energy sources and emerging technologies by
D.P.Kothari,K.C.Singhal,
Online Learning Resources:
- **https://onlinecourses.nptel.ac.in/noc21_ee13/preview**

POWER ELECTRONICS AND DRIVES

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0223T	3:0:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

Student will be able to

- To understand the basic principles of all industrial drives .
- To understand the basic concepts of control of dc motors.
- To analyze Speed-torque characteristics .
- To understand the performance of induction motor.
- To understand the performance of synchronous motor.

Syllabus — **Total Hours: 48**

Unit-I	INTRODUCTION TO INDUSTRIAL DRIVES	10Hrs

Electrical Drives, Advantages of Electrical drives, Parts of Electrical Drives, Choice of electrical Drives, Fundamental torque equation, multi-quadrant operation, Components of load torques, Nature and classification of load torques, Braking of DC motor-Dynamic braking, plugging and regenerative braking

Unit-II	CONTROL OF DC MOTORS BY SINGLE PHASE CONVERTERS	10Hrs

Controlled Converter Fed DC Motor Drives 1-phase half and fully controlled converter fed separately and self-excited DC motor drive – Output voltage and current waveforms – Speed-torque expressions – Speed-torque characteristics — Principle of operation of dual converters and dual converter fed DC motor drives -Numerical problems.

Unit -III	CONTROL OF CHOPPER-FED DC MOTORS	8Hrs

Single quadrant, Two quadrant and four quadrant chopper fed dc separately excited and series excited motors, Continuous current operation, Output voltage and current wave forms, Speed torque expressions, Speed-torque characteristics, Problems on Chopper fed D.C Motors, Closed loop operation.

Unit -IV	CONTROL OF INDUCTION MOTOR	10Hrs

Closed loop operation of induction motor drives ,Static rotor resistance control-rotor resistance variation in slip ring Induction motor using a chopper, Slip power recovery scheme, Static Kramer Drive - performance and speed torque characteristics, Advantages, Doubly fed Induction Generator-Principle of operation -Applications, Numerical problems

Unit -V	CONTROL OF SYNCHRONOUS MOTORS	10Hrs

Separate control & self-control of synchronous motors, Operation of self-controlled synchronous motors by VSI & CSI, Load commutated CSI fed Synchronous Motor, Operation, Waveforms, Speed-torque characteristics, Applications, Advantages and Numerical Problems, Closed-loop control operation of synchronous motor drives, Variable frequency control, Cyclo-converter, PWM.

Course Outcomes(CO):

On completion of this course, student will be able to

- Analyze DC motor drive fed from phase controlled converters
- Understand DC motor drive fed from Chopper.
- Apply AC voltage Controller fed to Induction motor.
- Analyze Induction motor fed from VSI and CSI.
- Analyze Synchronous motor drive fed from VSI, CSI & Cycloconverter.

Textbooks:

1. G K Dubey, “Fundamentals of Electrical Drives”, Narosa Publications, 2nd Edition, 2008.
2. B K Bose, “Modern Power Electronics & AC Drives”, PHI learning, 1st Edition, 2010.

Reference Books:

1. Vedam Subramanyam, “Electric Drives— Concepts and Applications”, Tata Mc Graw Hill Publications, 4th Edition, 2011.
2. N.K De and P.K. Sen, “Electric Drives”, Prentice Hall of India Publications, 9th Edition, 2006.
3. MD Singh and KB Khanchandani, “Power Electronics”, Tata – McGraw-Hill Publishing company, 3rd Edition, 2008.

ELECTRICAL MEASUREMENTS & INSTRUMENTATION LAB

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0224P	0:0:3	1.5	CIE:30 & SEE:70	3 Hours	PCC

Course Objectives:

1. Calibration of various electrical measuring instruments
2. Accurate determination of inductance and capacitance using AC Bridges
3. Measurement of coefficient of coupling between two coupled coils
4. Measurement of resistance for different range of resistors using bridges

List of Experiments:

1. Calibration & Testing of single phase Energy meter with all accessories
2. Calibration of Dynamo meter type Power factor meter with all accessories
3. Crompton DC Potentio-meter Calibration of PMMC Ammeter & Voltmeter with all accessories
4. Kelvin‟s Double Bridge – Measurement of very low Resistance values –Determination of Tolerance.
5. Measurement of % Ratio Error and Phase Angle of Given C.T. by Comparison.
6. Schering Bridge & Anderson Bridge for measurement of Capacitance and Inductance values.
7. Measurement of 3 Phase Reactive Power with Single-Phase Wattmeter.
8. Measurement of Parameters of a Choke Coil Using 3 Voltmeter and 3 Ammeter Methods.
9. Calibration of LPF Wattmeter – by Phantom Testing
10. Measurement of 3 Phase Power with Two Watt Meter Method (Balanced & Unbalanced).
11. Dielectric Oil Testing

Additional Experiments

1. LVDT and Capacitance Pickup – Characteristics and Calibration
2. Resistance Strain Gauge – Strain Measurement and Calibration.

Course Outcomes (CO):

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

- Calibrate various electrical measuring instruments
- Accurately determine the values of inductance and capacitance using AC bridges
- Compute the coefficient of coupling between two coupled coils
- Accurately determine the values of very low resistances

Online Learning Resources/Virtual Labs:

https://www.vlab.co.in/broad-area-electrical-engineering

Reference Book(s):

https://link.springer.com/book/10.1007/978-3-319-31102-9

DIGITAL SIGNAL PROCESSING LAB
(Common to ECE and EEE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0442P	0:0:3	1.5	CIE:30 & SEE:70	3 Hours	PCC

Course Objectives:

- Formulate problems and implement algorithms using Assembly language.
- Develop programs for different applications.
- Interface peripheral devices with 8086 and 8051.
- Use Assembly/Embedded C programming approach for solving real world problems

List of Experiments: (Conduct all experiments).

Note: Any TWELVE of the experiments are to be conducted.

1. Generate the following standard discrete time signals.
   i)Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Saw tooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
10. Design FIR filter (Low Pass Filter /High Pass Filter) using different window techniques (rectangular, hamming and Kaiser)
11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.
14. Compute the correlation coefficient for the two given audio signals of same length using a digital signal processor.

Course Outcomes (CO):

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

- Implement various DSP Algorithms using MATLAB.
- Implement DSP algorithms with Digital Signal Processor.
- Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR-Butterworth filters.
- Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital IIR- Chebyshev filters.
- Analyze and observe magnitude and phase characteristics (Frequency response Characteristics) of digital FIR filters using window techniques.
- Analyze and implement various digital filters.

Reference Book(s):

- Stephen J. Chapman, "MATLAB Programming for Engineers", Cengage, November 2012

- **Online Learning Resources/Virtual Labs:**
- https://www.vlab.co.in

MATLAB APPLICATIONS IN ELECTRICAL ENGINEERING LAB

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0242P	1:0:2	2	CIE:30 & SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

1. Understand the basic concepts of Electrical Engineering.
2. Analyze various Electrical engineering applications through MATLAB/PSPICE.
3. Develop real time models using MATLAB/PSPICE.

List of Experiments:

1. Transient analysis of given electrical network
2. Simulation of 1-phase and 3-phase transformers
3. Study of the dynamics of second **order system**
4. Implementation of buck and boost dc-dc converters
5. Study on the design of PI controllers and stability analysis for a DC-DC buck Converter
6. Sine-PWM techniques for single-phase half-bridge, full-bridge and three-phase inverters
7. Economic Load Dispatch of (i) Thermal Units and (ii) Thermal Plants using Conventional method
8. Transient Stability Analysis of Power Systems using Equal Area Criterion (EAC)
9. Reactive Power Control in a transmission system (Ferranti effect, Effect of shunt Inductor)
10. Fault studies using Zbus matrix
11. Design of virtual PMU
12. Wide area control of Two area **Kundur system**

(Any 10 experiments from the above list)

Course Outcomes (CO):

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

- Understand the basic concepts of Electrical Engineering.
- Apply the concepts to design MATLAB models.
- Analyze various Electrical engineering applications through MATLAB.

Online Learning Resources/Virtual Labs:

1. http://vem-iitg.vlabs.ac.in/
2. https://vp-dei.vlabs.ac.in/Dreamweaver/

INTELLECTUAL PROPERTY RIGHTS & PATENTS					
Course Code	**L:T:P:C**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0031M	**2:0:0:0**	**0**	**CIE:30 & SEE:70**	**3 Hours**	**MC**

Course Objectives:

Student will be able to

- This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws, Cyber Laws, Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations

Syllabus		**Total Hours: 32**
Unit-I	**INTRODUCTION TO INTELLECTUAL PROPERTY**	**6Hrs**

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

Unit-II	**COPYRIGHT FORMALITIES AND REGISTRATION**	**8Hrs**

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law-Semiconductor Chip Protection Act.

Unit -III	**PATENTS**	**6Hrs**

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters

Unit -IV	**TRADE MARK AND REGISTRATION**	**6Hrs**

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

Unit -V	**TRADE SECRETS AND AGREEMENTS**	**6Hrs**

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

Course Outcomes(CO):

Understand IPR law & Cyber law

1. Discuss registration process, maintenance and litigations associated with trademarks
2. Illustrate the copy right law
3. Enumerate the trade secret law..

Textbooks:

1. Deborah E.Bouchoux: "Intellectual Property". Cengage learning, New Delhi
2. Kompal Bansal &Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western's Special Topics Collections

Reference Books:

1.Prabhuddha Ganguli: ' Intellectual Property Rights" Tata Mc-Graw – Hill, New Delhi
2. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
3. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
4. M. Ashok Kumar and Mohd. Iqbal Ali: "Intellectual Property Right" Serials Pub.

B.TECH Electrical and Electronics Engineering
Course Structure (RG22)

Semester-6 (Theory-5, Lab-3, SC -1, MC-1)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	HSC	22A0022T	Managerial Economics and Financial Analysis	3	0	0	3
2	PCC	22A0225T	Power System Analysis	2	1	0	3
3	PCC	22A0427T	Digital Computing Platforms	2	1	0	3
4	PEC	22A0228T 22A0229T 22A0226T	**Professional Elective-II**: 1 Fundamentals of HVDC & FACTS 2. Power Quality 3. Neutral Networks & Fuzzy Logic	2	1	0	3
5	OEC		**Open Elective-II** :	3	0	0	3
6	PCC (Lab)	22A0230P	Power System & Simulation Lab	0	0	3	1.5
7	PCC (Lab)	22A0428P	Digital Computing Platforms Lab	0	0	3	1.5
8	PCC (Lab)	22A0231P	Soft skills	0	0	3	1.5
8	SC	22A0511P	**Skill Advanced Course:** HTML and JAVA Script	1	0	2	2
9	MC	22A0031T	**Mandatory Course:** Design Thinking and Innovation	2	0	0	0
Total credits							**21.5**
Industrial/ Research Internship (Mandatory) 2months during summer vacation							

Open Elective Course – II

S.No	Course Code	Course Name	Offered by the Dept.
1	22A0150T	Environmental Economics	CE
2	22A0431T	Microcontrollers & Applications	ECE
3	22A0528T	Machine Learning	CSE
4	22A0327Ta	Introduction to Composites	ME
5	22A0327Tc	Introduction to Robotics (For other Departments)	

Category	Credits
Professional Core Courses(PCC)	10.5
Humanities and Social Science Course (HSC)	3
Professional Elective Courses(PEC)	3
Open Elective Courses (OEC)	3
Skill Oriented Course (SC)	2
Total	**21.5**

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0022T	**3:0:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**HSC**

Course Objectives:

The objectives of the course are to make the students learn about:

- To understand the concepts of managerial economics and financial analysis this helps in optimal decision making in business environment.
- To have a thorough knowledge on the production theories and cost while dealing with the production and factors of production.
- To have a thorough knowledge regarding market structure and forms of business organizations in the market.
- To understand the concept of capital and capital budgeting in selecting the proposals.
- To have a thorough knowledge on recording, classifying and summarizing of transactions in preparing of final accounts.

Syllabus		**Total Hours: 48**
Unit-I	**INTRODUCTION TO MANAGERIAL ECONOMICS &DEMAND**	**9Hrs**

Managerial Economics – Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand - Demand Forecasting - Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management

Unit-II	**THEORY OF PRODUCTION AND COST ANALYSIS**	**9Hrs**

Production Function – Least-cost combination - Short-run and Long-run Production Function - Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale - Cost concepts and Cost behavior - Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems) - Managerial significance and limitations of Break-Even Analysis.

Unit -III	**INTRODUCTION TO MARKETS ANDFORMS OF BUSINESS ORGANIZTIONS**	**10Hrs**

Market structures - Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly - Monopolistic Competition – Oligopoly - Price-Output Determination - Pricing Methods and Strategies - Forms of Business Organizations - Sole Proprietorship - Partnership - Joint Stock Companies - Public Sector Enterprises-.

Unit -IV	**CAPITAL AND CAPITAL BUDGETING**	**10Hrs**

Concept of Capital - Significance - Types of Capital - Components of Working Capital Sources of Short-term and Long-term Capital - Estimating Working capital requirements – Capital Budgeting – Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Unit -V	**INTRODUCTION TO FINANCIAL ACCOUNTING AND ANALYSIS**	**10Hrs**

Accounting Concepts and Conventions - Introduction Double-Entry Book Keeping, Journal, Ledger, and Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Outline the Managerial Economic concepts for decision making and forward planning. Also know law of demand and its exceptions, to use different forecasting methods for predicting demand for various products and services. (L2)
- Assess the functional relationship between Production and factors of production and list out various costs associated with production and able to compute breakeven point to illustrate the various uses of breakeven analysis. (L5)
- Outline the different types of business organizations and provide a framework for analyzing money in its functions as a medium of exchange. (L2)
- Interpret various techniques for assessing the proposals of project for financial position of the business. (L2)
- Identify the principles of accounting to record, classify and summarize various transactions in books of accounts for preparation of final accounts. (L3)

Textbooks:

1. Managerial Economics, PL Mehata, Sulthan Chand Publications

Reference Books:

1. Ahuja Hl "Managerial economics" 3 rd edition, Schand, ,2013
2. S.A. Siddiqui and A.S. Siddiqui: "Managerial Economics and Financial Analysis", New Age International,. 2013.
3. Joseph G. Nellis and David Parker: "Principles of Business Economics", 2nd edition, Pearson, New Delhi.
4. Domnick Salvatore: "Managerial Economics in a Global Economy", Cengage, 2013.
5. Managerial Economics, Varshney &Maheswari, Sultan Chand, 2013.
6. Managerial Economics and Financial Analysis, Aryasri, 4th edition, MGH, 2019

POWER SYSTEM ANALYSIS					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0225T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**PCC**

Course Objectives:

The objectives of the course are to make the students learn about:

The use of per unit values and graph theory concepts, solving a problem using computer.

- Formation of Ybus and Zbus of a Power System network, power flow studies by various methods.
- Different types of faults and power system analysis for symmetrical and also unsymmetrical faults.
- Analysis of power system for steady state and transient stability and also methods to improve stability

Syllabus		**Total Hours:48**
Unit-I	**PER-UNIT SYSTEM AND Ybus FORMATION**	**10Hrs**

Per-Unit representation of Power system elements - Per-Unit equivalent reactance network of a three phase Power System - Graph Theory: Definitions, Bus Incidence Matrix, YBus formation by Direct and Singular Transformation Methods, Numerical Problems..

Unit-II	**FORMATION OF Zbus**	**10Hrs**

Formation of ZBus: Partial network, Algorithm for the Modification of ZBus Matrix for addition element for the following cases: Addition of element from a new bus to reference, Addition of element from a new bus to an old bus, Addition of element between an old bus to reference and Addition of element between two old busses - Modification of Z Bus for the changes in network

Unit -III	**POWER FLOW ANALYSIS**	**8Hrs**

Static load flow equations – Load flow solutions using Gauss Seidel Method: Algorithm and Flowchart. Acceleration Factor, Load flow Solution for Simple Power Systems (Max. 3-Buses): Newton Raphson Method in Polar Co-Ordinates Form: Load Flow Solution- Jacobian Elements, Algorithm and Flowchart. Decoupled and Fast Decoupled Methods.- Comparison of Different Methods

Unit -IV	**SHORT CIRCUIT ANALYSIS**	**10Hrs**

Short Circuit Current and MVA Calculations, Fault levels, Application of Series Reactors. Symmetrical Component Theory: Positive, Negative and Zero sequence components, Positive, Negative and Zero sequence Networks. Symmetrical Fault Analysis: LLLG faults with and without fault impedance, Unsymmetrical Fault Analysis: LG, LL and LLG faults with and without fault impedance, Numerical Problems.

Unit -V	**STABILITY ANALYSIS**	**10Hrs**

Elementary concepts of Steady State, Dynamic and Transient Stabilities. Derivation of Swing Equation, Power Angle Curve and Determination of Steady State Stability. Determination of Transient Stability by Equal Area Criterion, Application of Equal Area Criterion, Critical Clearing Angle Calculation. Numerical methods for solution of swing equation

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Develop Ybus , Zbus matrices for the power system networks
- Perform the load flow analysis of power system networks using Gauss-Seidel, Newton-Raphson methods.
- Analyze symmetrical and unsymmetrical faults in power system networks.
- Estimate the Transient and steady state Stability for single machine infinite system.
- Apply mathematical techniques/methods to solve economic load dispatch problems.
- Model and analyze the single and two area Load frequency control

systems for the control of frequency.

Textbooks:

1. I. J. Nagrath & D. P. Kothari Modern Power System Analysis, 4th Edition, Tata McGraw-Hill Publishing Company, 2011.
2. Dr. K.Uma Rao, Computer Techniques and Models in Power Systems, 2nd Revised Edition, I.K.International, 2014.
3. Dr. K.Uma Rao, Power System - Operation and Control, Wiley India Pvt. Ltd., 2012.

Reference Books:

1. Glenn W.Stagg, Ahmed H. El-Abiad, Computer Methods in Power System Analysis, McGraw-Hill Publishing Company
2. Olle. I. Elgerd, Electric Energy Systems Theory – An Introduction, 30th Reprint, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2007.
3. C.L.Wadhwa, Electrical Power Systems,7th Edition, New Age International (P) Limited Publishers, 2016. Electrical & Electronics Engineering150
4. John J.Grainer & W.D.Stevenson Power System Analysis, 1st Edition, McGraw Hill Education; July 2017.
5. Hadi Saadat, Power System Analysis, 3rd Edition TMH, 2011.

Online Learning Resources:

- **https://onlinecourses.nptel.ac.in/noc21_ee13/preview**

DIGITAL COMPUTING PLATFORMS					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0427T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**PCC**

Course Objectives:

The objectives of the course are to make the students learn about:

- Architecture and designing of 8086 Microprocessor with Assembling language programming and interfacing with various modules
- Understand the Interfacing of 8086 with various advanced communication devices
- Designing of 8051 Microcontroller with Assembling language programming and interfacing with various modules
- To know about Assembly Language Programs for the Digital Signal Processors and usage of Interrupts
- To understand Xilinx programming and understanding of Spartan FPGA board

Syllabus		**Total Hours: 48**
Unit-I	**INTRODUCTION TO MICROPROCESSORS**	**10Hrs**

Historical background- Evolution of microprocessors up to 64-bit. Architecture of 8086 microprocessor, special function of general-purpose registers. 8086 flag registers and functions of 8086 flags – Addressing modes of 8086 – Instruction set of 8086 – Assembler directives - Pin diagram 8086 – Minimum mode and maximum mode of operation - Timing diagrams - CISC and ARM Processors

Unit-II	**ASSEMBLY LANGUAGE PROGRAMMING & I/O INTERFACE**	**10Hrs**

Assembler directives – macros – simple programs involving logical – branch instructions – sorting – evaluating arithmetic expressions - string manipulations – 8255 PPI - various modes of operation - A/D - D/A converter interfacing, Memory interfacing to 8086 – interrupt structure of 8086 – vector interrupt table – interrupt service routine – interfacing interrupt controller 8259 - Need of DMA – serial communication standards – serial data transfer schemes

Unit -III	**8051 MICRO CONTROLLER PROGRAMMING AND APPLICATIONS**	**8Hrs**

Introduction to micro controllers, Functional block diagram, Instruction sets and addressing modes, interrupt structure – Timer – I/O ports – serial communication. Data transfer, manipulation, Control and I/O instructions – simple programming exercises key board and display interface – Closed loop control of servo motor – stepper motor control

Unit -IV	**INTRODUCTION TO TMS320LF2407 DSP CONTROLLER**	**10Hrs**

Basic architectural features - Physical Memory - Software Tools. Introduction to Interrupts - Interrupt Hierarchy - Interrupt Control Registers. C2xx DSP CPU and Instruction Set: Introduction & code Generation - Components of the C2xx DSP core - Mapping External Devices to the C2xx core - peripheral interface - system configuration registers - Memory - Memory Addressing Modes - Assembly Programming Using the C2xx DSP Instruction set.

Unit -V	**FIELD PROGRAMMABLE GATE ARRAYS (FPGA)**	**10Hrs**

Introduction to Field Programmable Gate Arrays – CPLD Vs FPGA – Types of FPGA – Xilinx, XC3000 series - Configurable logic Blocks (CLB) – Input / Output Block (IOB) – Programmable Interconnect Point (PIP) – Xilinx 4000 series – HDL programming –overview of Spartan 3E and Virtex II pro FPGA boards- case study.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Understand the basic architecture & pin diagram of 8086 microprocessor
- Understand the basic architecture of 8051 Microcontroller, DSP Processor and FPGA Processors
- Apply the concepts to design Assembly language programming to perform a given task, Interrupt service routines for all interrupt types
- Design Real time applications by writing Assembly Language Programs for the Digital Signal Processors.
- Design Real time applications by Xilinx programming for Spartan FPGA boards and use Interrupts for real-time control applications
- Analyze various real time systems by using various controllers

Textbooks:

1. . Ramesh S. Gaonkar, DI Architecture Programming and Applications with8085, Penram Intl. Publishing, 6th Edition, 2013 .

2. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw- Hill Publications, 3rd Edition, 2013..

Reference Books:

• Microprocessor and Interfacing by Douglas V Hall, 2nd Edition, Tata McGraw hill, 1992
• Application Notes from the webpage of Texas Instruments.
• XC 3000 series datasheets (version 3.1). Xilinx Inc., USA, 1998
• XC 4000 series datasheets (version 1.6). Xilinx Inc., USA, 1999
• Wayne Wolf, FPGA based system design, Prentice hall, 2004.

Online Learning Resources:

1. https://nptel.ac.in/courses/106108100
2. https://nptel.ac.in/courses/108105102
3. https://nptel.ac.in/courses/117108040

FUNDAMENTALS OF HVDC & FACTS SYSTEM					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0228T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**PEC**

Course Objectives:

Student will be able to

- Understand To get through knowledge on Basics of HVDC system.
- Understand the concepts of converters control schemes
- Get an idea on Harmonics and filters
- Understand reactive power control and power flow analysis in HVDC system
- Understand basic concepts of FACTS, necessity of FACTS controllers and their operation.
- Understand shunt and series compensation through various static compensators.

Syllabus		**Total Hours: 48**
Unit-I	**INTRODUCTION**	**10 Hrs**

Comparison of AC and DC transmission systems, application of DC transmission, types of DC links, typical layout of a HVDC converter station, HVDC converts, pulse number, analysis of Gratez circuit with and without overlap, converter bridge characteristics, equivalent circuits or rectifier and inverter configurations of twelve pulse converters

Unit-II	**CONVERTER & HVDC SYSTEM CONTROL**	**10 Hrs**

Principal of DC link control –Converters control characteristics- system control hierarchy, firing angle control, current and excitation angle control, starting and stopping of DC link.

Unit –III	**HARMONICS, FILTERS AND REACTIVE POWER CONTROL**	**8 Hrs**

Introduction, generation of Harmonics, AC and DC Filters. Reactive power requirements in steady state, sources of reactive power, static VAR systems.

POWER FLOW ANALYSIS IN AC/DC SYSTEMS: Modeling of DC/AC converts, controller equations solutions of AC/DC load flow- simultaneous method, sequential method.

Unit -IV	**INTRODUCTION TO FACTS**	**10 Hrs**

Flow of power in AC parallel pathsand meshed systems, basic types of FACTS controllers, brief description and definitions of FACTS controllers. STATIC SHUNT COMPENSATION: Objectives of shunt compensation, methods of controllable VAR generation, static VAR compensators, SVC and STATCOM, comparison between SVC and STATCOM.

Learning Outcomes:

At the end of this unit, the student will be able

1. Describe the switching technique facts controllers
2. Explain the principle of different VAR compensators

Unit –V	**STATIC SERIES COMPENSATORS**	**10 Hrs**

Objectives of series compensation, variable impedance type- thyristor switched series capacitors (TCSC), and switching converter type series compensators, static series synchronous compensator (SSSC)- power angle characteristics-basic operating control schemes. COMBINED COMPENSATORS: Introduction, unified power flow controller (UPFC),basic operating principle, independent real and reactive power flow controller, control structure.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the concept of AC and DC Transmission Systems and an overview of HVDC Converters
- Apply converters for HVDC transmission and also about control of converters
- Understand the concept of filters to mitigate harmonics, concept of reactive power requirements.
- Understand the concept of power flow in AC /DC Transmission systems
- Understand the concept of FACTS and operation of shunt FACTS controllers

Analyze the operation of series FACTS controllers and concept of series-shunt type FACTS controller

Textbooks:

1HVDC Power Transmission Systems: Technology and System Interactions, K.R.Padiyar, New Age International (P) Limited.

2. Understanding FACTS, Concepts and Technology of Flexible AC Transmission Systems, Narain. G. Hingorani, Laszlo Gyugyi, IEEE Press, Wiley India.

Reference Books:

1. HVDC and Facts Controllers Applications of static converters in power systems, Vijay K.Sood, Kluwer Academic Publishers.
2. HVDC Transmission, S.Kamakshaiah, V.Kamaraju, The Mc- Graw Hill Companies .
3. Thyristor- Based Controllers for Electrical Transmission Systems, R.Mohan Mathur, Rajiv K.Varma.Wiley India.
4. Facts controllers in power transmission and distribution, K.R.Padiyar, New Age International (P) Limited.

Web References:

Lecture Series on Power Electronics by Prof. B.G. Fernandes, Department of Electrical Engineering, IIT Bombay. https://nptel.ac.in/courses/108/101/108101038/

POWER QUALITY					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0229T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**PEC**

Course Objectives:

Student will be able to

- To learn about voltage disturbances and power transients that is occurring in power systems.
- To know about voltage sag and transient over voltages for quality of power supply
- To understand about harmonics and their mitigation
- To study about different power quality measuring and monitoring concepts.
- To know about long duration voltage variations.

Syllabus		**Total Hours: 48**
Unit-I	**POWER QUALITY ISSUES**	**10Hrs**

Power quality, voltage quality,The power quality Evaluation procedure, Terms and Definitions, Transients, Long-duration voltage variations, short-duration voltage variations, voltage imbalance, wave form distortion, voltage fluctuation, power frequency variations, power quality terms CBEMA and ITI curves.

Unit-II	**VOLTAGE SAGS AND TRANSIENT OVER VOLTAGES**	**9Hrs**

Sources of sags and interruptions, Estimating voltage sag performance, fundamental principles of protection, solutions at the end-use level, Motor-starting sags and utility system fault-clearing issues, sources of over voltages, principles of over voltage protection, devices for over voltage protection, utility capacitor-switching transients, utility system lightning protection.

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Unit –III	**FUNDAMENTALS OF HARMONICS**	**10Hrs**

Harmonic sources from commercial and industrial loads, locating harmonic sources, Power system response characteristics, Harmonics Vs transients, Effect of harmonics, harmonic distortion, voltage and current distortion, harmonic indices, inter harmonics, resonance, harmonic distortion evaluation, devices for controlling harmonic distortion, passive and active filters, IEEE and IEC Standards.

Unit -IV	**LONG-DURATION VOLTAGE VARIATIONS**	**10Hrs**

Principles of regulating the voltage, Devices for voltage regulation, utility voltage regulator Application, capacitors for voltage regulation, End user capacitor applications, flicker.

Unit –V	**POWER QUALITY BENCH MARKING AND MONITORING**	**9Hrs**

Benchmarking process, RMS Voltage variation Indices, Harmonic indices Power Quality Contracts, Monitoring considerations, power quality measurement equipment, Power quality Monitoring standards.

Course Outcomes(CO):

On completion of this course, student will be able to

- Know the severity of power quality problems in distribution system.
- Analyze voltage disturbances and power transients that are occurring in power systems.
- Understand the concept of voltage sag transformation from up-stream (higher voltages)
- Understand the concept of harmonics in the system and their effect on different power system equipment.
- Understand the principles of regulation of long duration voltage variations
- To get knowledge about different power quality measuring and monitoring concepts.
- Compute the concept of improving the power quality to sensitive load by various mitigating custom power devices

Textbooks:

1. Roger C. Dugan, Mark F.Mc Granaghan, Surya Santoso, H.Wayne Beaty, “Electrical Power Systems Quality” 2 nd Edition, TMH Education Pvt. Ltd, 2012 2. C. Sankaran, “Power quality”, CRC Press, 2017
Reference Books:
1. J. Arrillaga, N.R. Watson, S. Chen, “Electrical systems quality Assessment”, John Wiley & Sons, 2000. 2. Math H. J. Bollen, “Understanding Power quality problems”, Wiley-IEEE Press, 2000
Online Learning Resources:
https://archive.nptel.ac.in/courses/108/102/108102179/ https://www.youtube.com/watch?v=19eIVIVBrfE&t=1s

NEURAL NETWORKS AND FUZZY LOGIC

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0226T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- This course introduces the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks.
- It deals with Associate Memories and introduces Fuzzy sets and Fuzzy Logic system components.
- The Neural Network and Fuzzy Network system application to Electrical Engineering is also presented. This subject is very important and useful for doing Project Work.
- The main objective of this course is to provide the student with the basic understanding of neural networks and fuzzy logic fundamentals.

Syllabus — **Total Hours: 48Hrs**

Unit-I	INTRODUCTION TO NEURAL NETWORKS	10Hrs

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Unit-II	ESSENTIALS OF ARTIFICIAL NEURAL NETWORKS	8Hrs

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application

Unit -III	SINGLE LAYER AND MULTI LAYER FEED FORWARD NEURAL NETWORKS	10Hrs

Introduction, Perceptron Models, Training Algorithm, Limitations of the Perceptron Model, Applications, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm.

Unit -IV	CLASSICAL & FUZZY SETS	10Hrs

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

Unit -V	FUZZY LOGIC SYSTEM COMPONENTS	10Hrs

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Knowledge and understanding: Understanding principles of neural networks and fuzzy Logic fundamentals.
- Design the required and related systems
- After going through this course student will get thorough knowledge in biological neuron and artificial neurons.
- Students will be able to compare analysis between human and computer, Artificial Neural Networks models, characteristics of ANN's learning strategies, learning rules and basics of fuzzy logic.
- Students will be able to understand concept of classical and fuzzy sets
- Students will be able to understand fuzzification and defuzzification, with which they can be able to apply the conceptual things to the real world electrical and electronics problems and applications.

Textbooks:

1.Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.

2. Introduction to Neural Networks using MATLAB 6.0 - S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH, 2006

ReferenceBooks:

1.Neural Networks – James A Freeman and Davis Skapura, Pearson Education, 2002.
2. Neural Networks – Simon Hakins , Pearson Education
3. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
4. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.

POWER SYSTEMS & SIMULATION LABORATORY					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0230P	**0:0:3**	**1.5**	**CIE:30 & SEE:70**	**3 Hours**	**PCC**

Course Objectives:

Student will be able to

1. Experimental determination (in machines lab) of sequence impedance and sub trasient reactance's of synchronous machine
2. Conducting experiments to analyze LG, LL, LLG, LLLG faults
3. The equivalent circuit of three winding transformer by conducting a suitable experiment.
4. Developing MATLAB program for formation of Y and Z buses.
5. Developing MATLAB programs for gauss-seidel and fast decoupled load flow studies.
6. Developing the SIMULINK model for single area load frequency control problem.

List of Experiments:

1. Determination of Sequence Impedances of Cylindrical Rotor Synchronous Machine.
2. Fault Analysis – I
   - LG Fault
   - LL Fault
3. Fault Analysis – II
   - LLG Fault
   - LLLG Fault
4. Determination of Sub transient reactances of salient pole synchronous machine.
5. Equivalent circuit of three winding transformer
6. Develop a Simulink model for a single area load frequency control problem
7. Y bus formation using MATLAB
8. Z bus formation using MATLAB
9. Gauss-Seidel load flow analysis using MATLAB
10. Fast decoupled load flow analysis using MATLAB

Course Outcomes:

At the end of the course, students should be able to

1. Experimental determination (in machines lab) of sequence impedance and sub transient reactance of synchronous machine
2. Conducting experiments to analyze LG, LL, LLG, LLLG faults
3. The equivalent circuit of three winding transformer by conducting a suitable experiment.
4. Developing MATLAB program for formation of Y and Z buses.
5. Developing MATLAB programs for gauss-seidel and fast decoupled load flow studies.
6. Developing the SIMULINK model for single area load frequency control problem.

Text Book(s):

1. Power Systems Analysis, Grainger and Stevenson, Tata Mc Graw-hill, 2005.
2. Modern Power system Analysis 2 nd edition, I.J.Nagrath&D.P.Kothari: Tata McGraw-Hill Publishing Company, 2003.

Reference Book(s):

1. Computer Techniques in Power System Analysis 2nd Edition,, M A Pai, TMH, 2005.
2. Computer Techniques and Models in Power Systems, K. Uma Rao, I. K. International, 2007.
3. Electric Power Systems 1st Edition, S. A. Nasar, Schaum's Outline Series, TMH, 1997.
4. Computer Methods in Power System Analysis, E. I. Stagg and El-Abiad, Tata Mc Graw Hill, 1969

DIGITAL COMPUTING PLATFORMS LAB					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0428P	**0:0:3**	**1.5**	**CIE:30 & SEE:70**	**3 Hours**	**PCC**

Course Objectives:

Student will be able to

- Write Assembly language programming on 8086 Microprocessors
- To Interface various devices with 8086
- To develop MASAM Programming
- For Interfacing of 8051 Microcontroller with its peripheral devices.

List of Experiments:

1. Programs for 16-bit arithmetic operations for 8086 (using various addressing modes)
2. Program for sorting an array for 8086
3. Program for searching for a number or character in a string for 8086
4. Program for String manipulations for 8086
5. Interfacing ADC and DAC to 8086.
6. Parallel communication between two microprocessors using 8255.
7. Serial communication between two microprocessor kits using 8251.
8. Interfacing to 8086 and programming to control stepper motor.
9. Programming using arithmetic, logical and bit manipulation instructions of 8051
10. Program and verify Timer/Counter in 8051.
11. Program and verify interrupt handling in 8051.
12. UART operation in 8051.
13. Communication between 8051 kit and PC.
14. Interfacing LCD to 8051.
15. Interfacing matrix or keyboard to 8051

Course Outcomes:

At the end of the course, students should be able to

- Understand the basic concepts to write assembly language programming on 8086 Microprocessors.
- Understand various device configurations with 8086.
- Design Interfacing of various devices with 8086.
- Understand the basic concepts to write programming on 8051 Microcontroller.
- Analyze Assembly programming of 8051 micro controller.
- Design various Interfacing circuitry with 8051 Microcontroller with its peripheral devices.

Text Book(s):

1. Power Systems Analysis, Grainger and Stevenson, Tata Mc Graw-hill, 2005.
2. Modern Power system Analysis 2 nd edition, I.J.Nagrath&D.P.Kothari: Tata McGraw-Hill Publishing Company, 2003.

Reference Book(s):

1. Ray A. K., Bhurchandi K. M., Advanced Microprocessor and Peripherals, Tata McGraw-Hill Publications, 3rd Edition, 2013.
2. Microprocessor and Interfacing by Douglas V Hall, 2nd Edition, Tata McGraw hill, 1992
3. Microprocessors and Microcontrollers Lab Manual: 8086 & 8051 by Srinivasa Murthy, Kindle Edition.

SOFT SKILLS

Course Code	L:T:P:S	Credits	Exam marks	Exam Duration	Course Type
22A0231P	0:0:3:0	1.5	CIE:30 & SEE:70	3Hours	PCC

Course Objectives:

- To encourage all round development of the students by focusing on soft skills.
- To make the students aware of critical thinking and problem-solving skills.
- To develop leadership skills and organizational skills through group activities.
- To function effectively with heterogeneous teams.

Syllabus

Unit-I	Soft Skills & Communication Skills	10Hrs

Introduction, meaning, significance of soft skills –Vital Components of communication skills - Inter-personal skills - Verbal and Non-verbal Communication.

Activities: Narration about self- strengths and weaknesses- clarity of thought - Interpersonal Skills- Group Discussion – Debate – Mutual Understanding - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic. Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- Negotiation skills –Role Play- Non-verbal communication – Public speaking – Mock interviews – Anchoring Skills.

Unit-II	Critical Thinking	10Hrs

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking.

Activities: Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis.

Unit-III	Problem Solving & Decision Making	9 Hrs

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions.

Unit-IV	Emotional Intelligence & Stress Management	9 Hrs

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Pachayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO,ZillaParishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Unit-V	Leadership Skills	10Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk Taking - Team Building - Time Management.

Activities: Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

Course Outcomes (CO):

On completion of this course, student will be able to

- Memorize various elements of effective communicative skills.
- Interpret people at the emotional level through emotional intelligence.
- Apply critical thinking skills in problem solving.
- Analyze the needs of an organization for team building.
- Judge the situation and take necessary decisions as a leader.
- Develop social and work-life skills as well as personal and emotional well-being

Text books:

1. Personality Development and Soft Skills (English, Paperback, MitraBarunK.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)

2. Personality Development and Soft Skills: Preparing for Tomorrow,
Dr Shikha Kapoor Publisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press .
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India.

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

HTML AND JAVASCRIPT (SKILL)
(Common to CSE, AIML, CS, DS and EEE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0511P	1:0:2	2	CIE:30 & SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- Learn website development using HTML, CSS, and JavaScript.
- Understand the concepts of responsive web development using the bootstrap framework
- Learn the frame concepts to the websites and interactive websites.
- Discover how development process to use Google Charts to provide a better way to visualize data on a website
- Learn Content Management Systems to speed the development process

List of Experiments:

1: HTML: What is a browser, Internet concepts, Introduction to HTML, Basic structure of HTML document, Creating an HTML document, Mark up Tags, Heading-Paragraphs, and Line Breaks HTML Tags.

Task: Design HTML page to display different heading tags and scroll college name as a message.

2: Introduction to elements of HTML, Working with Text, Lists, Hyperlinks, Images, Multimedia.

Task: Design HTML page to display the list of departments in college by using ordered and unordered list.

3: HTML(continued):HTML Tables

Task: Design HTML page to display Class Timetable

4: HTML Frames and Frameset.

Task: Design college website.

5: HTML Form Elements.

Task: Design a Student Registration web page using forms.

6: Cascading Style Sheets(CSS):CSS Properties, Types of CSS, Selectors, box model ,Pseudo-elements, z-index

Task: Apply CSS on student registration form.

7: Bootstrap - CSS Framework: Layouts (Containers, Grid system), Forms, Other Components

Task: Style the student registration Form designed in Module-5still more beautiful using Bootstrap CSS (Re-size browser and check how the webpage displays in mobile resolution).

8: HTTP & Browser Developer Tools: Understand HTTP Headers (Request & Response Headers), URL & its Anatomy, Developer Tools: Elements/Inspector, Console, Network, Sources, performance, Application Storage.

Task: Analyze various HTTP requests (initiators, timing diagrams, responses) and identify problems

9: JavaScript: Variables, Data Types, Operators.

Task: Design a simple JavaScript program to perform arithmetic operations.

10: JavaScript objects, conditions, loops and functions.

Task: Write JavaScript to find the factorial of a given number and generate the Fibonacci series (Recursive and non-Recursive).

11: JavaScript arrays and pop-up box.

Task: Validate all Fields and Submit the student registration Form designed in Module-5

Course Outcomes:

At the end of the course, students should be able to

- Construct websites with valid HTML,CSS.
- Create responsive monitors.
- Develop websites using jQuery and bootstrap to provide interactivity and engaging user experiences
- Design and Develop JavaScript applications.

- Embed Google chart tools in a website for better visualization of data.
- Design and develop web applications using Content Management Systems like Word Press.

Reference Book(s):

1. Deitel and Deitel and Nieto, ―Internet and World Wide Web-How to Program, Prentice Hall, 5th Edition,2011.
2. Web Technologies, Uttam K.Roy, Oxford Higher Education., 1st edition, 10th impression, 2015.
3. Stephen Wynkoop and John Burke―Running a Perfect Website‖,QUE,2nd Edition,1999.
4. Jeffrey C and Jackson, ―Web Technologies A Computer Science Perspective Pearson Education, 2011.
5. Gopalan N.P. and Akilandeswari J.,―WebTechnology,PrenticeHallofIndia,2011

Web Reference:

1. HTML:https://html.spec.whatwg.org/multipage/
2. HTML:https://developer.mozilla.org/en-US/docs/Glossary/HTML5
3. CSS:https://www.w3.org/Style/CSS/
4. Bootstrap-CSS Frame work:https://getbootstrap.com/
5. Browser Develope
6. Tools:https://developer.mozilla.org/enUS/docs/Learn/Common_questions/What_are_browser_developer_tools
7. Javascript:https://developer.mozilla.org/en-US/docs/Web/JavaScript
8. JQuery:https://jquery.com
9. GoogleCharts:https://developers.google.com/chart
10. Wordpress:https://wordpress.com

DESIGN THINKING AND INNOVATION
(Common to CSE, AIML, CS, DS, CE, EEE, ME and ECE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0031T	2:0:0	0	CIE:30 & SEE:70	3 Hours	MC

Course Objectives:

Student will be able to

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Syllabus **Total Hours: 32**

Unit-I	INTRODUCTION TO DESIGN THINKING	6Hrs

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Unit-II	DESIGN THINKING PROCESS	7Hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Unit –III	INNOVATION	6Hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity. Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Unit -IV	PRODUCT DESIGN	7Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies. Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Unit –V	DESIGN THINKING IN BUSINESS PROCESSES	6Hrs

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs.

Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Course Outcomes(CO):

On completion of this course, student will be able to

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

Textbooks:

1. Change by design, Tim Brown, Harper Bollins (2009)
2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons

Reference Books:

1. Design Thinking in the Classroom by David Lee, Ulysses press
2. Design the Future, by Shrrutin N Shetty, Norton Press
3. Universal principles of design- William lidwell, kritinaholden, Jill butter.
4. The era of open innovation – chesbrough.H

Online Learning Resources:
1. https://nptel.ac.in/courses/110/106/110106124/ 2. https://nptel.ac.in/courses/109/104/109104109/ 3. https://swayam.gov.in/nd1_noc19_mg60/preview

B.TECH Electrical and Electronics Engineering
Course Structure (RG22)

Semester-7 (Theory-6, Lab-1, SC -1)							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	PEC	22A0234T 22A0235T 22A0232T	Professional Elective-III: 1. Utilization of Electrical Energy 2. Energy Auditing & Demand side Management 3. Hybrid electric vehicles .	2	1	0	3
2	PEC	22A0236T 22A0237T 22A0238T	Professional Elective-IV: 1. Electrical Distribution Systems 2. Power System Operation& Control 3. Advanced Control Theory	2	1	0	3
3	PEC	22A0242T 22A0241T 22A0243T	**Professional Elective-V**: 1. Power System Protection 2. Smart grid 3. Switched Mode Power Converters	2	1	0	3
4	OEC		**Open Elective-III** :	3	0	0	3
5	OEC		**Open Elective-IV** :	3	0	0	3
6	HSSE	22A0023T 22A0024T 22A0025T 22A0026T	**Humanities and Social Science Elective** 1. Management Science 2. Entrepreneurship & Innovation 3. Business Environment 4. Human Resource Management	2	1	0	3
7	SC	22A0520P	Object Oriented Programming through JAVA	1	0	2	2
Industrial/Research Internship 6-8 Weeks (Mandatory) after third year (to be evaluated during Semester -7)				0	0	0	3
			Total credits				**23**

Open Elective Course – III

S.No	Course Code	Course Name	Offered by the Dept.
1	22A0151T	Disaster Management	CE
2	22A0432T	Basic VLSI Design	ECE
3	22A0529T	Cloud Computing	CSE
4	22A0330Ta	Measurements and Mecatronics	ME
5	22A0330Tb	Unconventional Machining Processes	

Open Elective Course – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	22A0152T	Construction Management	CE
2	22A0433T	Industrial Electronics	ECE
3	22A0534T	Cyber Security	CSE
4	22A0332Ta	Non-Destructive Evaluation	ME
5	22A0332Tb	Renewable Energy Sources	

Category	Credits
Professional Elective Courses(PEC)	9
Humanities and Social Science Course (HSC)	3
Open Elective Courses (OEC)	6
Skil Advanced Course (SC)	2
Industrial/Research Internship	3
Total	**23**

UTILIZATION OF ELECTRICAL ENERGY
(EEE) (Professional Elective-III)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0234T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- The laws of illumination and their application for various lighting schemes.
- Principles and methods for electric heating and welding.
- Systems of electric traction, study of traction equipment, mechanics of train movement and associated calculations.

Syllabus		Total Hours: 48Hrs
UNIT-I	**ILLUMINATION**	**10Hrs**

Definition –Laws of Illumination–Polar Curves – Calculation of MHCP and MSCP. Lamps: Incandescent Lamp, Sodium Vapour Lamp, Fluorescent Lamp, CFL and LED.
Requirement of Good Lighting Scheme – Types, Design and Calculation of Illumination. Street Lighting and Factory Lighting – Numerical Problems

UNIT-II	**ELECTRIC HEATING & WELDING**	**10Hrs**

Electrical Heating: Advantages. Methods of Electric Heating – Resistance, Arc, Induction and Dielectric Heating.
Electric Welding: Types – Resistance, Electric Arc, Gas Welding. Ultrasonic, Welding Electrodes of Various Metals, Defects in Welding.

UNIT -III	**ELECTRIC TRACTION – I**	**10Hrs**

Introduction – Systems of Electric Traction. Comparison Between A. C. and D. C.
Traction – Special Features of Traction Motors - The Locomotive – Wheel arrangement and Riding Qualities – Transmission of Drive – Characteristics and Control of Locomotives and Motor Coaches for Track Electrification – DC Equipment – AC Equipment – Electric Braking with DC Motors and with AC Motors – Control Gear –Auxiliary Equipment.

UNIT -IV	**ELECTRIC TRACTION - II**	**8Hrs**

Mechanics of Train Movement. Speed-Time Curves of Different Services – Trapezoidal and quadrilateral Speed-Time Curves – Numerical Problems. Calculations of Tractive Effort, Power, and Specific Energy Consumption - Effect of Varying Acceleration and Braking Retardation, Adhesive Weight and Coefficient of Adhesion – Problems.

UNIT -V	**ECONOMIC ASPECTS OF UTILISING ELECTRICAL ENERGY**	**10Hrs**

Power Factor Improvement, Load Factor improvement, Off Peak Loads- Use of Exhaust Steam, Waste Heat recovery, Pit Head Generation, Diesel Plant, General Comparison of Private Plant and Public Supply- Initial Cost and Efficiency, Capitalization of Losses, Choice of Voltage.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Develop a lighting scheme for a given practical case.
- To study the basic principles of illumination and its measurement.
- Analyze the performance of Heating and Welding methods.
- Make all numerical calculations associated with electric traction.
- To understand the basic principle of electric traction including speed-time curves of different traction services.
- Assess the economic aspects in utilization of electrical energy.

Textbooks:

1. Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.
2. Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai & Co., 2004

Reference Books:
1. Generation, distribution and utilization of electrical energy, C.L Wadhwa, Wiley Eastern Limited,1993 2. .Electrical Power, S. L. Uppal, Khanna pulishers,1988

ENERGY AUDITING AND DEMAND SIDE MANAGEMENT (EEE)
(Professional Elective-III)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0235T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- I. This subject deals with the energy auditing, conservation, management techniques,
- measurements in energy audits. Information about how to improve the power factor &
- efficiency of electrical equipments.
- II. To deals with DSM programme to improve financial performance and customer relations.

Syllabus		Total Hours: 48Hrs
Unit-I	**INTRODUCTION**	**10Hrs**

Energy situation – world and India, energy consumption, conservation, Codes, standards and Legislation.

Unit-II	ENERGY AUDITING	9 Hrs

Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes. Measurements in energy audits, presentation of energy audit results.

Unit -III	ENERGY EFFICIENT MOTORS	10Hrs

Energy efficient motors , factors affecting efficiency, loss distribution , constructional details , characteristics - variable speed , variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

Unit -IV	LIGHTING AND ENERGY INSTRUMENTS	10Hrs

Good lighting system design and practice, lighting control ,lighting energy audit - Energy Instruments- watt meter, data loggers, thermocouples, pyrometers, lux meters, tongue testers ,application of PLC‘s

Unit -V	DEMAND SIDE MANAGEMENT	9Hrs

Introduction to dsm, concept of dsm, benefits of dsm, different techniques of dsm, load management, load priority technique, peak clipping, peak shifting, valley filling, strategic conservation, energy efficient equipment. Management and organization of energy conservation awareness programs

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Acquire the knowledge of fundamentals of energy auditing
- Conduct energy audit and present the result
- Select the energy efficient motors
- Use different instruments for cost effective lighting
- Determine the location and size of capacitor for power factor improvement
- Understand different techniques in demand side management and create awareness on energy conservation

Textbooks:

1.Industrial Energy Management Systems, Arry C. White, Philip S.
2.Schmidt, David R. Brown, Hemisphere Publishing Corporation,
1. New York.
2. Fundamentals of Energy Engineering - Albert Thumann, Prentice
3. Hall Inc, Englewood Cliffs, New Jersey.
4. Electrical Power distribution, A S. Pabla, TMH, 5th edition, 2004
5. Demand Side Management, Jyothi Prakash, TMH Publishers.

Reference Books:

- Energy management by W.R. Murphy & G. Mckay Butter worth, Heinemann publications.
- Energy management by Paul o‘ Callaghan, Mc-graw Hill Book company-1st edition, 1998
- Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc Ltd-2nd edition, 1995-
- Energy management hand book by W.C.Turner, John wiley and sons
- Energy management and good lighting practice : fuel efficiencybooklet12- EEO

- Recent Advances in Control and Management of Energy Systems, D.P.Sen, K.R.Padiyar, Indrane Sen, M.A.Pai, Interline Publisher, Bangalore, 1993.
- Energy Demand – Analysis, Management and Conservation, Ashok V. Desai, Wiley Eastern, 2005.
- Hand book on energy auditing - TERI (Tata Energy Research Institute)

Web References:

1. https://www.researchgate.net
2 https://www.facstaff.bucknell.edu/
3. https://www.electrical4u.com
4. https://www.gist.edu.in

E-Text Books:

1 .https://www.jntubook.com/
2. https://www.freeengineeringbooks.com

HYBRID ELECTRIC VEHICLES
(Professional Elective-III)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0232T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- Understand to Provide good foundation on hybrid and electrical vehicles.
- Understand To address the underlying concepts and methods behind power transmission in hybrid and electrical vehicles
- Familiarize energy storage systems for electrical and hybrid transportation
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles

Syllabus — **Total Hours: 48Hrs**

UNIT-I	**ELECTRIC VEHICLE PROPULSION AND ENERGY SOURCES**	**10Hrs**

Introduction to electric vehicles, vehicle mechanics - kinetics and dynamics, roadway fundamentals propulsion system design - force velocity characteristics, calculation of tractive power and energy required, electric vehicle power source - battery capacity, state of charge and discharge, specific energy, specific power, Ragone plot. battery modeling - run time battery model, first principle model, battery management system- soc measurement, battery cell balancing. Traction batteries - nickel metal hydride battery, Li-Ion, Lipolymer battery.

UNIT-II	**ELECTRIC VEHICLE POWER PLANT AND DRIVES**	**10Hrs**

Introduction electric vehicle power plants. Induction machines, permanent magnet machines, switch reluctance machines. Power electronic converters-DC/DC converters - buck boost converter, isolated DC/DC converter. Two quadrant chopper and switching modes. AC drives PWM, current control method. Switch reluctance machine drives - voltage control, current control.

UNIT -III	**HYBRID AND ELECTRIC DRIVE TRAINS**	**8Hrs**

Introduction hybrid electric vehicles, history and social importance, impact of modern drive trains in energy supplies. Hybrid traction and electric traction. Hybrid and electric drive train topologies. Power flow control and energy efficiency analysis, configuration and control of DC motor drives and induction motor drives, permanent magnet motor drives, switch reluctance motor drives, drive system efficiency.

UNIT -IV	**ELECTRIC AND HYBRID VEHICLES - CASE STUDIES**	**10Hrs**

Parallel hybrid, series hybrid -charge sustaining, charge depleting. Hybrid vehicle case study – Toyota Prius, Honda Insight, Chevrolet Volt. 42 V system for traction applications. Lightly hybridized vehicles and low voltage systems. Electric vehicle case study - GM EV1, Nissan Leaf, Mitsubishi Miev. Hybrid electric heavy duty vehicles, fuel cell heavy duty vehicles.

UNIT -V	**ELECTRIC AND HYBRID VEHICLE DESIGN**	**10Hrs**

Introduction to hybrid vehicle design. Matching the electric machine and the internal combustion engine. Sizing of propulsion motor, power electronics, drive system. Selection of energy storage technology, communications, supporting subsystem. Energy management strategies in hybrid and electric vehicles - energy management strategies- classification, comparison, implementation.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Understand the working of hybrid and electric vehicles
- Apply a suitable drive scheme for developing an hybrid and electric vehicles depending on resources
- e Develop the electric propulsion unit and its control for application of electric vehicles.
- Understand the proper energy storage systems for vehicle applications
- Design and develop basic schemes of electric vehicles and hybrid electric vehicles

Textbooks:

6. 1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, 2nd edition, CRC Press, 2003.
7. 2. Amir Khajepour, M. Saber Fallah, Avesta Goodarzi, “Electric and Hybrid Vehicles: Technologies, Modeling and Control - A Mechatronic Approach”, illustrated edition, John Wiley & Sons, 2014.

3. Mehrdad Ehsani, YimiGao, Sebastian E. Gay, Ali Emadi, “Modern Electric, Hybrid

Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004

Reference Books:

1. James Larminie, John Lowry, "Electric Vehicle Technology", Explained, Wiley, 2003.
2. John G. Hayes, G. Abas Goodarzi, "Electric Powertrain: Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles", 1st edition, WileyBlackwell, 2018.

ELECTRICAL DISTRIBUTION SYSTEMS
(Professional Elective-IV)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0236T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- The student has to acquire knowledge about:
- The classification of distribution systems
- The technical aspects and design considerations in DC and AC distribution systems and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation.

Syllabus		Total Hours:48
Unit-I	**INTRODUCTION & GENERAL CONCEPTS**	**9Hrs**

Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural and Industrial) and Their Characteristics.

Unit-II	**CLASSIFICATION OF DISTRIBUTION SYSTEMS**	**9Hrs**

Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System. Voltage Drop Calculations (Numerical Problems) In A.C. Distributors for The Following Cases: Power Factors Referred to Receiving End Voltage and With Respect to Respective Load Voltages.

Unit -III	**SUBSTATIONS**	**10Hrs**

Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar, Sectionalized Single Bus Bar, Main and Transfer Bus Bar Double Breaker – One and Half Breaker System With Relevant Diagrams.

Unit -IV	**POWER FACTOR IMPROVEMENT**	**10Hrs**

Voltage Drop and Power-Loss Calculations: Derivation for Voltage Drop and Power Loss in Lines, Manual Methods of Solution for Radial Networks, Three Phase Balanced Primary Lines. Causes of Low P.F -Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Numerical Problems. Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction- Economic Justification - Procedure to Determine the Best Capacitor Location.

Unit -V	**DISTRIBUTION AUTOMATION**	**10Hrs**

Distribution automation, distribution management systems, distribution automation system functions, Basic SCADA system, outage management

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Compute the various factors associated with power distribution
- Make voltage drop calculations in given distribution networks
- Learn principles of substation maintenance
- Compute voltage drop for a given system and load

- Compute power factor improvement for a given system and load
- Understand implementation of SCADA for distribution automation

Textbooks:

1. Electric Power Distribution Engineering, Turan Gonen, CRC Press, 3rd Edition, 2014.
2. Electric Power Distribution, A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

Reference Books:

1. Electric Power Distribution Automation, Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010.
2. Electrical Power Distribution Systems, V. Kamaraju, Jain Book Depot. 2012.
3. Electrical Power Systems for Industrial Plants, Kamalesh Das, JAICO Publishing House, 200

POWER SYSTEM OPERATION AND CONTROL (EEE)

(Professional Elective-IV)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0237T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

Student will be able to

- To know about economic load dispatch problems with and without losses in Power
- Systems
- To distinguish between hydro-electric and thermal plants and coordination between
- them
- To understand about optimal power flow problems and solving using specified
- method
- To understand about Automatic Generation Control problems and solutions in Power
- Systems
- To understand necessity of reactive power control, compensation under no-load and
- load operation of transmission systems
- To understand about deregulation aspects in Power Systems

Syllabus — **Total Hours: 48**

Unit-I	ECONOMIC OPERATION OF POWER SYSTEMS	10Hrs

Brief description about electrical power systems, introduction to power system operation and control, Characteristics of various steam units, combined cycle plants, cogeneration plants, Steam units economic dispatch problem with & without considering losses and its solutions, B Matrix loss formula – Numerical problems

Unit-II	HYDRO-THERMAL COORDINATION AND OPTIMAL POWER FLOW	10Hrs

Hydro-thermal Coordination: Characteristics of various types of hydro-electric plants andtheir models, Introduction to hydro-thermal Coordination, Scheduling energy with hydrothermal coordination, Short-term hydro-thermal scheduling.

Optimal Power Flow: Optimalpower flow problem formulation for loss and cost minimization, Solution of optimal powerflow problem using Newton's method – Numerical problems

Unit –III	AUTOMATIC GENERATION CONTROL	8Hrs

Speed governing mechanism, modelling of speed governing mechanism, models of various types of thermal plants (first order), definitions of control area, Block diagram representation of an isolated power system, Automatic Load Frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, AutomaticLoad-frequency control of two area system, Tie-line bias control of two area and multi-areasystem, Static response of two-area system – Numerical examples

Unit -IV	REACTIVE POWER CONTROL	10Hrs

Requirements in ac power transmission, factors affecting stability & voltage control, fundamental transmission line equation, surge impedance, Natural loading, uncompensated line on open circuit, uncompensated line under load, types of compensations on compensated transmission lines, passive and active compensators, uniformly distributed fixed and regulated shunt compensation, series compensation, compensation by sectioning – Numerical problemsLearning

Unit –V	POWER SYSTEM OPERATION IN COMPETITIVE ENVIRONMENT	10Hrs

Introduction – Restructuring models – Independent System Operator (ISO) – Power Exchange - Market operations – Market Power – Standard cost – Transmission Pricing– Congestion Pricing – Management of Inter zonal/Intra zonal Congestion – ElectricityPrice Volatility Electricity Price Indexes – Challenges to Electricity Pricing –Construction of Forward Price Curves – Short-time Price Forecastin

Course Outcomes(CO):

On completion of this course, student will be able to

- Design an optimal operation setup of power system which minimizes operation costs and meet desired needs.
- Illustrate about thermal and hydro power plants operation in meeting the load demand optimally.
- Discuss single area load frequency control and two area load frequency control.
- Apply the techniques to control power flows, frequency and voltage
- Differentiate pricing mechanism of electric energy and trading of power under deregulated environment.
- Assess the significance of power system restructuring and learn the Security Analysis, Contingency Analysis.

Textbooks:

1Allen J. Wood and Bruce F. Wollenberg, "Power Generation, Operation and Control", 2nd edition, John Wiley & Sons, Inc., New York, 1996.
2. D P Kothari and I J Nagrath, "Power System Engineering", McGraw Hill Education India Pvt. Limited, Chennai, 3e, 2019

Reference Books:

1. Power System Analysis and Design, J. Duncan Glover and M.S.Sharma, Thomson, 3rd Edition, 2008.
2. Electric Energy System Theory: An Introduction, OlleIngemarElgerd, Tata Mc Graw Hill, 2nd Edition, 1982.
3. Power System Stability and Control, P Kundur, Tata Mc Graw Hill, 1994, 5th Reprint, 2008

Web References:

https://archive.nptel.ac.in/courses/108/104/108104052/#download_transcripts

ADVANCED CONTROL THEORY
(Professional Elective-IV)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0238T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

Student will be able to

- Concepts of state vector, State transition matrix and solution of state equations.
- Importance of controllability and observability concepts.
- Pole placement, state estimation using observers
- Lyapunov criterion for stability analysis
- Types of nonlinearities, their effect on system performance

Syllabus — **Total Hours: 48Hrs**

Unit-I	**STATE VARIABLE DESCRIPTION AND SOLUTION OF STATE EQUATION**	**10Hrs**

Concept of State – Derivation of State Space models for Linear Continuous time Systems from Schematic Models, Differential equations, Transfer functions and block diagrams – Non uniqueness of state model – State diagrams for continuous time state models – Solution of state equations – State transition matrix. Complete response of continuous time systems.

Unit-II	**CONTROLLABILITYAND OBSERVABILITY**	**10Hrs**

Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability of state models in Jordan canonical form and other canonical forms. Effect of state feedback on controllability and observability.

Unit -III	**STATE FEEDBACK CONTROLLERS AND OBSERVERS**	**8Hrs**

Design of State Feedback Controllers through Pole placement. Full-order observer and reduced-order observer. State estimation through Kalman Filters.

Unit -IV	**ANALYSIS OF NONLINEAR SYSTEMS**	**10Hrs**

Introduction to nonlinear systems, Types of nonlinearities, Concept of describing functions, Derivation of describing functions for Dead zone, Saturation, backlash, relay with dead zone and Hysteresis - Jump Resonance. Introduction to phase-plane analysis, Method of Isoclines for Constructing Trajectories, Singular points, Phaseplane analysis of nonlinear control systems.

Unit -V	**STABILITY ANALYSIS**	**10Hrs**

Stability in the sense of Lyapunov. Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for Linear and Nonlinear continuous time autonomous systems

Course Outcomes(CO):

On completion of this course, student will be able to

- Model a given dynamic system in state space and obtain the solution for the state equation
- Test whether a given system is controllable and/or observable
- Design a state feedback controller for pole placement
- Design an observer for state estimation
- Apply Lyapunov criterion and determine stability of a given system
- Analyze nonlinear systems.

Textbooks:

1. Modern Control Engineering, Katsuhiko Ogata, Prentice Hall, 5th Edition, 2010.
2. Modern Control System Theory, M. Gopal, New Age International Publishers, Revised 2nd edition, 2005

Reference Books:

1. Control Systems Engineering, I.J. Nagarath and M.Gopal, New Age International Publishers, 5th Edition, 2007, Reprint 2012.
2. Modern Control Engineering, D. Roy Choudhury, PHI Learning Private Limited, 9th Printing, January 2015.

POWER SYSTEM PROTECTION
(Professional Elective-V)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0242T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- The different types of electromagnetic relays and microprocessor based relays
- The protection of Generators
- The protection of Transformers
- The protection of feeders and lines
- The technical aspects involved in the operation of circuit breakers
- Generation of over voltages and protection from them

Syllabus		Total Hours: 48Hrs
UNIT-I	**FUSES AND CIRCUIT BREAKERS**	**9Hrs**

Circuit Breakers: Elementary Principles of Arc Interruption, Restriking Voltage and Recovery Voltage - Restriking Phenomenon, Average and Max. RRRV, Current Chopping and Resistance Switching – Auto Reclosures. Minimum Oil Circuit Breakers, Air Blast Circuit Breakers, Vacuum and SF6 Circuit Breakers

Unit-II	RELAYS	10Hrs

Electromagnetic Relays - Basic Requirements of Relays – Primary and Backup Protection - Construction Details of – Attracted Armature, Balanced Beam, Inductor Type and Differential Relays – Universal Torque Equation – Characteristics of Over Current, Direction and Distance Relays. Static Relays – Advantages and Disadvantages – Definite Time, Inverse and IDMT. Static Relays – Comparators – Amplitude and Phase Comparators. Microprocessor Based Relays – Advantages and Disadvantages – Block Diagram for Over Current (Definite, Inverse and IDMT) and Distance Relays and Their Flow Charts.

Unit -III	PROTECTION OF GENERATORS & TRANSFORMERS	10Hrs

Protection of Generators against Stator Faults, Rotor Faults and Abnormal Conditions. Restricted Earth Fault and Inter-Turn Fault Protection – calculation of percentage winding unprotected. **Protection of Transformers:** Percentage Differential Protection, Numerical Problems on Design of CT Ratio, Buchholtz Relay Protection, Numerical Problem.

Unit -IV	PROTECTION OF FEEDERS & LINES	10Hrs

Protection of Feeder (Radial & Ring Main) Using Over Current Relays. Protection of Transmission Line – 3 Zone Protection Using Distance Relays. Carrier Current Protection. Protection of Bus Bars.s.

Unit -V	OVER VOLTAGES IN POWER SYSTEMS	9Hrs

Generation of Over Voltages in Power Systems.-Protection against Lightning over Voltages - Valve Type and Zinc-Oxide Lighting Arresters - Insulation Coordination –BIL.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Distinguish between the principles of operation of electromagnetic relays, static relays and microprocessor based relays
- Determine the unprotected percentage of generator winding under fault occurrence
- Design the protection system for transformers
- Identify various types of the relays in protecting feeders, lines and bus bars
- Solve numerical problems for arc interruption and recovery in circuit breakers
- Demonstrate the protection of a power system from over voltages .

Textbooks:

Badri Ram, D.N Viswakarma, “Power System Protection and Switchgear”, TMH Publications, 2011.

Sunil S Rao, “Switchgear and Protection”, Khanna Publishers, 1992

ReferenceBooks:
C.L.Wadhwa, “Electrical Power Systems”, New Age international (P) Limited, Publishers, 2012. Y.G. Paithankar , “Transmission network Protection”, Taylor and Francis,2009. Bhuvanesh Oza, “Power system protection and switch gear”, TMH, 2010..
Web References: 1. https://www.researchgate.net 2 https://www.facstaff.bucknell.edu/ 3. https://www.electrical4u.com 4. https://www.gist.edu.in
E-Text Books: 1 .https://www.jntubook.com/ 2. https://www.freeengineeringbooks.com

SMART GRID
(Professional Elective-V)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0241T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- Overview of the technologies required for the smart grid
- Switching techniques and different means for data communication
- Standards for information exchange and smart metering
- Methods used for information security on smart grid
- Smart metering and protocols for smart metering
- Power quality management with upgraded technologies

Syllabus		Total Hours: 48
Unit-I	**INTRODUCTION TO SMART GRID**	**10Hrs**

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self-Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives

Unit-II	**SMART GRID TECHNOLOGIES**	**8Hrs**

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, HighEfficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

Unit -III	**SMART METERS**	**10Hrs**

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

Unit -IV	**POWER QUALITY MANAGEMENT IN SMART GRID**	**10Hrs**

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Unit -V	**HIGH PERFORMANCE COMPUTING)**	**10Hrs**

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN),Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- Understand the concepts and design of Smart grid.
- Understand the various communication technologies in smart grid.
- Understand the various measurement technologies in smart grid.
- Understand the analysis and stability of smart grid.
- Learn the renewable energy resources and storages integrated with smart grid.
- familiarize the high performance computing for Smart Grid applications

Textbooks:

1. Smart Grid, Janaka Ekanayake, Liyanage, Wu, Akihiko Yokoyama, Jenkins, Wiley Publications, 2012, Reprint 2015.
2. Smart Grid: Fundamentals of Design and Analysis, James Momoh, Wiley, IEEE Press., 2012, Reprint 2016.

Reference Books:

1. The Smart Grid – Enabling Energy efficiency and demand response, Clark W. Gellings, P.E., CRC Press, Taylor & Francis group, First Indian Reprint. 2015.
2. Smart Grid – Applications, Communications, and Security Edited by Lars Torsten Berger, Krzysztof Iniewski, WILEY, 2012, Reprint 2015.
3. Practical Electrical Network Automation and Communication Systems, Cobus Strauss, ELSVIER, 2003

SWITCHED MODE POWER CONVERTERS (EEE)
(Professional Elective-V)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0243T	2:1:0	3	CIE:30 & SEE:70	3 Hours	PEC

Course Objectives:

The objectives of the course are to make the students learn about:

- To understand the concepts of modern power electronic converters and their applications
- Analyzing and control of various power converter circuits
- To understand the concepts of resonant converters
- To Analyze the dynamic analysis of DC-DC converter

Syllabus		Total Hours: 48Hrs
Unit-I	**NON-ISOLATED DC-DC CONVERTERS**	**10Hrs**

Basic Types of Switching Power Supplies – Volt-Sec balance – Non-Isolated Switched Mode DC-to-DC Converters – Buck Converter – Boost Converter – Buck-Boost Converter – Cuk Converter – SEPIC and Zeta Converters – Comparison of NonIsolated Switched mode DC-to-DC Converters..

Unit-II	ISOLATED DC-DC CONVERTERS	10Hrs

Need of Transformer Isolations in high frequency Power conversion - Isolated Switched Mode DC-to-DC Converters – Single Switch Isolated DC-to-DC Converters – Forward, Flyback, Push-Pull, Flux Weakening Phenomena, Half and Full Bridge Converters – Multi Switch Isolated DC-to-DC Converters – Comparison of Isolated and Non-Isolated Switched Mode DC-to-DC Converters.

Unit -III	RESONANT CONVERTERS	8Hrs

Classification of Resonant converters-Basic resonant circuits- Series resonant circuitparallel resonant circuits- Resonant switches, Concept of Zero voltage switching, principle of operation, analysis of M-type and L-type Resonant Buck and boost Converters.

Unit -IV	DYNAMIC ANALYSIS OF DC-DC CONVERTERS	10Hrs

Formulation of dynamic equations of buck and boost converters, State-Space Models, Averaged Models, linearization technique, small-signal model and converter transfer functions, Significance of Small Signal Models, Dynamical Characterization.

Unit -V	CONTROLLER DESIGN	10Hrs

Review of frequency-domain analysis of linear time-invariant systems, controller specifications, Proportional (P), Proportional plus Integral (PI), Proportional, Integral plus Derivative controller (PID), selection of controller parameters for Isolated and NonIsolated DC -DC Converters.

Course Outcomes(CO):

At the end of studying the course, the student should be able to:

- The student learns the fundamental concepts of DC - DC Converters
- Student can explain the operation of different topologies of DC to DC converters
- Student will be able to model various converters as per state space, time average
- Student can analyse in frequency domain with different P, PI and PID converters

Textbooks:

1. Issa Batarseh, Fundamentals of Power Electronics, John Wiley Publications, 2009.
2. Robert Erickson and Dragon Maksimovic, Fundamentals of Power Electronics, Springer Publications., 2nd Edition, 2001.

Reference Books:

1. Switched Mode Power Supplies design and construction 2nd Edition, H W Whittington, B W Flynn and D E Macpherson, Universities Press, 2009.
2. Philip T.Krein Elements of Power Electronics - Oxford University Press, 1997. 3. L. Umanand Power Electronics, Tata Mc-Graw Hill, 2004.

MANAGEMENT SCIENCE					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0023T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**HSSE**

Course Objectives:

Student will be able to

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HR Min order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Meritrating concepts.
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management.
- To make the students aware of the contemporary issues in management..

Syllabus		**Total Hours: 48**
Unit-I	**INTRODUCTIONTOMANAGEMENT**	**10Hrs**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art andboth. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayal's principles -Elton Mayo's Human relations - Systems Theory - Organizational Designs - Line organization -Line & Staff Organization - Functional Organization-Matrix Organization-Project Organization-Committee form of Organization-Social responsibilities of Management.

Unit-II	**OPERATIONSMANAGEMENT**	**10Hrs**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production),WorkStudy-Statistical Quality Control-Deming's contribution to Quality. Material Management - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - Marketing Management - Concept -Meaning-Nature-Functions of Marketing-Marketing Mix-Channels of Distribution-Advertisement and Sales Promotion-Marketing Strategies based on Product Life Cycle.

Unit –III	**HUMANRESOURCESMANAGEMENT**	**10Hrs**

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP)- Employee Recruitment-Sources of Recruitment- Employee Selection -Process and Tests in Employee Selection -Employee Training and Development-On-the-job & Off-the-job training methods-Performance Appraisal Concept- Methods of Performance Appraisal – Placement- Employee Induction -Wage and Salary Administration.

Unit -IV	**STRATEGIC&PROJECTMANAGEMENT**	**10Hrs**

Definition &Meaning- Setting of Vision -Mission -Goals - Corporate Planning Process-Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis -Project Management - Network Analysis-Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time-Project Cost-Analysis-Project Crashing (Simple problems).

Unit –V	**CONTEMPORARYISSUESINMANAGEMENT**	**8Hrs**

The concept of Management Information System (MIS) -Materials Requirement Planning (MRP) - Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the concepts & principles of management and designs of organization in a practical world (L2)
- Apply the knowledge of Work - study principles & Quality Control techniques in industry (L3)
- Analyze the concepts of HR Min Recruitment, Selection and Training & Development.(L4)
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project

& to analyze the business through SWOT.(L3)

- Create Modern technology in management science.(L3)

Textbooks:

1. A.RAryasri,"Management Science", TMH, 2013

Stoner, Freeman, Gilbert, Management, Pearson Education,NewDelhi,2012

Reference Books:

1. Koontz & Weihrich,"Essentials of Management",6th edition,TMH,2005.
2. Thomas N. Duening & John M. Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi,"Production and Operations Management",Oxford University Press, 2004.
4. SamuelC.Certo,"Modern Management",9th edition,PHI,2005

ENTERPRENEURSHIP & INNOVATION					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0024T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**HSSE**

Course Objectives:

Student will be able to

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise.
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs / women entrepreneurs
- To encourage the student in creating and designing business plans

Syllabus		**Total Hours: 48**
Unit-I	**INTRODUCTION TO ENTREPRENEURSHIP**	**10Hrs**

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur-Understanding individual entrepreneurial mind set and personality- Recent trends in Entrepreneurship.

Unit-II	**STARTING UP NEW VENTURE**	**10Hrs**

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas- Opportunity recognition - Feasibility study - Market feasibility , technical / operationa l feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors

Unit –III	**SOURCES OF FINANACE**	**9Hrs**

Sources of finance - Various sources of Finance available - Long term sources - Short term sources -Institutional Finance – Commercial Banks, SFC's in India- NBFC's in India - their way of financing in India for small and medium business -Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development.

Unit -IV	**WOMEN ENTREPRENEURSHIP**	**9Hrs**

Women Entrepreneurship -Entrepreneurship Development and Government-Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available -Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India-Issues &Challenges-Entrepreneurial motivations.

Unit –V	**INTRODUCTION TO INCUBATION&INNOVATION**	**10Hrs**

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation – Types, Advantages and Disadvantages of incubation.

Innovation Meaning & Definition - Forms of innovation - Innovation, features and characteristics - Factors initiating innovations - Innovation process and its stages.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the concept of Entrepreneurship and challenges in the world of competition.(L2)
- Apply the Knowledge in generating ideas for New Ventures.(L3)
- Analyze various sources off in ance and subsidies to entrepreneur /women Entrepreneurs.(L4)
- Evaluate the role of central government and state government in promoting entrepreneurship.(L3)
- Create and design business plan structure through incubations.(L3)

Textbooks:

1. DFKuratko and TVRao,"Entrepreneurship**"**-A South-Asian Perspective–Cengage Learning, 2012. (For PPT,Case Solutions Faculty may visit:login.cengage.com)
2. NandanH, "Fundamentals of Entrepreneurship",PHI,2013

Reference Books:

1. Vasant Desai, "Small Scale Industries and Entrepreneurship", HimalayaPublishing2012.
2. RajeevRoy"Entrepreneurship",2nd Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwanal"EntrepreneurshipDevelopment:Text&Cases",ExcelBooks,2011.
4. StuartRead, Effectual"Entrepreneurship",Routledge, 2013.

BUSINESS ENVIRONMENT					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0025T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**HSSE**

Course Objectives:

Student will be able to

- To make the student understand about the business environment.
- To enable the min knowing the importance of fiscal and monitory policy.
- To facilitate the min understanding the export policy of the country.
- Impart knowledge about the functioning and role of WTO.
- Encourage the student in knowing the structure of stock market

Syllabus		**Total Hours: 48**
Unit-I	**AN OVERVIEW OF BUSINESS ENVIRONMENT**	**10Hrs**

Overview of Business Environment – Types of Environments - Internal & External -Micro and Macro environment- Competitive structure of industries - Environmental analysis - Scopeofbusiness-Characteristicsofbusiness-Process&limitationsofenvironmentalanalysis.

Unit-II	**FISCALPOLICY & MONETARY POLICY**	**10Hrs**

FISCALPOLICY-Public Revenues-Public Expenditure-Public debt Development activities financed by public expenditure - Evaluation of recent fiscal policy of Government of India - Highlights of Budget - MONETARY POLICY - Demand and Supply of Money – RBI -Objectives of monetary and credit policy-Recent trends-Role of Finance Commission.

Unit –III	**INDIA'S TRADE POLICY & BALANCE OFPAYMENTS**	**10Hrs**

INDIA'S TRADE POLICY - Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - BALANCE OFPAYMENTS–Structure & Major components-Causes for Disequilibrium in Balance of Payments-Correction measures–WTO - Nature and Scope - Organization and Structure - Role and functions of WTO in promoting world trad.

Unit -IV	**MONEYMARKETSANDCAPITALMARKETS**	**10Hrs**

Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets -Reforms and recent development– SEBI - Stock Exchanges - Investor protection and role of SEBI.

Unit –V	**INTRODUCTION TO INFLATION**	**8Hrs**

Inflation – Meaning & Definition – Causes – Effects – Types – Advantages & Disadvantages Deflation – Meaning & Definition - Causes & Effects.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand various types of business environment. (L2)
- Evaluate fiscal and monitory policy (L3)
- Analyze India's Trade Policy (L4)
- Understand the role of WTO (L2)
- Apply the knowledge of Money markets in future investment(L3)

Textbooks:

1. Francis Cherunilam(2009),"International Business":Textand Cases,Prentice Hall of India.
2.K.Aswathappa,"Essentials of Business Environment": Texts and Cases & Exercises 13th Revised Edition. HPH2016.13

Reference Books:

1. K.V.Sivayya,V.B.MDas(2009),Indian Industrial Economy, Sultan Chand Publishers, NewDelhi, India.
2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, NewDelhi, India.
3. Chari.S.N (2009), International Business, Wiley India.

4. E.Bhattacharya (2009), International Business, Excel Publications, NewDelhi.

HUMAN RESOURCE MANAGEMENT					
Course Code	**L:T:P**	**Credits**	**Exam marks**	**Exam Duration**	**Course Type**
22A0026T	**2:1:0**	**3**	**CIE:30 & SEE:70**	**3 Hours**	**HSSE**

Course Objectives:

Student will be able to

- To make the student understand about human resource management.
- To enable the students about job analysis, job specification and job enrichment.
- To enable the students knowing about HR planning and retention.
- To impact knowledge about recruitment, selection and performance appraisal.
- To create knowledge on training and development, compensation management.

Syllabus		**Total Hours: 48**
Unit-I	**HUMAN RESOURCE MANAGEMENT-INTRODUCTION**	**9Hrs**

Introduction- Objectives – Scope & Features of HRM – Importance & - Functions of HRM- Challenges of HRM. Personnel Management Vs HRM – Role of HR manager - Strategic Human Resource Management.

Unit-II	**JOB ANALYSIS AND JOB DESIGN**	**9Hrs**

Job Analysis Process –Techniques of Data Collection - Contents of Job Description & Job Specification - Job design - Factors affecting Job design - Job enrichment Vs Job enlargement.

Unit –III	**HUMAN RESOURCE PLANNING AND EMPLOYEE RETENTION**	**10Hrs**

Objectives and Need of HR planning, Process of HR Planning and factors affect the HR Planning -HR Information System - Employee retention - Importance of retention - strategies of retention.

Unit -IV	**HR ACQUISITION AND MANAGING EMPLOYEE PERFORMANCE**	**11Hrs**

Recruitment - Objectives and Sources of recruitment - Selection - Objectives - Selection Procedure - Placement - Performance Appraisal –Objectives & Importance, performance Appraisal Methods – Constraints.

Unit –V	**HR DEVELOPMENT AND COMPENSATION MANAGEMENT**	**9Hrs**

Training and Development– Objectives, Need and Methods of Training –career planning and career development - Compensation Management - Job evaluation – welfare provisions and fringe benefits - Quality Circles and Total Quality Management.

Course Outcomes(CO):

On completion of this course, student will be able to

- Understand the basic concept of Human Resource Management.(L2)
- Explain the job analysis and job design methods.(L2)
- Understand the demand and supply of HR & concept of employee retention.(L2)
- Understand the sources of Recruitment, Selection process and Performance appraisal methods.(L2)
- Examine the Training and Development methods and compensation management process.(L2)

Textbooks:

1. Gary Dessler, Biju Varkkey, Human Resource Management, 4e, Pearson 2017.
2. Robert L. Mathis, John H. Jackson, Manas Ranjan Tripathy, Human Resource Management, Cengage Learning 2016.

Reference Books:

1. Aswathappa, Human Resource Management, 4th Edition, TMH 2006.
2. Subbarao, Personnel and Human Resource Management –Text and cases, Himalaya, 2009
3. R.Wayne Mondy, Robert M.Noe, Human Resource Management, Pearson
4. Noea.Raymond, John Hollenbeck, Barry Gerhart and Patrick Wright, Human Resource Management, Tata McGraw Hill.
5. Muller, Human Resource Management a case study approach, Jaico Publishers, 2008
6. VSP Rao, Human Resource Management, Text and Cases, Excel Books 2006.

OBJECT ORIENTED PROGRAMMING THROUGH JAVA (SKILL)
(Common to EEE,ME and ECE)

Course Code	L:T:P	Credits	Exam marks	Exam Duration	Course Type
22A0520P	1:0:2	2	CIE:30 & SEE:70	3 Hours	SC

Course Objectives:

This course will enable students to:

- To introduce the fundamental concepts of object-oriented programming to design & implement object oriented programming concepts in Java.
- To obtain knowledge about the principles of inheritance and polymorphism
- Learn the usage of Control structures in java
- To implement the concept of Array, interfaces, exception handling
- To understand the usage of Threads in java.

List of Experiments:

1. Fundamentals of Object Oriented Programming: Introduction, Object Oriented Paradigm, Basic concepts of OOP : Class, Object, Inheritance, Polymorphism, Abstraction, Encapsulation.
Task: introduction to Object Oriented Programming and its basic concepts.

2. Overview of Java Language: Introduction, Java features, Java program structure, parts of Java, Java Virtual Machine-Java versus C++, How to Compile & Executing a basic java program.
Task: Differences between Java and C++, Execute "Hello welcome to java" program

3. Variables-Identifiers-Literals- Data types: Integer literals-character literals-Floating point literals-String Literals, Variables, Keywords, Data types.
Task: implementing data types with variables, find valid/invalid variables, Identifiers

4. Operators: Arithmetic operators, Relational operators, Assignment operators, Conditional operators, Type casting/Type Conversion in java.
Task: Perform all arithmetic operators using a single program, program using typecast/type conversion

Module : 5
Java Statements: Input and Output Statements, Accepting Input from the Keyboard, Displaying output with System.out.printf( ) , Displaying Formatted output with String.format( )
Task: Write a program using I/O statements in java.

6. Control Structures: Conditional control statements :- if ..statement, if… else statement- if-else-if ladder, Switch statement
Task: Write a program to find a person is eligible for vote >18?, Largest number among 3 numbers?

7. Looping/Repetitive/Iterative statements: While statement- Do ..While statement-For Statement, Continue statement-Break statement.
Task: print N natural numbers, sum of N natural numbers, Armstrong number, Strong number using for statement.

8. Arrays: Arrays, One-dimensional arrays, Creating an array, Find The Length Of An Array, Types of Arrays:-Two-dimensional arrays, Creating a two-dimensional array.
Task: Find the N^{th} Largest value in an array, Insert and Addition of values using array

9. Strings: Introduction to strings, Built in strings, Creating Strings, String reverse, String Concatenation, String comparison, Immutability of Strings
Task: write a program to Perform all string operations as single output

10. Classes , Objects& Methods: Introduction, Defining a class, Adding Variables, Object Creation, Initializing the Instance variables, Access Specifiers, Methods, Constructors, Method Overloading
Task: To implement Class and Object concept, Method Overloading program

11. Interfaces: Interface, Multiple Inheritance using Interfaces.
Exception Handling: Errors in Java Program, Exceptions, throws clause, throw clause, Types of Exceptions,
Task: Implement a program using exception handling, write a program Multiple Inheritance using Interfaces.

12. Threads: Introduction, Creating Threads, Extending the Threads, Stopping and Blocking a Thread, Life Cycle of a Thread. single Tasking Using a Thread, Multi tasking Using Threads
Task: Implement a program using Threads.

Course Outcomes:
At the end of the course, students should be able to

- Understand the basic concepts of OOP
- Compare & Contrast basic constructs of C++ & Java
- Develop a program on operators in Java
- Apply Control statements to solve real time problems
- Analyze the concepts of constructers, overloading, Inheritance and Interfaces in java
- Implementing different types of Threads to solve real time problems

Reference Book(s):

1. Programming with Java by E.Balagurusamy.
2. Programming in Java by Sachin Malhotra, OXFORD University Press.
3. Java Complete Reference by Herbert Schildt.
4. John R.Hubbard, Programming with Java, Second Edition, Schaum's outline series, TATA McGraw-Hill Company.

Web Reference:

1. https://www.javatpoint.com/java-tutorial
2. https://www.learnjavaonline.org/
3. https://www.tutorialspoint.com/java/index.htm
4. https://www.w3schools.com/java/
5. https://www.geeksforgeeks.org/java/

B.TECH Electrical and Electronics Engineering
Course Structure (RG22)

Semester-8							
Sl. No.	Category	Course Code	Course Title	Hours per week			Credits
				L	T	P	C
1	Major Project	22A0243P	Project Work and Internship in Industry	0	0	24	12
						Total credits	12

COURSES OFFERED FOR HONOURS DEGREE IN EEE

Note: 1. The honor subject are having a total of 20 additional credits.
2. The students should acquire 4 credits through MOOCs compulsory to award the honor degree

S.No.	Course Code	Course Name	Contact Hours per week		Credits
			L	T	
1	22A0251H	Electric Vehicle Technology & Mobility	3	1	4
2	22A0252H	Battery Management Systems	3	1	4
3	22A0253H	Special Machines for Electric Vehicles	3	1	4
4	22A0254H	Grid Interface of Electric Vehicles	3	1	4
5	22A0255H	Special Electrical Machines	3	1	4
6	22A0256H	Power System Dynamics and Control	3	1	4
7	22A0257H	Advance Power System Protection	3	1	4
8	22A0258H	Industrial Automation & Control	3	1	4
9	22A0259H	Introduction to Hybrid and Electric Vehicles	3	1	4
10	22A0260H	Electric Vehicles and Renewable Energy	3	1	4

LIST OF MINORS OFFERED TO EEE

S.No.	Course Code	Course Name	Contact Hours per week		Credits
			L	T	
1	22A0271M	Principles of Controls Systems	3	1	4
2	22A0272M	Electrical Measurements	3	1	4
3	22A0273M	Renewable Energy Systems	3	1	4
4	22A0274M	Fundamentals of Electrical Machines	3	1	4
5	22A0275M	Fundamentals of Power Quality & Issues	3	1	4
6	22A0276M	Industrial Applications In Electrical Engineering	3	1	4
7	22A0277M	Power System Architecture	3	1	4
8	22A0278M	Measurements & Sensors	3	1	4
9	22A0279M	Fundamentals of Power Electronics	3	1	4
10	22A0280M	Utilization of Electrical Energy	3	1	4