ANDHRA UNIVERSITY
DEPARTMENT OF ELECTRICAL ENGINEERING

SCHEME AND SYLLABI
(with effect from 2022-23)

B.Tech & B.Tech+M.Tech
I Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EE1101	BS	Mathematics – I	4	0	30	70	100	3
EE1102	BS	Physics	4	0	30	70	100	3
EE1103	ES	Introduction to Python	4	0	30	70	100	3
EE1104	ES	Fundamentals of Electrical Engineering.	4	0	30	70	100	3
EE1105	ES	Basic Electronics Engineering.	4	0	30	70	100	3
EE1106	ES	Python Programming Lab	0	3	50	50	100	1.5
EE1107	BS	Physics Lab	0	3	50	50	100	1.5
EE1108	ES	Electrical Engineering Workshop	0	3	50	50	100	1.5
							Total Credits	**19.5**

B.Tech & B.Tech+M.Tech
I Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EE1201	BS	Mathematics – II	4	0	30	70	100	3
EE1202	BS	Green Chemistry	4	0	30	70	100	3
EE1203	HSS	English	4	0	30	70	100	3
EE1204	ES	Computer Programming and Numerical Methods	4	0	30	70	100	3
EE 1205	ES	Industry 4.O	4	0	30	70	100	3
EE 1206	HSS	English Language Lab	0	3	50	50	100	1.5
EE 1207	BS	Green Chemistry Lab	0	3	50	50	100	1.5
EE 1208	ES	Computer Programming and Numerical Methods Lab	0	3	50	50	100	1.5
							Total Credits	**19.5**

B.Tech & B.Tech+M.Tech
II Year - I Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EE2101	BS	Operations Research	4	0	30	70	100	3
EE2102	PC	Network Theory	4	0	30	70	100	3
EE2103	PC	Electronic Circuits	4	0	30	70	100	3
EE2104	PC	Electrical Machines - I	4	0	30	70	100	3
EE2105	HSS	Managerial Economics	4	0	30	70	100	3
EE2106	PC	Electrical Networks Lab	0	3	50	50	100	1.5
EE2107	PC	Electrical Machines – I lab	0	3	50	50	100	1.5
EE2108	PC	Electronic Circuits Lab	0	3	50	50	100	1.5
EE2109	SC	Matlab & Interfacing	1	2	50	50	100	2
EE2110	MC	Professional Ethics & Universal Human values	0	0	-	100	100	0
EE2111	MC	NCC/NSS	0	2	-	-	-	0
							Total credits	**21.5**

B.Tech & B.Tech+M.Tech
II Year - II Semester

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EE2201	ES	Signals & Systems	4	0	30	70	100	3
EE2202	BS/PC	Electrical Measurements	4	0	30	70	100	3
EE2203	PC	Electrical Machines – II	4	0	30	70	100	3
EE2204	PC	EMF Theory	4	0	30	70	100	3
EE2205	PC	Electrical Engineering Materials	4	0	30	70	100	3
EE2206	PC	Electrical Machines – II Lab	0	3	50	50	100	1.5
EE2207	PC	Electrical Measurements lab	0	3	50	50	100	1.5
EE2208	SC	Electrical CAD	1	2	50	50	100	2
EE2209	MC	Environmental Science	0	0	-	100	100	0
							Total credits	**20**
Internship I								

EE-1101 MATHEMATICS-I

Course Objectives

- To transmit the knowledge of Partial differentiation.
- To know of getting maxima and minima of function of two variables and finding errors and approximations.
- To evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.

Course Outcomes

- Find the partial derivatives of functions of two or more variables.
- Evaluate maxima and minima, errors and approximations.
- Evaluate double and triple integrals, volumes of solids and area of curved surfaces.
- To expand a periodical function as Fourier series and half-range Fourier series.
- Have a fundamental understanding of Fourier series and be able to give Fourier expansions of a given function.

Syllabus

Partial Differentiation
Introduction - Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative - Change of variables – Jacobins. Mean value Theorems (without proofs)

Applications of Partial Differentiation
Geometrical interpretation -Tangent plane and Normal to a surface -Taylor's theorem for functions of two variables - Errors and approximations -Total differential. Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Differentiation under the integral Sign - Leibnitz's rule.

Multiple Integrals
Introduction - Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates - Triple Integrals - Change of Variables.

Multiple Integrals-Applications
Area enclosed by plane curves - Volumes of solids - Area of a curved surface - Calculation of Mass - Center of gravity - Moment of inertia - product of inertia – principal axes- Beta Function - Gamma Function - Relation between Beta and Gamma Functions. Error Function or Probability Integral.

Fourier Series
Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula. Practical Harmonic analysis.

Text Book

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, 43rd Edition, Khanna publishers.

Reference Books

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K.International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

EE-1102 PHYSICS

Course Objectives

- To impart knowledge in basic concept of physics of Thermodynamics relevant to engineering applications.
- To grasp the concepts of physics for electromagnetism and its application to engineering. Learn production of Ultrasonics and their applications in engineering.
- To Develop understanding of interference, diffraction and polarization: connect it to a few engineering applications.
- To Learn basics of lasers and optical fibers and their use in some applications.
- To Understand concepts and principles in quantum mechanics and Nanopahse Materials. Relate them to some applications.

Course Outcomes

- Understand the fundamentals of Thermodynamics and Laws of thermodynamics. Understand the working of Carnot cycle and concept of entropy.
- Gain Knowledge on the basic concepts of electric and magnetic fields. Understand the concept of the nature of magnetic materials. Gain knowledge on electromagnetic induction and its applications.
- Understand the Theory of Superposition of waves. Understand the formation of Newton's rings and the working of Michelson's interferometer. Remember the basics of diffraction, Evaluate the path difference. Analysis of Fraunhofer Diffraction due to a single slit
- Understand the interaction of matter with radiation, Characteristics of Lasers, Principle, working schemes of Laser and Principle of Optical Fiber. Realize their role in optical fiber communication.
- Understand the intuitive ideas of the Quantum physics and understand dual nature of matter. Compute Eigen values, Eigen functions, momentum of Atomic and subatomic particles using Time independent one Dimensional Schrodinger's wave equation. Understand the fundamentals and synthesis processes of Nanophase materials.

Syllabus

Thermodynamics
Introduction Heat and Work, First law of thermodynamics and applications, Reversible and Irreversible process, Carnot cycle and Efficiency, Second law of thermodynamics, Carnot's Theorem, Entropy, Second law in terms of entropy, Entropy and disorder, Third law of thermodynamics (statement only).

Electromagnetism
Concept of electric flux, Gauss's law - some applications, Magnetic field - Magnetic force on current, torque on current loop, The Biot-Savart's Law, B near a long wire, B for a circular Current loop, Ampere's law, B for a solenoid, Hall effect, Faraday's law of induction, Lenz's law, Induced magnetic fields, Displacement current, Maxwell's equations (no derivation), Magnetic materials: Classification of magnetic materials and properties.

Ultrasonics
Introduction, Production of Ultrasonics – Piezoelectric and Magnetostriction methods, acoustic grating, applications of ultrasonics.

Optics
Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films (reflected light), Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Introduction, Differences between interference and diffraction, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit **(**Qualitative and quantitative treatment**)**.

Polarisation: Polarisation by reflection, refraction and double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization.

LASERS and Fibre Optics
Introduction, characteristics of a laser beam, spontaneous and stimulated emission of radiation, population inversion, Ruby laser, He-Ne laser, Semiconductor laser, applications of lasers

Introduction to optical fibers, principle of propagation of light in optical fibers, Acceptance Angle and cone of a fibre, Numerical aperture, Modes of propagations, classification of fibers, Fibre optics in communications, Application of optical fibers.

Modern Physics
Introduction, De Broglie concept of matter waves, Heisenberg uncertainty principle, Schrodinger time independent wave equation, application to a particle in a box. Free electron theory of metals, Kronig - Penney model (qualitative treatment), Origin of energy band formation in solids, Classification of materials into conductors, semi conductors and insulators.

Nanophase Materials
Introduction, properties, Top-down and bottom-up approaches, Synthesis - Ball milling, Chemical vapour deposition method, sol-gel methods, Applications of nano materials.

Text Books
1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Physics by R.K. Gaur and S.L. Gupta –Dhanpat Rai

Reference Books
1. Modern Engineering Physics by A.S. Vadudeva
2. University Physics by Young and Freedman

EE1103 INTRODUCTION TO PYTHON

Course Objectives

- To develop skills on procedural oriented and object oriented programming in Python
- To understand and apply different data wrangling techniques using Python.
- To perform data analysis using python libraries like NumPy, Pandas and exploratory data analysis using Matplotlib

Course Outcomes

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

- Acquire programming knowledge on Basics of Python
- Acquire programming knowledge on Text and File Handling
- Develop Python programs to Mean, Median, Mode, Correlation
- Acquire programming knowledge on thinker
- Acquire programming knowledge on NumPy, Pandas Library
- Acquire programming knowledge on Graph Visualizations in Python and Data Analysis using Python

Syllabus

Introduction to Python: Introduction to Python
What Is Python, History of Python, Unique Features of Python, Python Identifiers, Keywords, Python Core objects and Functions, Integral Types, Floating Point Types,Strings**,** Tuples, Lists, Sets, dictionaries, Iterating and copying collections

Python built in Functions and OOP
Python user defined functions, Python packages functions, Defining and calling Function, The anonymous Functions, Loops and statement in Python, Python Modules & Packages, Overview of Object oriented programming- Creating Classes and Objects Accessing attributes Built-In Class Attributes Destroying Objects, Writing and Reading Text Files, Writing and Parsing Text Files.

Thinker and GUI Programming

Tkinter ,wxPython, JPython, Tkinter Widgets-Tkinter Button, Tkinter Canvas, Tkinter Checkbutton, Tkinter Menubutton, Tkinter Menu, Tkinter Scrollbar, Tkinter PanedWindow, Tkinter Text, Tkinter Message, Tkinter Label, Tkinter Frame, Tkinter Listbox

NumPy Arrays and Vectorized Computation
NumPy arrays, Array creation, Indexing and slicing, Fancy indexing, Numerical operations on arrays, Array functions, Data processing using arrays, Loading and saving data, Saving an array, Loading an array, Linear algebra with NumPy, NumPy random numbers

Data Analysis with Pandas:
An overview of the Pandas package, The Pandas data structure-Series, The Data Frame, The

Essential Basic Functionality: Re-indexing and altering labels , Head and tail, Binary operations, Functional statistics , Function application Sorting, Indexing and selecting data, Computational tools, Working with Missing Data, Advanced Uses of Pandas for Data Analysis - Hierarchical indexing, The Panel data

Data Analysis and Visualization:
Data munging, Cleaning data, Filtering, Merging data, Reshaping data, Data aggregation, Grouping data, The Matplotlib API primer-Line properties, Figures and subplots, Exploring plot types-Scatter plots, Bar plots, Histogram plots, Legends and annotations, Plotting functions with Pandas

Text Books

1. Programming in Python 3: A Complete Introduction to Python Language, Mark Summerfield, Second Edition, Addison-Wesley Publications
2. Python: End-to-End Data Analysis Learning Path, Module 1: Getting Started with Python Data Analysis , Phuong VothiHong , Martin Czygan, , Packt Publishing Ltd

Reference Books

1. Learning Python, 5th Edition, Mark Lutz, Orielly Publications
2. Python for Data Analysis, Wes McKinney, Orielly Publications
3. How to Think Like a Computer Scientist: Learning with Python 3 Documentation 3rd Edition, Peter Wentworth, Jeffrey Elkner, Allen B. Downey, Chris Meyers
4. Core Python Programming, Second Edition, Wesley J. Chun, Prentice Hall
5. Python Cookbook – Recipes for Mastering Python 3,3rdEdition, David Beazley, Brian K. Jones, Oreilly

EE-1104 FUNDAMENTALS OF ELECTRICAL ENGINEERING

Course objectives

- To familiarize the basic laws in Electrical engineering.
- To brief the components of electrical engineering.
- To explain the principles of various measuring instruments.
- To illustrate fundamentals of AC and DC networks.
- A brief introduction to electrical wiring.
- To analyze the behavior of electrical circuits.

Course outcomes

- Demonstrate the basic principles of electrical components.
- Outline electric circuits using network laws and reduction techniques.
- Illustrate the behaviour of basic circuit elements for an AC excitation.
- Outline the working principle and construction of the measuring instruments.
- Choose appropriate wiring schemes.

Syllabus

Electrical Engineering Fundamentals

Electrical circuit elements and sources, Ohm's law, effect of temperature on resistance, resistance temperature coefficient, insulation resistance, Series-parallel connection of inductors, rise and decay of current in inductive circuit, Concepts of mutual inductance, Concept of Potential difference. Charging and discharging of capacitor, Concepts of induced emfs, comparison between electric and magnetic circuit, Kirchhoff's laws, star-delta conversion.

Fundamental Laws of Electrical Engineering

Coulombs law of Electrostatics (1^{st} law and 2^{nd}), Faradays laws of Electromagnetic induction, Fleming Left hand and Right hand rules, Lenz's law, Biot-Savart's law, Ampere circuital law, Maxwell's corkscrew rule.

Alternating Current Fundamentals

Sinusoidal voltage and currents, their mathematical and graphical representation, concept of cycle, period, frequency, instantaneous value, peak value, average value, RMS value, Peak factor and Form factor; Phase difference, lagging, leading and in phase quantities; and phasor representation, Rectangular and polar representation of phasors, study of A.C circuits (RL, RC and RLC series circuits), Phasor diagrams, voltage, current, powers and power factor, Introduction to poly-phase systems.

Fundamentals of Electrical Measurements (no need to explain errors and compensations)

Classification of instruments, various forces in indicating instruments (deflection, control and damping), construction and operation of MI and MC type instruments for voltage and current measurement, Construction and operation of dynamometer type wattmeter, Construction and operation of single-phase induction type energy meter.

Electrical Wiring

Symbols for various electrical equipment, Service mains, meter board and distribution board, Types of wirings and their Installations, Various types of conductors, conductor sizes and current ratings, Examples of house wiring (one lamp-one switch, Stair case, Corridor wiring, Power wiring), Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's), significance of various parameters on name plates of equipment.

Note: The syllabus is prepared to give basic concepts of Electrical Engineering to First year students. Hence, in the evaluation, problems need to be avoided.

Text Books

1. Basic Electrical Engineering D. C. Kulshreshtha TMH 1st Edition.
2. S L Uppal and G C Garg, "Electrical Wiring, Estimating & Costing", Khanna Publishers, 2015.

Reference Books

1. Fundamentals of Electrical Engineering Rajendra Prasad PHI Third Edition 2014.
2. V. N. Mittal and Arvind Mittal, " Basic Electrical Engineering" McGraw Hill.
3. A.K.Sawhney, A Course in Electrical and Electronics Measurements and Instruments- DhanpatRai and Sons,Delhi, 2005.

EE-1105 BASIC ELECTRONICS ENGINEERING

Course objectives

- To brief evolution and impact of electronics.
- To illustrate principles and characteristics of semiconductor devices.
- To familiarize about various applications of electronic devices.
- To expose basic concepts and applications of op-amps.

Course outcomes

- Imparts the basic idea about types, specifications and common attributes of electronic components
- Familiarity in working with diodes, transistors, MOSFETs etc.,

Syllabus

Introduction
Evolution and Impact of Electronics in industries and in society, Familiarization of Resistors, Capacitors, Inductors, Transformers and Electro mechanical components

Semiconductor Diodes
Semiconductor materials- intrinsic and extrinsic types, Ideal Diode, Terminal characteristics of diodes: p-n junction under open circuit condition p-n junction under forward bias and reverse bias conditions p-n junction in breakdown region, Diode small signal model, Zener diode and applications, Rectifier Circuits, Clipping and Clamping circuits.

Bipolar Junction Transistors (BJTs)
Physical structure and operation modes, Active region operation of transistor, D.C. analysis of transistor circuits, Transistor as an amplifier, Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and voltage divider bias, Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers, Transistor as a switch: cut-off and saturation modes, High frequency model of BJT amplifier.

Field Effect Transistor (FET)
Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics, Depletion-type MOSFET, D.C. operation of MOSFET circuits, MOSFET as an amplifier, Biasing in MOSFET amplifiers, Basic MOSFET amplifier configuration: common source, common gate and common drain types, High frequency model of MOSFET amplifier, Junction Field-Effect Transistor (JFET).

Operation Amplifier (Op-amps)
Ideal Op-amp, Differential amplifier: differential and common mode operation common mode rejection ratio (CMRR), Practical op-amp circuits: inverting amplifier, non -inverting amplifier, weighted summer, integrator, differentiator, other applications of op-amps: instrumentation circuits, active filters, controlled sources.

Text Books

1. Bell, D. A., Electronic Devices and Circuits, Oxford University Press
2. Principles of Electronics, V.K.Mehta, S.Chand Publications.

References Books

1. Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education

EE1106 PYTHON PROGRAMMING LAB

Course Objectives

- To impart writing skill of Python programming to the students and solving problems.
- To write and execute programs in Python to solve problems such as modularize the problems into small modules and then convert them into programs.
- To write and execute programs in Python to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Python Programming languages.

Course Outcomes

- Understand various computer components, Installation of software. Python programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analysing the complexity of problems, modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of Python features including arrays, strings, structures and files.
- Apply and practice logical ability to solve the real-world problems.

List of Experiments

1) Write a python program to add two numbers.
2) Write a python program to print a number is positive/negative using if-else.
3) Write a python program to find largest number among three numbers.
4) Write a python Program to read a number and display corresponding day using if_elif_else?
5) Write a program to create a menu with the following options
   To Perform Addititon 2. To Perform Subtraction 3. To Perform Multipication 4. To Perform Division Accepts users input and perform the operation accordingly. Use functions with arguments.
6) Write a python program to check whether the given string is palindrome or not.
7) Write a python program to find factorial of a given number using functions.
8) Write a Python function that takes two lists and returns True if they are equal otherwise false
9) Write a program to double a given number and add two numbers using lambda ()?
10) Write a program for filter() to filter only even numbers from a given list
11) Write a program to design calculator using thinker library which can perform addition , subtractions, square root, division, multiplication, modulus

EE-1107 PHYSICS LAB

Course Objectives

- To enable the students to acquire skill, technique and utilization of the Instruments
- Draw the relevance between the theoretical knowledge and to imply it in a practical manner with respect to analyze various electronic circuits and its components.
- To impart the practical knowledge in basic concepts of Wave optics, Lasers and Fiber optics.
- To familiarize the handling of basic physical apparatus like Vernier callipers, screw gauge,
- spectrometers, travelling microscope, laser device, optical fibre, etc.

Course Outcomes

- Ability to design and conduct experiments as well as to analyze and interpret
- Ability to apply experimental skills to determine the physical quantities related to Heat, Electromagnetism and Optics
- The student will learn to draw the relevance between theoretical knowledge and the means to imply it in a practical manner by performing various relative experiments.

List of Experiments

1. Determination of Radius of Curvature of a given Convex Lens by forming Newton's Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy's Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray μ_o and Extraordinary μ_e ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth's Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.
11. Carey Foster's Bridge – Verification of laws of Resistance and determination of Specific Resistance.
12. Melde's Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

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EE-1108 **Electrical Engineering Workshop**

Course objectives

- To familiarize with different types of basic electrical circuits.
- To learn how to work with common electrical wiring components.
- To get hands on experience with house hold wiring.
- To familiarize with the working skills of electrical house hold items.

Course outcomes

- Can be able to work with electrical wiring components in real time applications.
- Can be able to build various parts with electrical wiring in day-to-day life.

List of Experiments

Ten experiments on electrical wiring of domestic and industrial applications, electrical testing of cables, earth resistance testing etc.

EE-1201 MATHEMATICS – II

Course Objectives

- The way of obtaining rank, eigen values and eigen vectors of a matrix.
- To know the importance of Cayley-Hamilton theorem and getting canonical form from a given quadratic form.
- To solve the system of equations by using direct and indirect methods.
- To solve first order and higher order differential equations by various methods.
- To obtain the Laplace transforms and inverse Laplace transforms for a given functions and their applications.

Course Outcomes

- Find rank, eigen values and eigen vectors of a matrix and understand the importance of Cayley-Hamilton theorem.
- Reduce quadratic form to canonical forms and solving linear systems by direct and indirect methods.
- Demonstrate solutions to first order differential equations by various methods and solve basic applications problems related to electrical circuits, orthogonal trajectories and Newton's law of cooling
- Discriminate among the structure and procedure of solving higher order differential equations with constant and variable coefficients.
- Understand Laplace transforms and its properties and finding the solution of ordinary differential equations.

Syllabus

Linear Algebra
Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Gauss Seidal Method. Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

Eigen Values and Eigen Vectors
Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications. Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form.

Ordinary Differential Equations of First Order and its Applications
Formation of ordinary differential equations (ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations - Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

Differential Equations of Higher Order
Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of

parameters - Cauchy's linear equation - Legendre's linear equation - Simultaneous linear differential equations.

Laplace Transforms

Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t – Evaluation of integrals by Laplace Transforms - Inverse Laplace Transform - Applications of Laplace Transforms to Ordinary Differential Equations - Simultaneous Linear Differential Equations with Constant Coefficients - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function and Laplace Transforms of Periodic Functions.

Text Book

1. Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, $43r^d$ edition, Khanna publishers.

Reference Books

1. Graduate Engineering Mathematics by V B Kumar Vatti., I.K. International publishing house Pvt. Ltd.
2. Advanced Engineering Mathematics by Erwin Kreyszig.
3. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal. Lakshmi Publications.
4. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
5. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

EE1202 GREEN CHEMISTRY

Course Objectives

- To know the sources of water, impurities and treatment methods of water.
- To know the types of batteries, their uses and batteries for Electrical Vehicles.
- To know about fuel cells, its working, different types and their applications.
- To know about the corrosion, types and methods to reduce corrosion.
- To identify the goals of Green Chemistry and application of Green Chemistry.

Course Outcomes

The student is able

- To know the Treatment methods of water and different water softening methods.
- To understand the construction of different types of batteries.
- To understand different types of Fuel Cells.
- To differentiate the types of corrosion and its eradication.
- To understand the concept of Green Chemistry and its importance.

Syllabus

Water Technology
Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis.

Batteries
Primary batteries: The chemistry - Types: Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells – liquid cathode, solid cathode and lithium-ferrous sulphide cells. Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells. Advanced Batteries for electric vehicles, requirements of the battery – sodium-beta and redox batteries.

Fuel Cells
Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells- Membranes and Fuels

Corrosion
Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion. Corrosion Controlling Methods, Protective Coatings, Metallic Coatings, Electroplating and Electroless Plating.

Green Chemistry and Technology

Introduction and significance of green chemistry, Goals of green chemistry, 12 principles of green chemistry, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-functional toxicity, functional group approaches to green chemistry, Elimination of toxic functional group, optimization of frameworks for the design of greener synthetic pathways, Applications of green chemistry - Green solvents, green fuels and propellants, biocatalysis.

Text Book

1. Engineering Chemistry – PC Jain and M. Jain – Dhanpath Rai and Sons, New Delhi.
2. A Text book of Engineering Chemistry – S. S. Dara – S. Chand & Co. New Delhi.
3. Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.

EE-1203 ENGLISH

Course Objectives

- To make students understand the explicit and implicit meanings of a text/topic;
- To give exposure to new words and phrases, and aid to use them in different contexts;
- To apply relevant writing formats to draft essays, letters, emails and presentations; and
- To adapt oneself to a given situation and develop a functional approach to finding solutions: adaptability and problem solving.

Course Outcomes

- Students will be able to analyze a given text and discover the various aspects related to language and literature;
- Learn the various language structures, parts of speech and figures of speech;
- Develop one's reading and writing abilities for enhanced communication; and
- Learn to apply the topics in real-life situations for creative and critical use.

Syllabus

On the conduct of life: William Hazlitt
Life skills: Values and Ethics
If: Rudyard Kipling

The Brook: Alfred Tennyson
Life skills: Self-Improvement
How I Became a Public Speaker: George Bernard Shaw

The Death Trap: Saki
Life skills: Time Management
On saving Time: Seneca

Chindu Yellama
Life skills: Innovation
Muhammad Yunus

Politics and the English Language: George Orwell
Life skills: Motivation
Dancer with a White Parasol: Ranjana Dave

Grammar
Prepositions – Articles – Noun-Pronoun Agreement, Subject-Verb Agreement – Misplaced Modifiers – Clichés, Redundancies.

Vocabulary
Introduction to Word Formation – Root Words from other Languages – Prefixes and Suffixes – Synonyms, Antonyms – Common Abbreviations

Writing
Clauses and Sentences – Punctuation – Principals of Good Writing – Essay Writing – Writing a Summary
Writing: Essay Writing
Life skills: Innovation
Muhammad Yunus

Textbook

1. Language and Life: A Skills Approach Board of Editors, Orient Blackswan Publishers, India. 2018.

References

1. Practical English Usage, Michael Swan. OUP. 1995.
2. Remedial English Grammar, F.T. Wood. Macmillan.2007
3. On Writing Well, William Zinsser. Harper Resource Book. 2001
4. Study Writing, Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills, Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English, Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

EE-1204 COMPUTER PROGRAMMING AND NUMERICAL METHODS

Course Objectives

- The course is designed to provide complete knowledge of C language.
- To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To provide knowledge to the students to develop logics which will help them to create programs, applications in C.
- This course aims to identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.
- This course provides the fundamental knowledge which is useful in understanding the other programming languages.

Course Outcomes

- Identify basic elements of C programming structures like data types, expressions, control statements, various simple functions and Apply them in problem solving.
- Apply various operations on derived data types like arrays and strings in problem solving.
- Design and Implement of modular Programming and memory management using Functions, pointers.
- Apply Structure, Unions and File handling techniques to Design and Solve different engineering programs with minimal complexity.
- Apply Numerical methods to Solve the complex Engineering problems.

Syllabus

Introduction to C
Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations Formatted Input, Formatted Output.

Decision Making, Branching, Looping, Arrays & Strings
Decision making with if statement, Simple if statement, The if…else statement, Nesting of if…else statement, the else..if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, the do statement, The for statement, Jumps in Loops ,One, Two-dimensional Arrays, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

Functions
Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, the scope, visibility and lifetime of variables.

Pointers
Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays,

pointers and character strings, array of pointes, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications

Structure and Unions

Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

File handling

Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments- Program Applications

Numerical Methods

Solutions of Algebraic and Transcendental Equations, Bisection Method, Newton Raphson Method. Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals. Numerical Integration: Trapezoidal rule, Simpson's 1/3 rules. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

Text Book

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.
2. Introduction to Numerical Methods, SS Sastry, Prentice Hall.

Reference Books

1. Let Us C,YashwantKanetkar, BPB Publications, 5th Edition.
2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, " 3rd Edition, Thomson, 2007.
3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI.
4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

EE1205 INDUSTRY 4.0

Course Objective

- This course provides students with an introduction to Industry 4.0, its buildingblocks, its applications and advantages compared to conventional production techniques.
- Learners get a deep insight into components and technologies of industry 4.0 canbe used to build up the production of the future.
- It is also important that the theory is deepened by means of roadmap technologies with phase wise developments.
- To expand Robotic technology with Augmented reality for Industry 4.0 and obstacle with framework conditions for Industry 4.0

Course Outcomes
Students will be able to:

- Describe Industry 4.0 and scope for Indian Industry
- Demonstrate conceptual framework and road map of Industry 4.0
- Describe Robotic technology and Augmented reality for Industry 4.0
- Demonstrate obstacle and framework conditions for Industry 4.0

Syllabus

Introduction to Industry 4.0
Introduction, Idea of Industry 4.0, Various Industrial Revolutions, Origin concept of Industry 4.0,Industry 4.0 Production system, How is India preparing for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory.

Trends in Industry 4.0
Introduction, Main Concepts and Components of Industry 4.0, State of Art Technologies, Proposed Framework for Industry 4.0, Trends of Industrial Big Data and Smart Business Transformation.

Roadmap for Industry 4.0
Introduction, Proposed Framework for Technology Roadmap: Strategy Phase, Development Phase, Smart Manufacturing, Types of Smart Devices, Smart Logistics, Smart Cities, Predictive Analytics.

Advances in the Era of Industry 4.0
Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Things, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly, IIoT- Industrial IoT.

The Role of Industry 4.0 and Future Aspects
Introduction, Challenges & Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world.

Reference Books:

1. Alp Ustundag and Emre Cevikcan,"Industry 4.0: Managing the Digital Transformation".
2. Bartodziej, Christoph Jan,"The Concept Industry 4.0".
3. Klaus Schwab,"The Fourth Industrial Revolution".
4. Christian Schröder ,"The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".

List of Open Source Software/learning website:

1. www.nptel.ac.in/

(Material Is Readily Available On Internet)

EE-1206 ENGLISH LANGUAGE LAB

Course Objectives

- To make students recognize the sounds of English through Audio-Visual aids;
- To help students build their confidence and help them to overcome their inhibitions and self consciousness while speaking in English;
- To familiarize the students with stress and intonation and enable them to speak English effectively; and
- To give learners exposure to and practice in speaking in both formal and informal contexts.

Course Outcomes

- Students will be sensitized towards recognition of English sound patterns and the fluency in their speech will be enhanced;
- A study of the communicative items in the laboratory will help students become successful in the competitive world;
- Students will be able to participate in group activities like roleplays, group discussions and debates; and
- Students will be able to express themselves fluently and accurately in social as well professional context.

Syllabus

Introduction to Phonetics
The Sounds of English (Speech sound – vowels and consonants) - Stress and Intonation - Accent and Rhythm.

Listening Skills
Listening for gist and specific information - listening for Note taking, summarizing and for opinions - Listening to the speeches of eminent personalities.

Speaking Skills
Self-introduction - Conversation Skills (Introducing and taking leave) - Giving and asking for information - Role Play - Just A Minute (JAM) session - Telephone etiquette.

Reading and Writing skills
Reading Comprehension – Précis Writing - E-Mail writing - Punctuation.

Presentation skills
Verbal and non-verbal communication - Body Language - Making a Presentation.

Reference Books

1. Ashraf Rizvi. *Effective Technical Communication*. Tata McGraw Hill Education Private Limited, New Delhi.
2. *Speak Well*. Orient Blackswan Publishers, Hyderabad.
3. Allan Pease. *Body Language*. Manjul Publishing House, New Delhi.

EE-1207 GREEN CHEMISTRY LAB

Course Objectives:

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare ion exchange/ zeolite column for removal of hardness
- To develop the skill of green synthesis through the preparation of a polymer/ drug

Course Outcomes

- The students are able to determine the amount of various chemical species in solutions by titrations quantitatively with accuracy
- The students are able to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The students develop skills to synthesise a polymer or a drug

SYLLABUS

1. Determination of Sodium Hydroxide with HCl (Na_2CO_3 Primary Standard)
2. Determination of Alkalinity (Carbonate and Hydroxide) of water sample
3. Determination of Chromium (VI) by Mohr's Salt Solution
4. Determination of Hardness of Water sample by EDTA method
5. Ion exchange/ Zeolite column for removal of hardness of water
6. Green Synthesis of Polymer/ drug

Text Books:

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.

2. Experiments in Applied Chemistry (For Engineering Students) – Sirita Rattan – S. K. Kataria & Sons, New Delhi

EE-1208 COMPUTER PROGRAMMING AND NUMERICAL METHODS LAB

Course Objectives

- To impart writing skill of C programming to the students and solving problems.
- To write and execute programs in C to solve problems such as Modularize the problems into small modules and then convert them into programs.,
- To write and execute programs in C to solve problems such as arrays, files, strings, structures and different numerical methods.
- This reference has been prepared for the beginners to help them understand the basic to advanced concepts related to Objective-C Programming languages.

Course Outcomes

- Understand various computer components, Installation of software. C programming development environment, compiling, debugging, and linking and executing a program using the development environment.
- Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs.
- Construct programs that demonstrate effective use of C features including arrays, strings, structures, pointers and files.
- Apply and practice logical ability to solve the real-world problems.
- Apply Numerical methods to Solve the complex Engineering problems.

List of Experiments

1. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
2. Write a program, which generates 100 random integers in the range of 1 to 100. Store them in an array and then print the arrays. Write 3 versions of the program using different loop constructs. (e.g. for, while, and do while).
3. Write a set of string manipulation functions e.g. for getting a sub-string from a given position, Copying one string to another, Reversing a string, adding one string to another.
4. Write a program which determines the largest and the smallest number that can be stored in different data types like short, int, long, float, and double. What happens when you add 1 to the largest possible integer number that can be stored?
5. Write a program, which generates 100 random real numbers in the range of 10.0 to 20.0, and sort them in descending order.
6. Write a function for transposing a square matrix in place (in place means that you are not allowed to have full temporary matrix).
7. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.
8. Given two points on the surface of the sphere, write a program to determine the smallest arc length between them.
9. Implement bisection method to find the square root of a given number to a given accuracy.
10. Implement Newton Raphson method to det. a root of polynomial equation.
11. Given table of x and corresponding f(x) values, Write a program which will determine f(x) value at an intermediate x value by using Lagrange's interpolation/

12. Write a function which will invert a matrix.
13. Implement Simpson's rule for numerical integration.
14. Write a program to solve a set of linear algebraic equations.

EE2101 OPERATIONS RESEARCH

Course Objectives

- To introduce optimization techniques to students.
- To explain linear programming, transportation problem, assignment problem, pert network with few computations.
- To discuss few inventory models.

Course Outcomes

At the end of this course, students will demonstrate the ability to

- Analyze any real-life system with limited constraints and depict it in a model form.
- Convert the problem into a mathematical model.
- Understand variety of problems such as assignment, transportation, travelling salesman etc.

Syllabus

Introduction to Optimization

Engineering Applications of Optimization, Statement of Problem, Classification of Optimization Problem Techniques.

Linear Programming

Introduction, Requirements for a LP Problem, Examples on The Application of LP, Graphical Solution of 2-Variable LP Problems, Some Exceptional Cases, General Mathematical Formulation For LPP, Canonical and Standard Forms of LP Problem, Simplex Method, Examples on The Application of Simplex Techniques.

Artificial Variable Techniques

Big-M Method and Two-Phase Techniques.

Transportation Problem

Matrix Terminology, Definition and Mathematical Representation of Transportation Model, Formulation and Solution of Transportation Models (Basic Feasible Solution by North-West Corner Method, Inspection Method. Vogell's Approximation Method).

Assignment Problem

Matrix Terminology, Definition of Assignment Model, Comparison with Transportation Model, Mathematical Representation of Assignment Model, Formulation and Solution of Assignment Models.

Pert Network

Introduction, Phases of Project Scheduling, Network Logic, Numbering the Events (Fulkerson's Rule), Measure of Activity.

Pert Network Computations

Forward Pass and Backward Pass Computations, Slack Critical Path, and Probability of Meeting the Scheduled Dates.

Inventory Models

Introduction, Necessity for Maintaining Inventory, Classification of Inventory Models, Inventory Models with Deterministic Demand, Demand Rate Uniform Production Rate Infinite, Demand Rate Non-Uniform Production Rate Finite, Demand Rate Uniform-Production Rate Finite.

Game Theory: Useful Terminology, Rules for Game Theory, Saddle Point, Pure Strategy, Reduce Game by Dominance, Mixed Strategies, 2x2 Games Without Saddle Point.

Text Books

1. "Operations Research-An Introduction' By H.Taha, Prentice Hall Of India Pvt. Ltd.
2. "Engineering Optimization-Theory & Practice" By S.S. Rao, New Age International (P) Ltd.

Reference Books

1. "Operations Research – An Introduction" By P.K.Gupta& D.S.Hira, S. Chand & Co. Ltd

EE2102 NETWORK THEORY

Course Objectives

- To enrich the students to acquire knowledge about the basics of circuit analysis, network theorems, concepts of AC circuits, coupled & three phase circuits, transient analysis.
- Explain the basic laws and theorems of DC circuits.
- Discuss the DC transients for RL, RC & RLC circuits and explain about Magnetic Circuits.
- Explain different types of Laplace Transforms of different signals and their response when applied to simple circuits.

Course Outcomes

At the end of this course, a student

- Will be able to articulate in working of various components of a circuit.
- Will be familiar with ac and dc circuits solving.
- Will be ready with the most important concepts like mesh and nodal analysis.
- Ability to measure three phase voltages and current, active, reactive powers
- Ability to convert Three phase Star to Three phase Delta circuits and Vice-Versa.
- Ability to Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits.

Syllabus

Introduction of Network Elements

Basic definition of the unit of Charge, Voltage, Current, Power and Energy, Circuit concept, Active and Passive circuit elements; Ideal, Practical and dependent sources and their V-I characteristics, Reference Directions for current and voltage, Energy stored in Inductors and Capacitors ,Kirchhoff's Laws, Voltage and Current Division Nodal Analysis, Mesh Analysis, Star-Delta transformation, Source Transformation.

Network Theorems

Linearity and Superposition, Thevenin's and Norton's Theorem, Reciprocity, Compensation, Maximum power transfer theorems, Tellegan's and Millman's theorems, Application of theorems to DC circuits.

DC Transients

Inductor, Capacitor, Source free RL, RC and RLC Response, Evaluation of Initial conditions, application of Unit-step Function to RL, RC and RLC Circuits, Concepts of Natural, Forced and Complete Response.

Introduction of Alternating Circuits

The Sinusoidal Forcing Function Instantaneous, Peak, Average and RMS values of Voltage and Current; Crest factor, Form factor; Concept of phase and phase difference in sinusoidal waveforms; Phase relation in pure resistor, Inductor and capacitor; Impedance diagram, phasor diagram, series and parallel circuits, compound Circuits, Instantaneous and Average Power, Complex Power Computation of active, reactive and complex powers; power triangle, power factor.

Sinusoidal Steady State Analysis

Steady State Analysis Using Mesh and Nodal Analysis, Application of Network Theorems to AC Circuits, Series resonance, Impedance and phase angle, voltages and currents, bandwidth and Q factor and its effect on bandwidth, parallel resonance, resonant frequency, variation of impedance with frequency, Q factor and its effect on bandwidth, Balanced 3-phase circuits, Resonance, Concept of Duality. Magnetically Coupled Circuits, Dot Convention, Y, Z, H, A,B,C,D – Parameters of Two – Port Networks.

Laplace Transform Techniques

Transforms of Typical Signals, Response of Simple Circuits to Unit – Step, Ramp and Impulse Functions, Initial and Final Value Theorem, Convolution Integral, Time Shift and Periodic Functions, Transfer Function.

Text Books

1. Engineering Circuit Analysis, Willam H. Hayt Jr., and Jack E. Kemmerly, 5th Edition, McGraw Hill.
2. Electric circuits by J.A Edminister (Schaum outline series)

Reference Books

1. Franklin F. Kuo, Network Analysis and Synthesis, 2nd Edition, John Wiley & Sons
2. Network Analysis, M. E. Vanvalkenburg, 3rd Edition, PHI**.**

EE2103 ELECTRONIC CIRCUITS

Course Objectives

- To familiarize the students with theory of various kinds of amplifiers and oscillators.
- To explain concepts of gain, band-width and gain band-width product.
- To analyze all kinds of feedback amplifiers.
- To deal with various aspects of power amplifiers and tuned voltage amplifiers.
- To introduce operational amplifiers and their applications

Course Outcomes

At the end of this course, students will demonstrate the ability to

- Understand the characteristics of transistors.
- Design and analyze various rectifier and amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

Syllabus

Multistage Amplifiers

BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Band Width of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

Feedback Amplifiers

Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

Sinusoidal Oscillators

Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators – Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators -- RC Phase Shift and Wein bridge Oscillators.

Power Amplifiers

Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier, Derating Factor – Heat Sinks.

Tuned Voltage Amplifiers

Single Tuned and Stagger Tuned Amplifiers – Analysis – Double Tuned Amplifier – Bandwidth Calculation.

Operational Amplifiers

Concept of Direct coupled amplifiers, Ideal Characteristics, Differential amplifier, normalized transfer characteristics, Measurement of Op-Amp Parameters.

Applications of Op-Amps: Inverting and Non-inverting Amplifiers, Integrator, Differentiator, Comparator, Logarithmic Amplifiers, Instrumentation Amplifiers.

Text Books

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias, McGrawHill, 1972
2. Electronic Devices & Circuits, K VenkataRao and K Rama Sudha, McGraw Hill Education, 1986.

Reference Books

1. Linear Integrated Circuits, D Choudhury Roy, New Age International Pvt Ltd, publishers, New Delhi,2004
2. Electronic Devices and Circuits – G.K.Mithal, Khanna Publishers, 23rd Edition, 2004.
3. OP-Amps and Linear Integrated Circuits, Gayakwad, 4th ed. PHI publications, 1993.

EE2104 ELECTRICAL MACHINES – I

Course Objectives

- To familiarize the concepts of electro-mechanical energy conversion principles.
- To know the concept of dc machines.
- To know about different testing methods of a dc machine.
- To find out the efficiency and regulation characteristics of a dc machine
- To know the principle of operation of a Transformer
- To draw the phasor diagrams of transformer under no-load and also different load conditions to represent the primary and secondary quantities.
- To explain the single and three phase transformers and their testing

Course Outcomes

At the end of this course, students will demonstrate the ability to

- Understand the operating principle of DCmotor and DC generator
- Able to find the efficiency of a dc motors and dc generator when the specifications are given.
- Able to find the efficiency of a transformer .
- Able to know different testing methods of a transformer
- To know about construction features of single and three-phase transformers.

Electro-mechanical Energy Conversion:
Principles, Forces and Torques inMagnetic Field Systems, Energy Balance, Energy and Force in Singly Excited Magnetic Field System, Co-energy, Multiply Excited Magnetic Field Systems.

D.C. Generators:
Principle of Operation, Constructional Features, EMF Equation of a D.C. Generator, Collection and Flow of Current from Armature, Armature Reaction, Methods to Reduce Effects of Armature Reaction and Commutation Process, Armature Winding Diagram (Lap and Wave), Methods of Excitation, Generator Characteristics, Parallel Operation, Losses in DC Generator, Power Stages in D.C. Generator, Efficiency, Condition for Maximum Efficiency of a dc generator and Applications.

D.C. Motors:
Principle of operation, Types of DC Motors, Significance of Back Emf, condition for maximum power, Torque and Speed Equations, Starting and necessity of Starters, Types of Starters, DC Motor characteristics, Speed Control Methods of a D.C. Motors, Losses occur in DC Motors, Power Stages in D.C. Motor, Condition for Maximum Efficiency and Applications. Brake Test, Swinburne's Test, Hopkinson's Test, Retardation Test, Field's Test and Separation of Losses.

Transformers:

Principle of operation, Constructional features, Types of Transformers, emf equation of a Transformer, Ideal Transformer, Practical Transformer on No-Load and Load and its vector diagrams, Equivalent Circuit of a Transformers, Losses in a Transformer, Voltage Regulation and Efficiency, Testing of a Transformers, All Day Efficiency, Condition for Maximum Efficiency of a Transformer, auto transformers, tap changers on transformers, Parallel Operation of single phase transformers.Concepts of Three-phase Connections-Y/Y, Delta-Delta, Wye/Delta, Delta/Wye, Open-Delta Connections, Three-phase to Two-Phase conversion and vice-versa.

TEXT BOOKS:

1. DR.P.S.BIMBHRA, Electrical Machinery, KHANNA PUBLISHERS, New Delhi, 7th edition, 1995.
2. D P KOTHARI and I J NAGRATH, Electrical Machines, Mc Graw Hill Education Private Limited, New Delhi, 4th edition, 2010.

Reference Books:

1. A E Fitzgerald, Charles Kingsley Jr. and Stephen d. Umans, Electric Machinery, McGraw Hill, New Delhi, 6th edition, 2003.
2. A E Clayton and N N Hancock, The performance and Design of Direct Current Machines, CBS Publishers & Distributors Pvt. Ltd., 2004.
3. M G Say, The performance and Design of Alternating Current Machines, CBS Publishers & Distributors Pvt. Ltd., 2002.

EE2105 MANAGERIAL ECONOMICS

Course Objectives:

1. To bring about an awareness about the nature of Managerial Economics and its linkages with other disciplines.
2. To understand the Micro and Macro Environment of Business.
3. To familiarize the prospective engineers with the concepts and tools of Managerial Economics with an objective to understand the real world of business.

Course Outcomes:

After completion of the course, student will be able to:

1. Understand the various economic activities in business and industry.
2. Analyse the real world business problems.
3. Make optimal business decisions for the effective and efficient management of Organisations.

Significance of Economics and Managerial Economics:

Economics: Definitions of Economics- Wealth, Welfare and Scarcity definitions Classification of Economics- Micro and Micro Economics.

Managerial Economics: Definition, Nature and Scope of Managerial Economics, Differences between Economics and Managerial Economics, Main areas of Managerial Economics, Managerial Economics with other disciplines.

Demand and Utility Analysis:

Demand - Definition, Meaning, Nature and types of demand, Demand function, Law of demand - Assumptions and limitations. Exceptional demand curve.

Elasticity of demand - Definition, Measurement of elasticity, Types of Elasticity (Price, Income, Cross and Advertisement), Practical importance of Price elasticity of demand, Role of income elasticity in business decisions, Factors governing Price Elasticity of demand.

Utility Analysis: Utility- Meaning, Types of Economic Utilities, Cardinal and Ordinal Utility, Total Utility, Marginal Utility, The law of Diminishing Marginal Utility and its Limitations**.**

Theory of Production and Cost analysis:

Production - Meaning, Production function and its assumptions, use of production function in decision making;

Cost analysis - Nature of cost, Classification of costs - Fixed vs. Variable costs, Marginal cost, Controllable vs. Non - Controllable costs, Opportunity cost, Incremental vs. Sunk costs, Explicit vs. Implicit costs, Replacement costs, Historical costs, Urgent vs. Postponable costs, Escapable vs. Unavoidable costs, Economies and Diseconomies of scale.

Market Structures : Definition of Market, Classification of markets; Salient features or conditions of different markets - Perfect Competition, Monopoly, Duopoly , Oligopoly, Importance of kinked demand curve ;Monopolistic Competition.

Pricing and Business Cycles:

Pricing Analysis : Pricing – Significance; Different Pricing methods- Cost plus pricing, Target pricing, Marginal cost pricing, Going -rate pricing, Average cost pricing, Peak load pricing , Pricing of joint Products, Pricing over the life cycle of a Product, Skimming pricing Penetration pricing, Mark- up and Mark- down pricing of retailers.

Business cycles - Definition, Characteristics, Phases, Causes and Consequences; Measures to solve problems arising from Business cycles.

Text Books:

1. Sankaran,S., **Managerial Economics,** Marghan Publications, 2015, Chennai.
2. Aryasri, A.R., **Managerial Economics and Financial Analysis,** MC Graw Hill Education, New Delhi,2015.

Reference Books:

1. Dwivedi, D.N., **Managerial Economics,** Vikhas Publishing House Pvt. Ltd. 6th Edition, New Delhi,2004.
2. Dewett, K.K., **Modern Economic Theory**, S.Chand & Company Ltd., New Delhi, 2005.

EE2106 ELECTRICAL NETWORKS LAB

Course Objectives

- To enhance student learning by applying knowledge and skills to provide solutions to Electrical and Electronics Engineering problems in industry and governmental organizations
- To identify, formulate, design and investigate complex engineering problems of electric circuits.
- Work as a team with a sense of ethics and professionalism, and communicate effectively with a practical orientation.

Course Outcomes

After completion of this course, a student will be

- Able to analyze and design DC and AC circuits.
- Able to apply concepts of electrical circuits throughout engineering.
- Able to evaluate response in any given network using theorems
- Able to analyze a given network by applying various Network Theorems

List of Experiments

1. Verification of ohm's law and to measure filament lamp resistance.
2. Verification of Kirchhoff's law
3. Verification of Thevenin's theorem
4. Verification of Norton's theorem
5. Verification of superposition theorem.
6. Verification of Maximum Power Transfer theorem.
7. Verification of Reciprocity theorem.
8. Two Port Network Parameters
9. Time response of first order RC / RL network for periodic non – sinusoidal inputs – Time constant and Steady state error determination
10. Series and Parallel Resonance
11. Measurement of Active Power for Star and Delta connected balanced loads
12. Measurement of reactive Power for Star and Delta connected balanced loads

EE2107 ELECTRICAL MACHINES – I LAB

Course Objectives

- To understand design and each part of dc electrical machines.
- To gain expertise in controlling dc electrical machines.
- Also to perform tests on dc electrical machines and determine their characteristics.

Course Outcomes

After completion of course, a student will be able to

- Analyze DC electrical machines.
- To define characteristics of dc machines.
- To test them in various methods.

List of Experiments

1. Magnetization characteristics of DC shunt generator.
2. Load characteristics of DC shunt generator.
3. Load characteristics of DC compound generator (cumulative & differential) (long shunt)
4. Load characteristics of DC compound generator (cumulative & differential) (short shunt)
5. Swinburne‘s test and Pre-determination of efficiencies as Generator and Motor.
6. Brake test on DC shunt motor. Draw the performance characteristics
7. Load test on DC Series motor.
8. Hopkinson‘s test on DC shunt machines. Pre-determination of efficiency.
9. Speed control of DC shunt motor by Field and Armature Control.
10. Separation of losses in DC shunt motor.
11. O.C. & S.C. Tests on Single phase Transformer
12. Sumpner’s test on single phase transformers
13. Scott connection of transformers

Any other Experiments can be drafted basing on the theory course#

EE2108 ELECTRONIC CIRCUITS LAB

Course Objectives

- To study various feedback Amplifiers, oscillators practically
- To study various feedback Amplifiers, oscillators through software simulations.

Course Outcomes

- To understand the concepts of variousfeedback Amplifier, oscillators practically
- To understand the concepts of various feedback Amplifier, oscillators through software simulations.

LIST OF EXPERIMENTS

1. Current series feedback Amplifier
2. Colpitts oscillator
3. RC-Phase shift oscillator
4. Two stage RC-Coupled Amplifier
5. Wein bridge oscillator
6. Hartley Oscillator
7. Class-B Push pull Amplifier
8. Voltage series feedback Amplifier
9. Common source FET Amplifier
10. Tuned Voltage Amplifier

Any other Experiments can be drafted basing on the theory course#

EE2109 MATLAB & INTERFACING

Course Objectives

- To understand the MATLAB software
- To write program for electrical applications
- To simulate an electric and electronic circuit.

Course Outcomes

- After successful completion of the course the students should be able to
- They become familiar with the basic circuit components and know how to connect them to make a real electrical circuit.
- They become familiar with basic electrical measurement instruments and know how to use them to make different types of measurements.
- Be able to verify the laws and principles of electrical circuits, understand the relationships and differences between theory and practice.
- Be able to gain practical experience related to electrical circuits, prompt more interest and motivation for further studies of electrical circuits.
- Be able to carefully and thoroughly document and analyse experimental work.

. **List of Experiments**

1. Introduction to MATLAB, MATLAB help system, Simulink Tools.
2. Verification of network theorems using MATLAB/Simulink. Those are
    a) Verification of ohm's law.
    b) Verification of KVL&KCL.
    c) Verification of Thevenin's Theorem.
    d) Verification of Norton's Theorem.
    e) Verification of Maximum Power Transfer Theorem.
    f) Verification of Superposition Theorem.
    g) Verification of Reciprocity Theorem.
3. Verification of Two-port Network Parameters using MATLAB/Simulink.
4. Verification of Half-wave Rectifier, observe the waveforms and calculate average value, RMS value, form factor and ripple factor using MATLAB/Simulink.
5. Verification of Full-wave Centre Tapped Rectifier, observe the waveforms and calculate average value, RMS value, form factor and ripple factor using MATLAB/Simulink.
6. Verification of Full-wave Bridge Rectifier, observe the waveforms and calculate average value, RMS value, form factor and ripple factor using MATLAB/Simulink.
7. To study initial conditionsand External Characteristics of DC Shunt motor using MATLAB/Simulink
8. To study Speed Control of DC Shunt motor using MATLAB/Simulink.

#The programs/experiments can be drafted to make the student acquainted with the latest concepts Related to Electrical Engineering#

Textbooks

1. MATLAB and Simulation Books NI Engineering Signals and Systems, 2nd edition
2. Introduction to MATLAB for Engineers William J. Palm III.

Internal resources

1. MATLAB Programming for Numerical Computation, NPTEL, SWAYAM Portal.

EE2110 PROFESSIONAL ETHICS AND UNIVERSAL HUMAN VALUES

Course Objectives:

- To recognize the moral values that should guide the Engineering profession.
- To resolve moral issues concerning one's profession.
- To develop and exhibit a set of moral beliefs and attitudes that engineers should inculcate.
- To inculcate social values and morality in one's life.
- To develop awareness about Professional/Engineering Ethics and Human Values.

Course Outcomes:

Students will be able to:

- Apply the conceptual understanding of ethics and values into everyday practice.
- Understand the importance of moral awareness and reasoning in life.
- Acquire professional and moral etiquette that an engineer requires.
- Develop the acumen for self-awareness and self-development.
- Develop cultural tolerance and integrity.
- Tackle real-life challenges with empathy.

Syllabus

HUMAN VALUES

Values - Respect - Caring - Sharing - Honesty- Courage - Self confidence - Communal Harmony
Morals - Virtues

PROFESSIONAL VALUES

Integrity - Discipline - Valuing time - Cooperation - Commitment - Code of conduct - Challenges in the workplace

PROFESSIONAL ETHICS

Overview - Engineering ethics - Moral issues - Profession - Models of professional roles - Responsibility

RESPONSIBILITIES AND RIGHTS

Safety and risk - Collegiality and loyalty - Confidentiality - Occupational crime - Human rights - Employee rights - Intellectual property rights

GLOBAL ISSUES

Globalization - Environmental ethics - Computer ethics - Code of ethics - Multinational corporations - Engineers as advisors in Planning and Policy making

Textbook:

R.S. Nagarazan. *A Textbook on Professional Ethics and Human Values.* New Age International Publishers. 2006.

Reference Books:

Premvir Kapoor. *Professional Ethics and Human Values.* Khanna Publishing House. 2019.
B.S. Raghavan. *Human Values and Professional Ethics*. S.Chand Publications. 2012.
R.R. Gaur & Others. *A Foundation Course in Human Values and Proff. Ethics*. Excel Books. 2009.
A. N. Tripathi. *Human Values*. New Age International (P) Limited. 2009
R. Subramanian. *Professional Ethics*. OUP India. 2013.

EE2111 NCC/NSS

Course Objectives

1. To evoke social consciousness among students through various activities.
2. To develop youth leadership in the students
3. To create awareness of the students in Attention, saluting, etc.
4. To create the awareness of all kinds of discipline to the students

Course Outcomes

After completion of this course, student will be able to:-

1. Maintain his physical fitness and health.
2. Maintain disciplines of all kinds.
3. Create self interest in various sports.
4. Take leadership

NCC/ NSS training is compulsory for all the Undergraduate students. A student will be required to participate in an activity during the first or second semesters of second year.

1. The activities will include Practical / field / Extension /outreach activities.
2. The activities shall be carried out outside class hours.
3. The student participation shall be for a minimum period of 24 hours per semester during the first or second semesters of second year.
4. The activities will be monitored by the respective faculty in charge and HOD
5. Grades will be awarded on the basis of participation, attendance, performance and behavior. Grades shall be entered in the mark statement as given below:
   a.SATISFACTORY or UNSATISFACTORY
6. If a student gets an unsatisfactory Grade, he/she has to repeat the above activity in the subsequent years, along with the preceding year students**.**

E2201 SIGNALS & SYSTEMS

Course Objectives

- To understand the fundamental properties of linear systems
- Use linear systems tools, especially transform analysis and convolution, to analyze and predict the behavior of linear systems
- Apply properties of the Fourier Transforms and Z-transforms.

Course Outcomes

After completion of this course, a student

- Able to describe signals mathematically and to perform mathematical operations on signals to classify the signals.
- Able to compute the output of an LTI system for a given input.
- Able to find Fourier series coefficients of a periodic signal.
- Able to find Z transform of a discrete-time signal.

Syllabus

Size of a Signal, Signal Energy, Signal Power, Some Useful Signal Operations, Time Shifting, Time Scaling, Time Reversal, Combined Operations.

Classification of Signals
Continuous-Time and Discrete-Time Signals, Analog and Digital Signals, Periodic and Aperiodic Signals, Energy and Power Signals, Deterministic and Random Signals.

Some Useful Signal Models
Unit Step Function u(t), The Unit Impulse Function, The Exponential Function, Even and Odd Functions, Some Properties of Even and Odd Functions, Even and Odd Components of a Signal.

Systems, Classification of Systems
Linear and Nonlinear Systems, Time-Invariant and Time-Varying Systems, Instantaneous and Dynamic Systems, Causal and Non-causal Systems, Continuous-Time and Discrete-Time Systems, Analog and Digital Systems, Invertible and Noninvertible Systems, Stable and Unstable Systems.

Properties of Systems
Linear Time – invariant Systems. Continuous Time and Discrete time.

Fourier series
Convergence of Fourier series, Fourier Transform. Periodic Signals and Continuous and discrete Fourier Transform. Z-transform of a Discrete Sequence, Region of Convergence for the Z transform. Inverse Z-transform, Properties of Z-transform, Relation Between Z and Fourier Transform.

Linear Time – Invariant (LTI) Systems
Representation of Signals in terms of Impulses, Discrete Time LTI Systems, the Convolution Sum, Continuous Time LTI Systems, the Convolution Integral. Properties of LTI Systems, Systems

described by Differential and Difference Equations. Block Diagram Representation of LTI Systems described by Differential Equations and, Singularity Functions.

Frequency Response
Characterized by Linear Constant Coefficient Differential Equations. First-order and Second-order Systems. Representation of DTFT, First-order and Second-order Systems.

Sampling Theorem, Reconstruction of a Signal from Samples, the Effect of under sampling, Discrete Time Processing of Continuous Time Signals. Sampling in Frequency Domain, Sampling of Discrete Time Signals.

Text Books

1. V. Oppenheim et al., (1997) Signals & Systems (2nd Edition), Prentice Hall.,
2. Principles Of Linear Systems and Signals, B.P. Lathi, Oxford University Press
3. Signals and Systems, Ramakrishna Rao, Shankar Prakriya, Mc Graw Hill Education India

Reference Books

1. Theory and Problems of Signals and Systems, Hwei P. Hsu, Schaums Outline Series.
2. Open Course Ware Material Signals and Systems, Massachusetts Institute of Technology.

EE2202 ELECTRICAL MEASUREMENTS

Course objectives:

- Gain knowledge between different types analog and digital measurements.
- Study the characteristics of moving element measurements
- Study the concepts of measuring various electrical parameters/quantities
- Knowledge regarding the magnetic measurement & devices.
- To study various bridges and their applications.
- To study various potentiometers configurations.

Course Outcome:

Upon successful completion of the course, the students will be able to

- Describe operation of electrical measuring instruments.
- Select suitable instrument for measuring power and energy of electrical systems.
- Determine the parameters of electrical circuits using suitable measuring instruments.

Basic Concepts: Methods of measurements, Classification of instruments,Analog versus Digital Measurements, Elements of a generalized measurement system, Operating forces, Static characteristics of instruments, Standard Cell and Standard Resistance.

Principles of instruments: Construction and principles of operation of Moving Coil type instruments, Moving Iron type instruments, Dynamometer type instruments, Induction type instruments &Electrostatic Instruments.

Measuring Instruments: Ammeters and extension of range, Voltmeters and extension of range, Torque equation of Wattmeters, Single phase and poly-phase power measurement, errors in dynamometer type wattmeters and its compensation, LPF wattmeters, Reactive Power Measurement using wattmeter,Energy Meters for Single Phase and Poly Phase, Errors and Compensation in energy meters, Power Factor Meters, Frequency Meters (electrical resonance type and mechanical resonance type)and Weston Type of Synchro-Scope.

Bridge Methods: Types of detectors,Measurement of Resistance using Wheatstone bridge, Kelvin's double bridge, loss of charge method and Meggar, Measurement of inductance using Maxwell's Inductance bridge and inductance & capacitance bridge, Anderson's bridge, Measurement of mutual inductance using Heaviside mutual inductance bridge, Heaviside-Campbell equal ratio bridge, Measurement of capacitance using De Sauty's bridge, Schering bridges (for high voltage also), Measurement of frequency using Wien's bridge, Wagner's Earthing Device.

Magnetic Measurements: Ballistic Galvanometer, Calibration of Hibbert's Magnetic Standard, Flux Meter, Lloyd& Fischer Square for Measuring Iron Loss. Testing of Ring and Bar Specimens, Determination of B-H Curve and Hysteresis Loop Using CRO, Determination of Leakage Factor.

Potentiometers & Instrument Transformers: Crompton's D.C. Potentiometer, A.C. Polar and Co-Ordinate Type Potentiometers,Applications - measurement of Impedance, Calibration of Ammeters, Voltmeters and Wattmeters, measurement of resistance, use of Oscilloscope in Frequency, Phase and Amplitude Measurements, Instrument Transformers –Ration and Phase Angle Errors and Their Reduction.

Text Book:

1. Electric and Electronic Instrumentation by A.K. Sawhney, DhanpatRai& Sons, Delhi, 11th Edition, 1995.

References:

1. Electrical & Electronic Instrumentation by UmeshSinha, SatyaPrakashan, Newdelhi,1998
2. Electrical Measurements byE.W.Golding. &Widdis, 5thEdition, Wheeler Publishing.

EE2203 ELECTRIC MACHINES – II

Course Objectives

- To introduce the concepts about three phase induction motor and its testing
- To learn the basic concepts of synchronous generator and different voltage regulation methods
- To introduce concepts of synchronous motors
- To study various special machines

Course Outcomes

At the end of this course, students will demonstrate the ability to

- Analyze three phase induction motor.
- Able to predict the performance characteristics of synchronous generator
- Analyze the operation of synchronous machines
- Will learn about special mahines

Syllabus

Induction Motors - I

Principle of operation, Constructional details, Rotating Magnetic field, Types of rotors, Slip, Stator and Rotor current frequencies, Development of torque and torque calculations, Torque-Speed Characteristics, Power flow and performance calculations, Equivalent circuit, Calculation of equivalent circuit parameters from No-load and Rotor-blocked tests.

Induction Motors - II

Predetermination of performance characteristics using circle diagram and load test, Starting of Induction motors using Rheostat/reactor starter, Auto-transformer starter, Star-Delta starter, and Rotor Resistance starter, Crawling and cogging, Brief description of the induction motor speed control using Voltage control, frequency control, pole changing, rotor resistance control, cascading, and rotor emf injection, Induction generator and principle of operation, Double-cage rotors.

Synchronous Generators

Basic requirements, Constructional details, EMF equation, Effect of chording and distribution of winding, Armature reaction, Phasor diagram, Regulation of Synchronous Generators using EMF, MMF and ZPF methods, Synchronization of alternators, Parallel operation of two-alternators, Parallel operation of Synchronous Generator to infinite bus, Sharing of real and reactive powers, Capability curve, Salient-pole synchronous machine, Two-reaction theory, Determination of direct axis reactance and quadrature axis reactance of salient-pole machines, Power-Angle characteristics of cylindrical and salient-pole machines.

Synchronous Motors

Principle of operation, starting methods, phasor diagram, effect of changing load and changing excitation on machine performance, V and Inverter ‘V’ curves, Hunting, Damper winding, power developed by synchronous motor.

Special Machines

Single phase Induction motors: Double-field revolving theory, Principle of operation of Split-phase, capacitor start, capacitor start and run, shaded pole machines.

Principle of operation of hysteresis motor, Reluctance motor, BLDC motor and Doubly-fed Induction generator.

Text books

1. M G Say, The performance and Design of Alternating Current Machines, 3rd edition, CBS Publishers & Distributors, New Delhi, 2002.
2. P S Bimbhra, Electrical Machinery, Khanna Publishers, New Delhi, 7th edition, 1995.
3. D P Kothari and I J Nagrath, Electrical Machines, Tata McGraw Hill Educaiton Private Ltd., New Delhi, 4th edition, 2010.

Reference books

1. A E Fitzferald, Chrles Kingsley, Jr., and Stephen D Umans, Electric Machinery, 6th edition, Mc. Graw-Hill, New Delhi, 2003.
2. B L Theraja, and A K Theraja, A textbook of Electrical Technology, Vol. 2, AC & DC Machines, S Chand Publications.
3. Gonzalo Abad, *et al*, Doubly Fed Induction Machine: Modelling and Control for Wind Energy Generation, John. Wiley & Sons, Inc., USA, 2011.

EE2204 EMF THEORY

Course Objectives

- To familiarize the students with different coordinate systems.
- To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
- To impart knowledge on the concepts of magnetostatics, magnetic flux density, scalar and vector potential and its applications.
- To impart knowledge on the concepts of Faraday‘s law, induced emf and Maxwell‘s equations.

Course Outcomes

At the end of the course, the student could able to

- Understand the basic mathematical concepts related to electric and magnetic vector fields.
- Apply the principles of electrostatics to the problems relating to electric field and electric potential, boundary conditions and electric energy density.
- Apply the principles of magnetostatics to the problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.

Syllabus

Electrostatics

Coulomb’s Law, Electric Field of Different Charge Configurations using Coulomb’s Law, Electric Flux, Field Lines, Gauss’s Law in terms of E (Integral Form and Point Form), Applications of Gauss’s Law, Curl of the Electric Field, Electric Potential, Calculation of Electric Field Through Electric Potential for given Charge Configuration, Potential Gradient, The Dipole, Energy density in the Electric field.

Conductors, Dielectrics, and Capacitance

Current and Current Density, Continuity of current, Metallic conductors, Conductor properties and Boundary Conditions, The Method of Images, Semiconductors , The Nature of Dielectric materials, Boundary conditions for Perfect Dielectric Materials, Capacitance, Several Capacitance Examples, Continuity Equation, Basic Properties of Conductors in Electrostatic Fields, Capacitance, Poisson’s and Laplace’s Equations, Examples of the Solution of Laplace’s Equations, Uniqueness Theorem, Examples Of The Solution Of Poisson’s equations.

The Steady Magnetic Field

Biot-Savart’s Law, Amperes Circuital Law, Curl, Stokes Theorem, Magnetic Flux and Magnetic Flux Density, The Scalar and Vector Magnetic Potentials, Derivation of Steady Magnetic Field Laws.

Magnetic Forces, Materials and Inductance

Force on Moving Charge, Force on a Differential Current Element, Force Between Differential Current Elements, Force and Torque on a Closed Circuit, The Nature of Magnetic Materials, Magnetization and Permeability, Magnetic Boundary Conditions, The Magnetic Circuit, Potential Energy and Forces On Magnetic Materials.Self-Inductance, Internal Inductance and Mutual

Inductance, Magnetic circuits , BH Curve , Cores with Air Gaps, Parallel Magnetic Circuits (Chapter 11 Joseph. A. Edminster)

Time Varying Fields and Maxwell's Equations

Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Point Form, Maxwell's Equations in Integral Form, Time -Varying Potentials Time-Harmonic Fields.

Text Books

1. Elements of Electromagnetics by Matthew N.O. Sadiku, Oxford University Press.
2. 2. Engineering Electromagnetics by William H. Hayt Jr. and John A. Buck, Sixth Edition, McGraw Hill, New Delhi, 2001.
3. Electromagnetics, Joseph A. Edminister, Schaum's Outline Series, McGraw-Hill International Editions.

Reference Books

1. Introduction to Electrodynamics by David J. Griffiths, 3rd Edition, Prentice Hall, New Jersey, 1999.
2. Electromagnetics by John D Kraus, Mc Graw-Hill International Edition, 1999.
3. Engineering Electromagnetics by J. P. Tewari, Khanna Publishers, 2nd edition.

EE2205 ELECTRICAL ENGINEERING MATERIALS

Course Objectives

- To explain students about dielectric materials and their properties.
- To detail about magnetic materials and their properties.
- To familiarize with semiconductor materials and their applications.
- To introduce various kinds of special purpose materials.

Course Outcomes

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

- Understand various types of dielectric materials, their properties in various conditions.
- Evaluate magnetic materials and their behavior.
- Evaluate semiconductor materials and technologies.
- Acquire Knowledge on Materials used in electrical engineering and applications.

Syllabus

Dielectric Materials

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

Magnetic Materials

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magneto-striction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis.

Semiconductor Materials

Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI) Materials for Electrical Applications: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

Special Purpose Materials

Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI.

Text Books

1. “R K Rajput”, “ A course in Electrical Engineering Materials”, Laxmi Publications, 2009
2. “T K Basak”, “ A course in Electrical Engineering Materials”, New Age Science Publications 2009

Reference Books

1. TTTI Madras, “Electrical Engineering Materials”, McGraw Hill Education, 2004.
2. “AdrianusJ.Dekker”, Electrical Engineering Materials, PHI Publication, 2006.
3. P. Seth, P. V. Gupta “A course in Electrical Engineering Materials”, Dhanpat Rai & Sons,2011.

EE2206 ELECTRICAL MACHINES – II LAB

Course Objectives

- To understand design and each part of AC electrical machines.
- Also to perform tests on AC electrical machines and transformers and determine their characteristics.

Course Outcomes

After completion of course, a student will be able to

- To define characteristics of ac machines.
- To test them in various methods.

List of Experiments

1. Parallel operation of two Single phase Transformers
2. Load test on three phase Induction Motor
3. No-load & Blocked rotor tests on three phase Induction motor
4. Regulation of a three –phase alternator by synchronous impedance & MMF methods
5. Regulation of three-phase alternator by Z.P.F. method
6. V and Inverted V curves of a three—phase synchronous motor.
7. Equivalent Circuit of a single phase induction motor
8. Determination of Xd and Xq of a salient pole synchronous machine
9. Separation of core losses of a single-phase transformer
10. Measurement of sequence impedance of a three-phase alternator.

#Experiments can be drafted basing on the theory course#

EE2207 ELECTRICAL MEASUREMENTS LAB

Course Objectives

- To gain practical knowledge on measuring electrical quantities.
- To understand the functioning of measuring devices
- To understand the circuits of electrical measuring devices.
- To develop team spirit.

Course Outcomes

After completion of this course, a student will be able to

- Analyze various measured electrical quantities.
- Developing circuits for small applications.

List of Experiments

1. Calibration of Voltmeter and Ammeter.
2. Calibration of UPF Dynamometer type Wattmeter by direct loading method.
3. Calibration of UPF Dynamometer type Wattmeter by phantom loading method (AC & DC).
4. Calibration of single-phase energy meter by phantom loading and direct loading.
5. Measurement of power and power factor by using three Ammeter method.
6. Measurement of power and power factor by using three Voltmeter method.
7. Measurement of Three-phase power using one-wattmeter and two-wattmeters method.
8. Kelvin's Double Bridge
9. Wheatstone Bridge
10. Wein's Bridge
11. Anderson Bridge
12. Schering Bridge
13. Experiment on Crompton’s DC potentiometer.

Experiments can be drafted basing on the theory course#

EE2208 ELECTRICAL CAD

Course Objectives

- To introduce the students with the associated features of ECAD using standard-based drafting and drawing skills.
- To familiarize with standard 2D and 3D drawing, modifying, dimension and view commands.
- To introduce the drafting tools, PLC I/O tools, report generation and ways of organising files and projects.
- To provide the animation, gripping visuals, layouts and electrical panel and wiring diagrams and their modules.

Course Outcomes

- Student will know the symbol naming conventions, usage of symbol libraries and generate layout modules.
- Acquire the knowledge of drawing reports, create drawings and wire numbering and component tagging in electrical circuits.
- Students will be able to bring components in to panel for layout, to generate and update customizable reports and use folders to organise drawings.

List of Experiments

1. Introduction and overview of ECAD
2. Starting with Electrical CAD and basic drawing commands
3. Creation of simple project and inserting and interconnecting components
4. Use with PLC modules
5. Schematic reports
6. Bill of material reports
7. Star-Delta Starter Control Circuit
8. Forward-Reverse Control Circuit
9. Electrical motor connections
10. 2D, 3D drawings and animations

#Experiments can be drafted for preparing the electrical drawings using CAD software manual. #

EE2209 ENVIRONMENTAL STUDIES

Course Objectives

The objectives of the Environmental Science course are to

- Familiarize the fundamental aspects of environment and the environmental management'
- Provide information of some of the important international conventions which will be useful during the future endeavors after graduation.
- Make realize the importance of natural resources management for the sustenance of the life and the society.
- Apprise the impact of pollution getting generated through the anthropogenic activities on the environment
- Provide the concept of Sustainable Development, energy and environmental management
- Impart knowledge on the new generation waste like e-waste and plastic waste.

Course Outcomes:

- Knowledge on the fundamental aspects of environment and the environmental management
- The knowledge on the salient features of the important international conventions
- Understanding of the importance of natural resources management for the sustenance of the life and the society.
- Familiarity on various forms of pollution and its impact on the environment.
- Understand the elements of Sustainable Development, energy and environmental management
- Knowledge on the new generation waste like e-waste and plastic waste.

Syllabus

Introduction

Structure and functions of Ecosystems-Ecosystems and its Dynamics-Value of Biodiversity impact of loss of biodiversity, Conservation of bio-diversity. Environmental indicators – Global environmental issues and their impact on the ecosystems.

Salient features of international conventions on Environment

Montreal Protocol, Kyoto protocol, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, United Nations Framework Convention on Climate Change (UNFCCC),

Natural Resources Management: Importance of natural resources management-Land as resource, Land degradation, Soil erosion and desertification, Effects of usage of fertilizer, herbicides and pesticide watershed management.

Forest resources

Use and over-exploitation, Mining and dams – their effects on forest ecosystems and the living beings.

Water resources

Exploitation of surface and groundwater, Floods, droughts, Dams: benefits and costs.

Mineral Resources
Impact of mining on the environment and possible environmental management options in mining and processing of the minerals. Sustainable resource management (land, water, and energy), and resilient design under the changing environment.

Environmental Pollution
Local and Global Issues. Causes, effects and control measures. Engineering aspects of environmental pollution control systems.

Air pollution
Impacts of ambient and indoor air pollution on human health. Water pollution: impacts water pollution on human health and loss of fresh water resources. Soil pollution and its impact on environment. Marine pollution and its impact on blue economy. Noise pollution.
Solid waste management: Important elements in solid waste management- Waste to energy concepts. Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act and their amendments. Salient features of Environmental protection Act, 1986.

Sustainable Development
Fundamentals of Sustainable Development– Sustainability Strategies and Barriers – Industrialization and sustainable development. Circular economy concepts in waste (solid and fluid) management.

Energy and Environment
Environmental Benefits and challenges, Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability.

Solar Energy
Process of photovoltaic energy conversion, solar energy conversion technologies and devices, their principles, working and applications, disposal of solar panel after their usage.

Biomass energy
Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in context of India.

Management of plastic waste and E-waste
Sources, generation and characteristics of various e- and plastic wastes generated from various industrial and commercial activities; Waste management practices including onsite handling, storage, collection and transfer. E-waste and plastic waste processing alternatives. E-Waste management rules and Plastic waste management rules, 2016 and their subsequent amendments.

Text Books

1. Bharucha, Erach (2004). Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, University Grants Commission, New Delhi.
2. Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
3. Masters, G. M., & Ela, W. P. (1991). Introduction to environmental engineering and science. Englewood Cliffs, NJ: Prentice Hall.

4. Enger, E. and Smith, B., Environmental Science: A Study of Interrelationships, Publisher: McGraw-Hill Higher Education; 12th edition, 2010.

Reference Books

1. Sharma, P. D., & Sharma, P. D. (2005). Ecology and environment. Rastogi Publications
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Clark R.S. (2001). Marine Pollution, Clanderson Press Oxford (TB)
4. Jadhav, H & Bhosale, V.M. (1995). Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
5. MoEF& CC, Govt. of India, CPCB: E-waste management rules, 2016 and its amendments 2018.
6. MoEF& CC, Govt. of India, CPCB: Plastic waste management rules, 2016.