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 Engg.	4	0	30	70	100	3
EE1105	ES	Basic Electronic Engg.	4	0	30	70	100	3
EE1106	ES	Python Lab	0	3	50	50	100	1.5
EE1107	BS	Physics Lab	0	3	50	50	100	1.5
EE1108	ES	Electrical Engg 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	Fundamentals of 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	Electronics 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								

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

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EE3101	PC	Pulse & Digital Circuits	4	0	30	70	100	3
EE3102	PC	Power Electronics	4	0	30	70	100	3
EE3103	PC	Power Systems – I	4	0	30	70	100	3
EE3104	PE	Professional Elective I	4	0	30	70	100	3
EE3105	OE	Open Elective I	4	0	30	70	100	3
EE3106	PC	PDC Lab	0	3	50	50	100	1.5
EE3107	PC	Power Electronics Lab	0	3	50	50	100	1.5
EE3108	SC	PLCs	1	2	50	50	100	2
EE3109	INT	Internship I	0	0	50	50	100	2
							Total Credits	**22**

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

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EE3201	PC	Power System Analysis & Stability	4	0	30	70	100	3
EE3202	PC	Power Systems – II	4	0	30	70	100	3
EE3203	PC	Control Systems	4	0	30	70	100	3
EE3204	PE	Professional Elective II	4	0	30	70	100	3
EE3205	OE	Open Elective II	4	0	30	70	100	3
EE3206	PC	Microprocessors & Microcontrollers Lab	0	3	50	50	100	1.5
EE3207	PC	Control Systems Lab	0	3	50	50	100	1.5
EE3208	PC	Power Systems Simulation Lab	0	3	50	50	100	1.5
EE3209	SC	Soft Skills	1	2	50	50	100	2
Internship II								
							Total Credits	**21.5**

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

Course code	Category	Course Title	Hours per week		Internal Marks	External Marks	Total Marks	Credits
			L	P				
EE4101	PE	Professional Elective III	4	0	30	70	100	3
EE4102	PE	Professional Elective IV	4	0	30	70	100	3
EE4103	PE	Professional Elective V	4	0	30	70	100	3
EE4104	OE	Open Elective III	4	0	30	70	100	3
EE4105	OE	Open Elective IV	4	0	30	70	100	3
EE4106	HSSE	HSS Elective	4	0	30	70	100	3
EE4107	SC	IoT	1	2	50	50	100	2
EE4108	INT	Internship II	0	0	50	50	100	2
Total Credits								**22**

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

Course code	Category	Course Title	Internal Marks	External Marks	Total Marks	Credits
EE4201	PROJ	Project work	100	100	200	14
Total Credits						**14**

SA **:** Skill Advanced
SI **:** Skill Interdisciplinary
OE **:** Open Elective/Job Oriented Elective

PROFESSIONAL ELECTIVES

1. Digital Signal Processing
2. Utilization Of Electrical Energy
3. Hybrid Electric Vehicles
4. Energy Management & Auditing
5. Power Station Practice
6. Advanced Control System
7. Digital Control System
8. High Voltage Engineering
9. Smart Grids
10. Flexible AC Transmission Systems
11. Electrical Distribution System
12. Electric Drives and Traction
13. HVDC Transmission
14. Power System Protection
15. Power System Operation & Control

OPEN ELECTIVES

1. Digital Logic Design
2. Computer Architecture & Organization
3. Control Systems
4. Computer Networks
5. Renewable Energy Sources
6. Electrical GIS
7. Energy Management & Auditing
8. Microprocessors & Microcontrollers
9. Advanced Control System
10. Digital Control System
11. Electrical Wiring
12. Artificial Intelligence & Machine Learning

HSS ELECTIVES

1. Organizational behavior
2. Industrial management and entrepreneurship
3. * Operations research

* The course will be selected if not covered in previous years.

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

EE-1103 ENGINEERING GRAPHICS

Course Objectives

- Understand the basics of Engineering Graphics and BIS conventions.
- Develop the graphical skills for communication of concepts, ideas and design of engineering products through technical drawings
- Demonstrate and practice the various profiles/curves used in engineering practice through standard procedures.
- Demonstrate and practice the orthographic projections of points, lines, planes, solids and section of solids
- Demonstrate and practice the development of surfaces of simple solids
- Familiarize the basic concept of isometric views clearly.

Course Outcomes

- Develop simple engineering drawings by considering BIS standards.
- Able to draw different engineering curves with standard Procedures
- Comprehend the basics of orthographic projections and deduce orthographic projections of points, lines, planes and solids at different orientations in real life environment.
- Visualize clearly the sections of solids.
- Apply the concepts of development of surfaces while designing/analyzing any product.
- Recognize the significance of isometric drawing to relate 2D environment with 3D environment.

Syllabus

Introduction
Lines, Lettering and Dimensioning, Geometrical Constructions, and Scales.

Curves
Conic sections: General construction of ellipse, parabola and hyperbola. Construction of involutes of circle and polygons only. Normal and tangent to curves.

Projections of Points
Principal or Reference Planes, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines
Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane.

Projections of Straight Line Inclined to Both the Reference Planes
Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids

Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

Sections of Solids

Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces

Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Isometric Views

Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, and their combinations.

Text Book

1.Elementary Engineering Drawing by N. D. Bhatt, Charotar Publishing House.

Reference

1.Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata Mc-Graw Hill.

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

EE-1106 WORKSHOP

Course Objectives

- Get hands on experience with the working skills in Carpentry trade.
- Know how to work with Sheet Metal tools.
- Get familiar with the working skills of Metal Fitting operations.
- Get hands on experience with house hold electrical wiring.

Course Outcomes

- Can be able to work with Wood Materials in real time applications.
- Can be able to build various parts with Sheet Metal in day-to-day life.
- Can be able to apply Metal Fitting skills in various applications.
- Can be able to apply this knowledge to basic house electrical wiring and repairs.

List of Experiments

Carpentry
Any three jobs from – Half lap joint, Mortise and Tenon joint, Half – lap Dovetail joint, Corner Dovetail joint, Central Bridle joint.

Sheet Metal
Any three jobs from – Square tray, Taper tray(sides), Funnel, Elbow pipe joint.

Fitting
Any three jobs from – Square, Hexagon, Rectangular fit, Circular fit and Triangular fit.

House wiring
Any three jobs from – Tube light wiring, Ceiling fan wiring, Stair-case wiring, Corridor wiring.

References

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. Work shop Manual / P.Kannaiah/ K.L.Narayana/ SciTech Publishers.
3. Engineering Practices Lab Manual, Jeyapoovan, Saravana Pandian, 4/e Vikas.

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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 $\lceil_o$ and Extraordinary $\lceil_e$ 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.

EE-1202 CHEMISTRY

Course Objectives

- To apply the basic knowledge of Chemistry to the Engineering Discipline.
- To develop knowledge about water and its treatment for industrial and potable purposes.
- To develop understanding in the areas of Polymers, Mechanism of Corrosion of Metals and Corrosion Control Methods, Fuels, Lubricants and Nanomaterials for of conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

Course outcome

- This course applies the basic concepts and principles studied in Chemistry to Engineering.
- It provides an application of chemistry to different branches of engineering
- The students will be able acquire knowledge in the areas of Water Chemistry, Polymers, Corrosion, Fuels and Lubricants and nanomaterials and suggest innovative solutions for existing challenges in these areas.

Syllabus

Water Chemistry
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.

Polymers and Plastics
Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process. **Plastics:** Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers.

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 – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints.

Fuels and Lubricants
Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications; **Liquid Fuels:** Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number; **Gaseous Fuels:** Biogas, LPG and CNG – Characteristics – Applications; **Rocket Fuels:** Propellants – Classification – Characteristics
Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications.

Nanomaterials

Nanomaterials, Properties and application of fullerenes, fullerols, Carbon nanotubes and nanowires. Synthesis - Top-down and Bottom-up approaches - Nanocomposites - Nanoelectronics- Applications of nanomaterials in catalysis, telecommunication and medicine.

Text Books

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.

Reference Books

1. Engineering Chemistry – B. K. Sharma – Krishna Prakashan – Meerut.
2. Introduction to Nanoscience - S. M. Lindsay - Oxford University Press
3. Engineering Chemistry - B. L. Tembe, Kamaluddin and M. S. Krishnan, (NPTEL).

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.

EE-1205 COMPUTATIONAL METHODS IN ELECTRICAL ENGINEERING

Course objectives

- To introduce to modern analytical and computational methods in critical problem solving related electrical engineering.
- To identify appropriate algorithms to obtain solutions for mathematical models.
- To introduce to fundamentals of computational techniques for solving engineering problems.
- To provide basic working knowledge of artificial intelligence in solving complex problems.

Course outcomes

- Identify suitable numerical technique for the solution of a mathematical model.
- Study and analyze the various computational algorithms.
- Develop and Apply algorithms for various numerical analysis methods.
- Obtain the solutions by using various numerical methods.

SYLLABUS

Numerical Integration and Differentiation
Introduction, Trapezoidal Rule, Simpson's Rule, Gaussian Quadrature, Romberg Integration, Numerical Differentiation

Nonlinear Systems of Equations
Bisection Method, Fixed-Point Method, Newton–Raphson Method: Method, Rate of Convergence Analysis, Breakdown Phenomena and algorithm, Least squares approximation, Chaotic Phenomena and a Cryptography Application.

Introduction to Graph Theory
Basic Concepts, Terminology, Directed Graphs, Flow Graphs for Differential Equations, Construction and Analysis of Signal Flow Graphs, Signal-Flow-Graph Reduction and the Solution of Equations, Flow-Graph Algebra, Loop Elimination and Equation Solving by Equation Reduction, Mason's Rule, Application of Mason's Rule to Dynamic Systems.

Introduction to Nano-scale Solution Methods
Special Models for the Nanoscale, Brief Overview of Partial Differential Equations, Applications of Hyperbolic PDEs, The Finite-Difference (FD) Method, The Finite-Difference Time-Domain (FDTD) Method, The Finite Element Method, The Finite Volume method.

Introduction to Computational Intelligence
Artificial intelligence and Computational intelligence, Fundamental elements of soft computing: Logic of fuzzy sets, Computational models of neural nets, Genetic Algorithms. Computational learning theory, Synergism in soft computing: Neuro – Fuzzy, Neuro-GA, Fuzzy-GA synergism, Neuro belief network, GA belief network, Neuro Fuzzy GA belief network synergism.(basic treatment of various concepts only)

Text Books

1. "An Introduction to Numerical Analysis for Electrical And Computer Engineers" by Christopher J. Zarowski, John Wiley & Sons, Inc. 2004

2. “Graph Theory In Modern Engineering-Computer Aided Design, Control, Optimization, Reliability Analysis” by Ernest J. Henley & R. A. Williams, Academic Press, 1973.

Reference Books

1. “Computational Methods for Nanoscale Applications - Particles, Plasmons and Waves” by Igor Tsukerman, Springer 2008.
2. “Computational Intelligence- Principles, Techniques and Applications” by Amit Konar, Springer 2005.

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 CHEMISTRY LAB

Course Objectives

- To develop the fine skills of quantitative determination of various chemical components through titrimetric analysis
- To prepare and use ionexchange/ zeolite columns for the removal of hardness of water
- To develop the skill of organic synthesis through the preparation of a polymer/ drug

Course Outcomes

- The course provides quantitative determine the amount of various chemical species in solutions by titrations and conduct the quantitative determinations with accuracy
- The course provides to develop novel materials to be used as zeolite and prepare columns for removal of hardness of water
- The course provides to synthesize a polymer or a drug

List of Experiments

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 Fe(II)/Mohr's Salt by Permanganometry
4. Determination of Oxalic Acid by Permanganometry
5. Determination of Chromium (VI) by Mohr's Salt Solution
6. Determination of Zinc by EDTA method
7. Determination of Hardness of Water sample by EDTA method
8. Determination of Chlorine in water by Iodometric Titration
9. Ionexchange/ Zeolite column for removal of hardness of water
10. Synthesis of Polymer/ drug

Reference Books

1. Vogel's Quantitative Chemical Analysis – V – Edition – Longman.
2. Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi

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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 understand the concepts of Thermal Prime Movers.
- To understand the concepts of Hydraulic turbines
- To familiarize the concepts of electro-mechanical energy conversion principles.
- To explain the theory of dc machines, and their testing.
- 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

- Discuss the working principle of different types of thermal & hydraulic turbines.
- Understand the operation of dc machines.
- Understand the testing of dc motors
- Analyze the differences in operation of different dc machine configurations.

Syllabus

Prime movers
Gas Turbines: Introduction, Classification of Gas Turbines. Analysis of Constant Pressure Closed Cycle Gas Turbines, Open Cycle Gas Turbines. Methods to Improve the Thermal Efficiency of Gas Turbines.

Hydraulic turbines: Layout of a typical hydro power installation, heads and efficiencies – classification of turbines – Pelton wheel, Francis turbine, Kaplan turbine working – velocity diagram, work done and efficiency.

Electro-mechanical Energy Conversion
Principles, Forces and Torques in Magnetic 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, Idea 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. R S Kurmi and J K Gupta, A text book of Thermal Engineering, S Chand & Company Ltd., New Delhi, 2003.
2. P N Modi and S M Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House, New Delhi, 2017.
3. P S Bimbhra, Electrical Machinery, Khanna Publishers, New Delhi, 7th edition, 1995.
4. D P Kothari and I J Nagrath, Electrical Machines, Tata McGraw Hill Education Private Ltd., 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

- To introduce the managerial economics to students.
- To explain the concepts of demand forecasting and cost analysis.
- To discuss concepts of investment decisions & market structures.
- To understand financial statements.
- To describe marketing.

Course Outcomes

At the end of this course student will be able to

- Explain basic principles of engineering economics
- Apply cost – volume -profit (CVP) analysis in their business decision making
- Evaluate investment proposals through various capital budgeting methods
- Apply the knowledge to prepare the simple financial statements for measuring performance ofbusiness firm
- Analyze key issues of organization, management and administration
- Evaluate project for accurate cost estimates and plan future activities

Syllabus

Introduction to Engineering Economics

Concept of Engineering Economics – Types of efficiency – Managerial Economics - Nature and Scope – Law of Demand – Types of Elasticity of demand.

Demand Forecasting & Cost Analysis

Demand Forecasting: Meaning, Factors Governing Demand Forecasting, Methods of Demand Forecasting (Survey and Statistical Methods) – Cost Analysis: Basic Cost Concepts, Break Even Analysis. Factors affecting the elasticity of demand – Supply and law of Supply.

Investment Decisions & Market Structures

Financial Statements & Ratio Analysis Time Value of Money – Capital Budgeting: Meaning, Need and Techniques of Capital Budgeting – Types of Markets Structures – Features – Price Out - put determination under Perfect Competition and Monopoly.

Financial Statements & Ratio Analysis

Introduction to Financial Accounting –Double entry system – Journal - Ledger – Trail Balance – Final Accounts (with simple adjustments) – Financial Analysis through Ratios: Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio, Creditors Turnover Ratio, Capital Turnover Ratio), Solvency Ratios (Debt - Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).Price output determination under Monopolistic markets, Accounting concepts and conventions.

Introduction to Management & Strategic Management

Introduction to management: Nature-Importance – Classical Theories of Management: F. W. Taylor's and Henri Fayol's Theory – Functions and Levels of Management – Decision Making Process. Methods of Production (Job, Batch and Mass production) - Inventory Control, Objectives, Functions – Analysis of Inventory –EOQ. Maslow& Douglas Mc. Gregor theories of Management, ABC Analysis.

Project Management

Introduction – Project Life Cycle and its Phases – Project Selection Methods and Criteria – Technical Feasibility – Project Control and Scheduling through Networks – Probabilistic Models of Networks – Time - Cost Relationship (Crashing) –Human Aspects in Project Management: Form of Project Organization – Role & Traits of Project Manager.

Text Books

1. Chan S. Park, "Fundamentals of Engineering Economics", Pearson, 2013, 3 Edition, New Delhi, 2015
2. 2. Rajeev M Gupta, "Project Management", 2nd Ed., PHI Learning Pvt. Ltd. New Delhi, 2014

Reference Books

1. Panneer Selvam. R, "Engineering economics", 3rdEdision., Prentice Hall of India, New Delhi, 2013
2. R. B. Khanna, "Project Management", PHI Learning Pvt. Ltd. New Delhi, 2011

EE2106 NETWORKS LABORATORY

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.

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

The objective of the course are Six fold

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- This course will illuminate the students in the concepts of laws and its applicability to engineers
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
- Strengthening of self-reflection, Development of commitment and courage to act and also enable the students to imbibe and internalize the Values and Ethical Behavior in the personal and professional lives
- To enable the students to imbibe the Values and Ethical Behavior in the personal and Professional lives
- The students will learn the rights and responsibilities Individual, employee, team member and a global citizen.

Course Outcomes

By the end of the course Student will be able to

- Grasp the meaning of the concept – Law and also Get an overview of the laws relating to Engineers and also Apprehend the importance of being a law abiding person and They would have better critical ability.
- Self-explore by using different techniques to live in harmony at various levels.
- Analyze themselves and understand their position with respect to the moral and ethical
- Character needed for a successful and satisfactory work life.
- Students are expected to become more aware of themselves and their surroundings (family, society, nature).
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society)

Syllabus

Need, Basic Guidelines, Content and Process for Value Education

Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation - as the process for self-exploration, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility - the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking, Include practice sessions and case studies.

Understanding Harmony in the Human Being - Harmony in Myself!
Understanding human being as: a co-existence of the sentient 'I' and the material 'Body', the needs of Self ('I') and 'Body' - happiness and physical facility, the Body as an instrument of 'I' (I being the doer, seer and enjoyer), the characteristics and activities of 'I' and harmony in 'I', the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, P to ensure Sanyam and Health, Include practice sessions and case studies.

Understanding Harmony in the Family and Society - Harmony in Human – Human Relationship
Understanding values in human-human relationship: meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, the meaning of Trust; Difference between intention and competence, the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, the harmony in the society (society being an extension of family),Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order from family to world family, Include practice sessions and case studies.

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence
Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all – pervasive space, Holistic perception of harmony at all levels of existence, Include practice sessions and case studies.

Concept of Law and Law of Torts
Understanding Essentials of a Valid Contract and the basics of contract law protecting rights and obligations, Introduction to the Law of Torts and the basics to protect oneself and the company Law affecting the Workplace Employers Responsibilities/Duties Hiring Practices, Introduction to Intellectual Property Law, Professional Code of Conduct for Engineers, Relationship between Law and Ethics, Include practice sessions and case studies.

Implications of the above Holistic Understanding of Harmony on Professional Ethics
Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Include practice sessions and case studies.

Text Books

1. R R Gaur, R Asthana, G P Bagaria, “A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, “Teachers’ Manual for A Foundation Course in Human Values and Professional Ethics”, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
3. R. Subramanian, “Professional Ethics”, Oxford University Press.
4. S.B. Srivasthva, “Professional Ethics & Human Values”, SciTech Publications (India) Pvt. Ltd. New Delhi.
5. D.R. Kiran, “Professional Ethics & Human Values”, TATA Mc Graw Hill Education.
Saroj Kumar, “Business Law” and Avtar Singh, “Law of Contract”

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. A. N. Tripathi, “Human Values”, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book), Mohandas Karamchand Gandhi “The Story of My Experiments with Truth”, E. FSchumacher. “Small is Beautiful”, Slow is Beautiful –Cecile Andrews, J C Kumarappa “Economy of Permanence”, Pandit Sunderlal “Bharat Mein Angreji Raj” and Dharampal, “Rediscovering India
4. G K Kapoor, “Business Law” and Sen & Mitra, “Business & Commercial Laws” and Calvin Frank Allen, “Business law for Engineers”
5. Hilgard, E. R.; Atkinson, R. C. & Atkinson, R.L. (1975). Introduction to Psychology. 6th Edition. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.
6. Govindarajan, M; Natarajan, G. M. &Senthilkumar, V.S. (2013). Professional Ethics & Human Values. Prentice Hall: New Delhi
7. Gogate, S. B. (2011). Human Values & Professional Ethics. Vikas Publishing: New Delhi.
8. Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, “Engineering Ethics, Concepts Cases: 4e, Cengage learning, 2015.
9. Caroline Whitbec, “Ethics in Engineering Practice & Research: 2e, Cambridge University Press 2015.

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 Outcomes

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.

Syllabus

Instruments

Objectives of Measurements, Analog versus Digital Measurements, Accuracy, Precision and Uncertainty, Sources of Measurement Error, Standard Cell And Standard Resistance.

Characteristics of measuring instruments with a moving element instrument

Ammeter, Voltmeter, Expression for Torque of Moving Coil, Moving Iron, Dynamometer, Induction and Electrostatic Instruments.

Extension of Range of Instruments

Wattmeters, Torque Expression for Dynamometer Instruments. Reactive Power Measurement, Energy Meters Single Phase and Poly Phase, Driving Torque And Braking Torque Equations, Errors And Testing, Compensation, Maximum Demand Indicator, Power Factor Meters, Frequency Meters, Electrical Resonance And Weston Type of Synchro-Scope.

Bridge Methods

Measurement of Inductance, Capacitance & Resistance Using Bridges. Maxwell's, Anderson's, Wein's Heave-Side & Campbell's, Desauty's, Schering's Bridges, Kelvin's Double Bridge, Price Guard Wire Bridge, Loss of Charge Method, Megger, Wagner's Earthing Device.

Magnetic Measurements

Ballastic Galvanometer, Calibration of Hibbert's Magnetic Standard Flux Meter, loydfischer 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. Use of Oscilloscope in Frequency, Phase and Amplitude Measurements, Indian Standard Specifications for Voltmeters, Ammeters, Energy Meters, Instrument Transformers – Ration and Phase Angle Errors and Their Reduction.

Text Books

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

Reference Books

1. Electrical & Electronic Instrumentation by Umesh Sinha, Satya Prakashan, Newdelhi,1998
2. Electrical Measurements by E. W. Golding. &Widdis, 5th Edition, 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. O.C. & S.C. Tests on Single phase Transformer
2. Sumpner's test on single phase transformers
3. Scott connection of transformers
4. Parallel operation of two Single phase Transformers
5. Load test on three phase Induction Motor
6. No-load & Blocked rotor tests on three phase Induction motor
7. Regulation of a three –phase alternator by synchronous impedance & MMF methods
8. Regulation of three-phase alternator by Z.P.F. method
9. V and Inverted V curves of a three—phase synchronous motor.
10. Equivalent Circuit of a single phase induction motor
11. Determination of Xd and Xq of a salient pole synchronous machine
12. Separation of core losses of a single-phase transformer
13. 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.

EE3101 PULSE & DIGITAL CIRCUITS

Course Objectives

The objectives of the Pulse & Digital Circuits course are to

- To understand the concept of wave shaping circuits, Switching Characteristics of diode and transistor.
- To study the design and analysis of various Multivibrators.
- To understand the functioning of different types of time-base Generators.
- To learn the working of logic families & Sampling Gates.

Course Outcomes

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

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

Syllabus

Linear Wave Shaping

High pass and Low pass RC circuits, Response of High pass and Low pass RC circuits to sinusoidal, step, pulse, square, exponential and Ramp inputs, High pass RC circuit as a differentiator, Low pass RC circuit as an integrator. Attenuators and its application as CRO probe, RL and RLC Circuits and their response for step input, Ringing Circuit.

Nonlinear Wave Shaping

Diode clippers, Transistor Clippers, Clipping at two independent levels, Comparator, Applications of voltage Comparators, Diode Comparator, Clamping Operation, Clamping Circuits using Diode with Different Inputs, Clamping Circuit Theorem, Practical Clamping circuits, Effect of diode Characteristics on Clamping Voltage.

Bistable Multivibrators

Transistor as a switch, Switching times of a transistor, Design and Analysis of Fixed-bias and self-bias transistor binary, Commutating capacitors, Triggering schemes of Binary, Transistor Schmitt trigger and its applications.

Monostable And Astable Multivibrators

Design and analysis of Collector coupled Monostable Multivibrator, Expression for the gate width and its waveforms. Design and analysis of Collector coupled Astable Multivibrator, expression for the Time period and its waveforms, The Astable Multivibrator as a voltage to frequency convertor.

Time Base Generators

General features of a time-base signal, Methods of Generating time base waveform, Exponential voltage sweep circuit, Basic principles of Miller and Bootstrap time base generators, transistor Miller sweep generator, transistor Bootstrap sweep generator, Current Sweep circuit, Linearity correction through adjustment of driving Waveform.

Logic Gates

Realization of gates using diodes and Transistors, RTL, DTL.

Text Books

1. Pulse Digital and Switching Waveforms, J. Millman and H. Taub, McGraw-Hill, 2nd Edition
2. 1991.
3. 2.Pulse and Digital CircuitsVenkata Rao K., Rama Sudha K., Manmadha Rao G., Pearson Education India, 2nd Edition, 2010.

Reference Books

1. Pulse and Digital Circuits, A. Anand Kumar, PHI, second edition, 2005.
2. Pulse switching and digital circuits – David A. Bell, PHI , 5th Edition, oxford university press.

EE3102 POWER ELECTRONICS

Course Objectives

- To study the characteristics of various power semiconductor devices and analyze the operation of silicon-controlled rectifier.
- To study the static and dynamic characteristics of SCR and analyze the series and parallel operation of SCR.
- To understand the operation of single phase and three phase full-wave converters and to understand basic performance parameters.
- To study the operation of dual converter and ac voltage controllers.
- To analyze the operation of single phase Cyclo-converters and high frequency dc-dc converters.
- To understand the working of inverters and application of PWM techniques for voltage control.

Course Outcomes

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

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters, Choppers & Cyclo-converters.

Syllabus

Thyristors

Introduction, Principle of Operation, Two Transistor Model, Gate Characteristics, Turn On Methods, Turn Off Methods, Thyristor Ratings, Measurement of Thyristor Parameters, Protection Circuits.

Gate Triggering Circuits

Firing of Thyristors, Pulse Transformers, Opto Isolators, Gate Triggering Circuits, Resistance Firing, Resistance-Capacitance Firing, UJT, Programmable UJT (PUT), UJT as an SCR Trigger, Synchronized UJT Triggering.

Series And Parallel Operation of Thyristors

Equalizing Networks, Triggering, String Efficiency, De-rating.

Phase Controlled Rectifiers

Single Phase-Half wave Rectifier with R& RL Circuits, Single Phase Full wave & Bridge Controlled Rectifiers, Three-Phase Half Wave and Fully Controlled Rectifiers, Three-Phase Fully Controlled Bridge Rectifier.

Inverters

Classification, Series and Parallel Inverters, Self-Commutated Inverters, The Mc Murray Inverter, The Mc Murray Bedford Inverter, Harmonic Reduction, Current Source Inverters, Voltage Source Inverters.

Choppers

Principle of Operation, Step-up, Step-down Choppers, Jones Chopper, Morgan Chopper.

Cyclo-converters

Principle of Operation, Single Phase to Single Phase Cyclo-converters, Cyclo-converter Circuits for Three-Phase Output, Control Circuits

Modern Power Semiconductor Devices

Basic Structure and Characteristics of Diode, Transistor, MOSFET, IGBT, GTO, DIAC, TRIAC

Text Books

1. Power Electronics by M. D. Singh, K. B. Khanchandani, Tata McGraw Hill Education (India) Private Limited.

Reference Books

1. Power Electronic Circuits Devices and Applications by M. H. Rashid, Pearson India
2. Power Electronics by Dr. P S Bhimbra, KhannaPublishers.

EE3103 POWER SYSTEMS - I

Course Objectives

- To study the principle of operation of different components of a thermal power stations. To study the principle of operation of different components of a Nuclear power stations.
- To study the concepts of DC/AC distribution systems and voltage drop calculations.
- To study the constructional and operation of different components of an Air and Gas Insulated
- substations. To study the constructional details of different types of cables.
- To study different types of load curves and tariffs applicable to consumers.

Course Outcomes

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

- Identify different components of a thermal power station.
- Describe the operation of various components of a nuclear power station.
- Distinguish between the operation of hydro and gas power plants.
- Analyze the significance of various factors for economic analysis of power generation.
- Select the suitable tariff method for various consumers.

Syllabus

Introduction
Basic Structure of power system, Power Generation, Comparison of different Sources of Energy.

Hydro Electric Plants
Choice of Site, Hydrology, Classification of Plants, General Arrangement, Functions of Different Components of a Hydro Plant, Advantages & Disadvantages

Thermal Power Stations (TPS)
Line Diagram and location of thermal power plant, TPS components, Boilers – Fire tube and Water tube, Super heaters, Economizers, Condensers, Draught, Cooling Water Systems.

Nuclear Power Plants
Schematic Arrangement, Components of Nuclear Reactor, Classification and working of Nuclear reactors, Different Power Reactors.

Diesel Power Plant
Understand the Working Principle, Site Selection, Plant Layout, Components, Merits and Demerits.

Gas Turbine Plants
Layout, Components of a Gas Turbine Plant, Open Cycle and Closed Cycle Plants.

Magneto Hydro Dynamic (MHD) Power Generation
Basic Concepts, Principle, Classification, Coal Burning MHD Steam Power Plant, Gas Cooled Nuclear MHD Power, Liquid Metal MHD Generator.

Operational Aspects of Generating Stations
Load Curves and Associated Definitions – Connected load, Maximum demand, Demand factor, Load factor, Diversity factor, Capacity factor, Utilization factor, Capacity, utilization and plant use factors-Numerical Problems, Selection of Units, and Load Duration Curves.

Economic Considerations
Capital and Running Costs of Generating Stations, Different Tariffs - Simple Rate Tariff, Flat Rate Tariff, Block-Rate Tariff, Two-part Tariff, Three-part tariff and power factor tariff, Comparison of Costs.

Text Books

1. A Text Book on Power System Engineering by Soni, Gupta, Bhatnagar & Chakrabarti, Dhanpat Rai & Co.

Reference Books

1. Generation & Utilization by C. L. Wadhwa
2. Electrical Power by S. L. Uppal, Khanna Publishers

EE3106 PULSE AND DIGITAL CIRCUITS LABORATORY

Course Objectives

To familiarize student with

1. Generation and processing of sinusoidal and non-sinusoidal signals.
2. Fundamentals of basic logic gates and its applications.
3. Analysis and design of various multivibrator circuits.
4. Design and analysis of UJT relaxation oscillator and boot-strap sweep circuits

Course Outcomes

After the completion of the lab, the student

1. Will be able to Generate and process sinusoidal and non-sinusoidal signals.
2. Will be able to understand fundamentals of basic logic gates and design applications.
3. Will be able to design and analyze various multivibrator circuits.
4. Will be able to design and analyze UJT relaxation oscillator and boot-strap sweep circuits

List of Experiments

1. Linear wave shaping (RC Integrator & RC differentiator).
2. Non-Linear wave shaping – Clippers.
3. Non-Linear wave shaping – Clampers.
4. Astable Multivibrator.
5. Monostable Multivibrator.
6. Bistable Multivibrator.
7. Schmitt Trigger.
8. UJT Relaxation Oscillator.
9. Bootstrap sweep circuit.
10. Constant Current Sweep Generator using BJT.

EE3107 POWER ELECTRONICS LABORATORY

Course Objectives

- To study the characteristics of various power semiconductor, derive and analyze the operation of diode bridge rectifier.
- To Design firing circuits for SCR., Analyze the operation of AC voltage controller and half-wave phase-controlled rectifiers.
- To understand the operation of single phase full-wave converters and analyze harmonics in the input current.

Course Outcomes

Student should be able to

- Explain the characteristics of various power semiconductor derive and analyze the operation of diode bridge rectifier.
- Design firing circuits for SCR. Analyze the operation of AC voltage controller and half-wave phase-controlled rectifiers.
- Explain the operation of single phase full-wave converters and analyze harmonics in the input current.

List of Experiments

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study firing circuits of SCR.
3. To study single-phase half wave controlled rectified with (i) resistive load (ii) inductive load with and without freewheeling diode.
4. To study single phase (i) fully controlled (ii) half-controlled bridge rectifiers with resistive and inductive loads.
5. To study Thyristor forced commutation circuit.
6. To study single-phase ac voltage regulator with resistive and inductive loads.
7. To study Mc-Murray Bedford full bridge inverter.
8. To study MOSFET/IGBT based single-phase series inverter.
9. To study MOSFET/IGBT based single-phase parallel inverter.
10. To study operation of DC Jones chopper circuit
11. To study single phase Cyclo-converter

EE3108 PLCs

Course Objectives

- To Identify the components and performance characteristics of the SIMATIC S7-1200 PLC
- To learn to Install a PLC system, including the HMI and communication cabling
- To Use the various address types to edit, reload, structure and run a program
- To Document, test, and basically troubleshoot the control system and its program
- To Interface an HMI with the PLC control system

Course Outcomes

On completion of this course the participant will be able to:

- Identify the components and performance characteristics of the SIMATIC S7-1200 PLC
- Install a PLC system, including the HMI and communication cabling
- Use the various address types to edit, reload, structure and run a program
- Document, test, and basically troubleshoot the control system and its program
- Understand and create binary operations, timers, counters etc.
- Interface an HMI with the PLC control system

List of Experiments

1. Overview and significant performance characteristics of the SIMATIC S7-1200 system family
2. The components of the TIA Portal: SIMATIC STEP 7 Basic and WinCC Basic
3. Program execution in automation systems
4. Binary and digital operations in Ladder language
5. Setup and assembly of the SIMATIC S7-1200 automation system
6. Addressing and wiring the signal modules
7. Hardware and software commissioning of the SIMATIC S7-1200 with the TIA Portal
8. SIMATIC S7-1200 hardware configuration and parameterization
9. Introduction to the Touch panel (HMI)
10. Saving and documentation of the implemented program changes with the TIA Portal
11. Deeper understanding of contents through practical exercises on TIA system model

Experiments can be drafted basing on the theory course#

EE3201 POWER SYSTEM ANALYSIS & STABILITY

Course Objectives

To development the impedance diagram (p.u) and formation of Y-bus

- To study the different load flow methods.
- To study the concept of the Z-bus building algorithm.
- To study short circuit calculation for symmetrical faults.
- To study the effect of unsymmetrical faults and their effects.
- To study the rotor angle stability of power systems.

Course Outcomes

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

- Describe the per unit system of power system.
- Apply the concepts of addition or removal of element in the power system for determining the impedance matrix.
- Formulate and solve the power flow problem of power system.
- Develop and solve the positive, negative, and zero sequence networks for systems consisting of machines, transmission lines and transformers.
- Determine the fault voltages and currents for various faults.
- Analyze the stability of power system under various disturbances.

Syllabus

Per Unit Representation & Topology

Per Unit Quantities–Single line diagram– Impedance diagram of a power system – Graph theory definition – Formation of element node incidence and bus incidence matrices – Primitive network representation – Formation of Y– bus matrix by singular transformation and direct inspection methods.

Power Flow Studies

Necessity of power flow studies – Derivation of static power flow equations – Power flow solution using Gauss-Seidel Method – Newton Raphson Method (Rectangular and polar coordinates form) – Decoupled and Fast Decoupled methods.

Symmetrical Fault Analysis

Formation of Z_{Bus}: Partial network– Algorithm for the Modification of Z_{bus} Matrix for addition element for the following cases: Addition of element from a new bus to reference– Addition of element from a new bus to an old bus– Addition of element between an old bus to reference and Addition of element between two old busses (Derivations and Numerical Problems) – Modification of Z_{Bus} for the changes in network (Problems). 3–Phase short circuit currents and reactances of synchronous machine–Short circuit MVA calculations.

Symmetrical Components

Synthesis of unsymmetrical phasor from their symmetrical components– Symmetrical components of unsymmetrical phasor–Phase–shift of symmetrical components in Y–Δ–Power in terms of symmetrical components – Sequence networks – Positive, negative and zero sequence networks

Unsymmetrical Faults

Various types of faults LG– LL– LLG and LLL on unloaded alternator– unsymmetrical faults on power system.

Power System Stability Analysis

Elementary concepts of Steady state– Dynamic and Transient Stabilities– Description of Steady State Stability Power Limit–Transfer Reactance Synchronizing Power Coefficient –Power Angle Curve and Determination of Steady State Stability –Derivation of Swing Equation–Determination of Transient Stability by Equal Area Criterion–Application of Equal Area Criterion–Methods to improve steady state and transient stability.

Text Books

1. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
2. Modern Power system Analysis – by I. J. Nagrath& D. P. Kothari: Tata McGraw–Hill Publishing Company, 2nd edition.

Reference Books

1. Power System Analysis by Hadi Saadat – TMH Edition.

EE3202 POWER SYSTEMS – II

Course Objectives

- To compute inductance/capacitance of transmission lines and to understand the concepts of GMD/GMR
- To study the performance and modeling of short, medium and long transmission lines and to obtain the equivalent circuits of various types of transmission lines
- To discuss sag and tension computation of transmission lines and to study about various effects on conductors
- To study the performance of overhead insulators and to gain knowledge on design of insulators for overhead lines
- To understand the construction and grading of cables in power transmission
- To study the corona effect and losses due to corona and how to overcome corona effect

Course Outcomes

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

- Estimate the inductance and capacitance for different conductor configurations.
- Analyze the performance of short, medium & long transmission lines.
- Evaluate the sag and tension of transmission line for various configurations under the effect of wind and ice.
- Select a suitable insulator for a particular operating voltage, configuration and best method to improve string efficiency.
- Analyze the effect of various factors on corona.

Syllabus

Power Supply Systems

Comparison between Various Systems and Copper Efficiencies, Effect of System Voltage on Transmission Efficiency, Choice of Transmission Voltage, Conductor Size and Kelvin's Law.

Transmission Line Constants

Transmission line components, Types of conductors, Inductance and Capacitance of Single Phase and Three Phase Lines, Concept of GMDR Mutual GMD Double Circuit Line, Inductance of Composite Conductors, Transposition, Skin Effect and Proximity Effect.

Transmission Line Modeling

Generalized Network Constants, Modeling of Short Transmission line, Modeling of Medium transmission line: Nominal-T and Nominal-π methods and Long Transmission Lines, Rigorous Line Modeling.

Mechanical Design of Transmission Lines

Sag and Tension Calculations with equal and unequal heights of towers, effect of Wind and Ice on weight of conductor. Line Supports, Conductor Materials, Overhead Lines Vs Underground Cables.

Over Head Line Insulators

Types of Insulators, String efficiency and Methods for improvement–Numerical Problems, Voltage distribution, Calculation of string efficiency, Capacitance grading and Static Shielding.

Under-Ground Cables

Types of Cables, Insulation in Cables, Armouring& Covering of Cable, Insulation Resistance OFR Cables, Stress in Insulation, Sheathing in Cable, Use of Inter Sheaths, Capacitance Grading, Capacitance in 3-Core Cables.

Corona: Phenomenon of Corona, Critical Voltages, Power Loss due to Corona, Factors Affecting Corona Loss, Radio Interference.

Text Books

1. A Text Book on Power Systems Engineering by Sony, Gupta, Bhatnagar and Chakrabarti, Dhanapatrai& Co.
2. Electrical Power Systems by C. L. Wadhwa.

Reference Books

1. Electrical Power by S. L. Uppal.
2. A Course in Power Systems by J. B. Gupta.
3. Electrical Power Transmission and Distribution by S. Siva Nagaraju and S. Satyanarayana.

EE3203 CONTROL SYSTEMS

Course Objectives

- To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function.
- To analyze the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integral controllers.
- To investigate the stability of closed loop systems using Routh's stability criterion and the analysis by root locus method.
- To present the Frequency Response approaches for the analysis of linear time invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.
- To discuss basic aspects of Design and compensation of linear control systems using Bode plots.
- Ability to formulate state models and analyze the systems.
- To learn the concepts of Controllability and Observability.

Course Outcomes

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

- Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
- Develop mathematical models for physical systems.
- Employ the time domain analysis to quantify the performance of linear control systems and specify suitable controllers.
- Understand the concept of stability and its assessment for linear-time invariant systems.
- Quantify time and frequency domain specifications to determine stability margins.
- Apply state variable theory to determine the dynamic behavior of linear control systems.

Syllabus

Basic Structure of a Feedback Control System

Introduction to Mathematical Modeling of Physical Systems – Equations of Electrical Networks – Modeling of Mechanical Systems – Equations of Mechanical Systems, Analogous Systems.

Transfer Functions of Linear Systems

Impulse Response of Linear Systems – Block Diagrams of Control Systems – Signal Flow Graphs (Simple Problems) – Reduction Techniques for Complex Block Diagrams and Signal Flow Graphs (Simple Examples). Feedback Characteristics of Control Systems.

Time Domain Analysis of Control Systems

Time Response of First and Second Order Systems with Standard Input Signals – Steady State Error Constants – Effect of Derivative and Integral Control on Transient and Steady State Performance of Feedback Control Systems.

Stability

Concept of Stability and Necessary Conditions for Stability – Routh-Hurwitz Criterion, Relative Stability Analysis, the Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus (Simple Problems to understand theory).

Frequency Domain Analysis of Control Systems

Correlation between Time and Frequency Responses – Polar Plots – Bode Plots – Log Magnitude versus Phase Plots – All Pass and Minimum Phase Systems – Nyquist Stability Criterion – Assessment of Relative Stability – Constant M and N Circles-The Nichols Chart.

Text Books

1. Automatic Control Systems, Benjamin C. Kuo, PHI Publication (5^{th} Edition).

Reference Books

1. Modern Control Engineering, Ogata, PHI.
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, Wiley Eastern Ltd.
3. Control Systems Principles and Design M. Gopal, McGrawHill.

EE3206 MICROPROCESSOR AND MICROCONTROLLERS LABORATORY

Course Objectives

- To study programming based on 8085 and 8086 microprocessor and 8051 microcontrollers.
- To study 8085 and 8086 microprocessor-based ALP using arithmetic, logical and shift operations.

Course Outcomes

- Ability to handle arithmetic operations using assembly language programming
- Demonstrate ability to handle logical operations using assembly language programming
- Demonstrate ability to handle string instructions using assembly language programming
- Demonstrate ability to handle sorting operations and using assembly language programming

List Of Experiments

1. Arithmetic operations (addition, subtraction, multiplication and division) in 8086
2. Addition of two BCD numbers in 8086
3. Ascending order descending order of an array of numbers in 8086
4. Finding largest smallest number in an array of number in 8086
5. Generation of Fibonacci series in 8086
6. Hexa decimal to decimal conversion in 8086
7. ASCII to decimal conversion in 8086
8. Program for sorting an array for 8086
9. Program for searching for a number of character in an array for 8086
10. Program for String Manipulations for 8086
11. Seven-segment display interfacing to 8086
12. Stepper Motor Interfacing to 8086
13. Arithmetic operations (addition, subtraction, multiplication and division) in 8051 Micro Controller

EE3207 CONTROL SYSTEMS LABORATORY

Course Objectives

- To impart hands on experience to understand the performance of basic control system components such as magnetic amplifiers, D.C. servo motors, A.C. Servo motors, stepper motor and potentiometer.
- To understand time and frequency responses of control system with and without controllers and compensators.
- To understand the time and frequency response plots.
- To know the stability of the systems upto 5th order using various plots

Course Outcomes

- Able to analyze the performance and working Magnetic amplifier, D.C and A.C. servo motors and synchronous motors.
- Able to Design P,PI,PD and PID controllers
- Able to Design lag, lead and lag–lead compensators
- Able to control the temperature using PID controller
- Able to determine the transfer function of D.C motor
- Able to control the position of D.C servo motor performance
- Able to assess system stability using different plots with the help of simulation

List of Experiments

1. Time response of Second order system
2. Characteristics of Synchros
3. Programmable logic controller – characteristics of stepper motor
4. Effect of feedback on DC servo motor
5. Effect of P, PD, PI, PID Controller on a second order systems
6. Lag and lead compensation – Magnitude and phase plot
7. DC position control system 8. Transfer function of DC motor
8. Temperature controller using PID
9. Characteristics of magnetic amplifiers
10. Characteristics of AC servo motor
11. Characteristics of DC servo motor
12. Potentiometer as an error detector
13. To design Bode plots for the transfer functions of systems up to 5th order.

14. To design Root locus for the transfer functions of systems up to 5th order.
15. To design Polar and Nyquist plots for the transfer functions of systems up to 5th order.

EE3208 POWER SYSTEM LABORATORY

Course Objectives

- To compute inductance/capacitance of transmission lines and to understand the concepts of GMD/GMR.
- To study the short and medium length transmission lines, their models and performance.
- To study the effect of travelling waves on transmission lines.
- To study the factors affecting the performance of transmission lines and power factor improvement methods.

Course Outcomes

- Able to understand parameters of various types of transmission lines during different operating conditions.
- Able to understand the performance of short and medium transmission lines.
- Student will be able to understand travelling waves on transmission lines.
- Will be able to understand various factors related to charged transmission lines.

List of Experiments

1. Computation of Transmission Line Parameters.
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks.
3. Power Flow Analysis Using Gauss-Seidel Method.
4. Power Flow Analysis Using Newton-Raphson Method.
5. Symmetric and unsymmetrical fault analysis.
6. Transient and Small Signal Stability Analysis: Single-Machine Infinite Bus System.
7. Economic Dispatch in Power Systems.
8. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems.
9. State estimation: Weighted least square estimation.
10. Electromagnetic Transients in Power Systems: Transmission Line Energization.

EE3209 Soft Skills

Course Objectives

1. To develop skills to communicate clearly.
2. To aid students in building interpersonal skills.
3. To enhance team building and time management skills.
4. To inculcate active listening and responding skills.

Course Outcomes

1. Make use of techniques for self-awareness and self-development.
2. Apply the conceptual understanding of communication into everyday practice.
3. Understand the importance of teamwork and group discussions skills.
4. Develop time management and stress management.

Syllabus

Introduction to Soft Skills

Communication – Verbal and Non-Verbal Communication - Personal grooming (Etiquette, Attitude, Body Language), Posture, Gestures, Facial Expressions, Eye Contact, Space Distancing, Presentation Skills, Public Speaking, just a Minute (JAM) sessions, Adaptability.

Goal Setting and Time Management

Immediate, Short term, long term, Smart Goals, Strategies to Achieve goals, Types of Time, Identifying Time Wasters, Time Management Skills, Stress Busters.

Leadership and Team Management

Qualities of a Good Leader, Team Dynamics, Leadership Styles, Decision Making, Problem Solving, Negotiation Skills.

Group Discussions

Purpose (Intellectual ability, Creativity, Approach to a problem, Tolerance), Group Behaviour, Analysing Performance.

Job Interviews

Identifying job openings, Covering Letter and CVs / Resumes, Interview (Opening, Body-Answer Q, Close-Ask Q), Telephone Interviews, Types of Questions.

Reference Books

1. Krannich, Caryl, and Krannich, Ronald L. Nail the Resume! Great Tips for Creating Dynamite Resumes. United States, Impact Publications, 2005.
2. Hasson, Gill. Brilliant Communication Skills. Great Britain: Pearson Education, 2012
3. Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Education, 2001.
4. Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.
5. Rizvi, Ashraf M. Effective Technical Communication: India, McGraw-Hill Education. 2010
6. Thorpe, Edgar &Showick Thorpe. Winning at Interviews. 2nd Edition. Delhi: Dorling Kindersley, 2006.

EE4107 Internet of Things

Course objectives

- To log data measurements in the cloud and display these measurements.
- To control devices from anywhere in the world using Wi-Fi module.
- To carry out machine to machine interaction.
- To set up a cloud-based home automation system.

Course Outcomes

After successful completion of the course the students should be able to

- Using the Wi-Fi module interaction can be made with web services.
- Different scenarios can be created to actuate various actions.
- The WI-Fi module can be configured to send messages on many different scenarios.
- The health of a device can be monitored.

List of IoT based small student projects

1. Observing (sensed and measured) data remotely.
2. Controlling or actuating devices remotely.
3. Data communication through social media.
4. Sending out alerts by objects without human intervention.
5. Machine to machine communication.
6. Setting up a web server for data reception, processing, and control.
7. Developing an elementary home automation model.

Textbooks

1. Internet of Things: Surya Durbha, Jyoti Joglekar

Internet resources

Introduction to IoT: NPTEL-SWAYAM Portal

PROFESSIONAL ELECTIVES

1. DIGITAL SIGNAL PROCESSING

Course Objectives

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

- Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
- Analyse discrete-time systems using z-transform.
- Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
- Design digital filters for various applications.
- Apply digital signal processing for the analysis of real-life signals.

Course Outcomes

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

- Represent signals mathematically in continuous and discrete-time, and in the frequency domain.
- Analyse discrete-time systems using z-transform.
- Understand the Discrete-Fourier Transform (DFT) and the FFT algorithms.
- Design digital filters for various applications.
- Apply digital signal processing for the analysis of real-life signals.

Syllabus

Discrete - Time Signals and Systems

Discrete - Time Signals – Sequences, Linear Shift – Invariant Systems, Stability and Casuality, Linear Constants – Coefficient Difference Equations, Frequency Domain Representation of Discrete – Time Signals and Systems.

Applications of Z – Transforms

System Functions H(z) of Digital Systems, Stability Analysis, Structure and Realization of Digital Filters, Finite Word Length Effects.

Discrete Fourier Transform (DFT)

Properties of the DFS, DFS Representation of Periodic Sequences, Properties of DFT, Convolution of Sequences.

Fast – Fourier Transforms (FFT)

Radix – 2 Decimation – In – Time (DIT) and Decimation – In – Frequency (DIF), FFT Algorithms, Inverse FFT.

IIR Digital Filter Design Techniques

Design of IIR Filters from Analog Filters, Analog Filters Approximations (Butterworth and Chebyshev Approximations), Frequency Transformations, General Considerations in Digital Filter Design, Bilinear Transformation Method, Step and Impulse Invariance Technique.

Design of FIR Filters

Fourier Series Method, Window Function Techniques, Comparison of IIR and FIR Filters.

Text Books

1. Alan V. Oppenheim and Ronald W. Schafer: Digital Signal Processing, PHI.

Reference Books

1. Sanjit K. Mitra, Digital Signal Processing "A – Computer Based Approach", Tata McGraw Hill.
2. Raddar and Rabiner, Application of Digital Signal Processing.
3. S. P. Eugene Xavier, Signals, Systems and Signal Processing, S. Chand and Co. Ltd.
4. Antonio, Analysis and Design of Digital Filters, Tata McGraw Hill.

2 UTILISATION OF ELECTRICAL ENERGY

Course Objectives

- To understand the operating principles and characteristics of traction motors with respect to speed, temperature, loading conditions.
- To acquaint with the different types of heating and welding techniques.
- To study the basic principles of illumination and its measurement.
- To understand different types of lightning system including Design.

Course Outcomes

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

- Describe various electric heating and welding methods.
- Design illumination systems for residential, commercial and industrial environments.
- Design an illumination system.
- Calculate the required tonnage capacity for a given air-conditioning system.
- Evaluate domestic wiring connection and debug any faults occurred.

Syllabus

Electric Heating & Welding

Electric Heating: Advantages and methods of electric heating, resistance heating induction heating and dielectric heating. Electric welding: resistance and arc welding, electric welding equipment, comparison between A.C. and D.C. Welding.

Illumination-I

Introduction terms used in illumination, laws of illumination, polar curves, photometry, integrating sphere, sources of light.

Illumination-II

Discharge lamps, MV and SV lamps - comparison between tungsten filament lamps and fluorescent tubes, Basic principles of light control, Types and design of lighting and flood lighting.

Electrical Circuits used in Refrigeration

Air Conditioning and Water Coolers: Principle of air conditioning, vapour pressure, refrigeration cycle, eco-friendly refrigerants Description of Electrical circuit used in refrigerator, air conditioner, Lift wiring and Automobile wiring.

Electrolytic Processes

Need of electro-deposition, Laws of electrolysis, process of electrode position – clearing, operation, deposition of metals, polishing, buffing, Equipment and accessories for electroplating, Factors affecting electrode position, Principle of galvanizing and its applications, Principle of anodising and its applications, Electroplating on non-conducting materials, Manufacture of chemicals by electrolytic process and electrolysis process.

Electrical Safety, Wiring & Introduction to Power System

Safety measures in electrical system- types of wiring- wiring accessories- staircase, fluorescent lamps & corridor wiring- Basic principles of earthing-Types of earthing- Simple layout of generation, transmission & distribution of power.

Text Books

1. C.L. Wadhwa, 'Generation, Distribution and Utilization of Electrical Energy', New Age International Pvt. Ltd, 2003.
2. B.R. Gupta, 'Generation of Electrical Energy', Eurasia Publishing House (P) Ltd, New Delhi, 2003.

Reference Books

1. H. Partab, 'Art and Science of Utilization of Electrical Energy', DhanpatRai and Co, New Delhi, 2004.
2. E. Openshaw Taylor, 'Utilization of Electrical Energy in SI Units', Orient Longman Pvt. Ltd, 2003
3. Dash.S.S, Subramani.C,Vijayakumar.K, "BasicElectrical Engineering", First edition, Vijay Nicole Imprints Pvt.Ltd,2013.

3. HYBRID ELECTRIC VEHICLES

Course Objectives

- To familiarize the students with the need and advantages of electric and hybrid electric vehicles.
- To know various architectures of hybrid electric vehicles
- To understand the power management of plug-in electric vehicles
- To study and understand different power converters used in electrical vehicles.
- To familiarize with different batteries and other storage systems.

Course Outcomes

After the completion of the course the student should be able to:

- Know the concept of electric vehicles and hybrid electric vehicles.
- Familiar with different configuration of hybrid electric vehicles.
- Choose an effective motor for EV and HEV application
- Understand the power converters used in hybrid electric vehicles
- Know different batteries and other energy storage systems.

Syllabus

Introduction

Fundamentals of vehicle – components of conventional vehicle and propulsion load; Drive cycles and drive terrain; Concept of electric vehicle and hybrid electric vehicle; history of hybrid vehicles-advantages and applications of Electric and Hybrid Electric Vehicles.

Hybridization of Automobile

Architecture of HEVs-series and parallel HEVs – complex HEVs, Plug-in hybrid vehicles(PHEV-constituents of PHEV- comparison of HEV and PHEV; Extended range hybrid electric vehicles(EREVs)-blended PHEVs-Fuel Cell vehicle and its constituents

Special machine for EV and HEVs

Characteristics of traction drive-requirement of electric motors for EV/HEVs, Induction Motor drives – their control and applications in EV/HEVs. Brushless DC Motors: Advantages- control of

application in EV/HEVs. Switch Reluctance motors: Merits limitations – converter configuration-control of SRM for EV/HEVs

Power Electronics in HEVs

Boost and Buck-Boost converters-Multi Quadratn DC-DC onverters – DC-AC Inverter for EV and HEV applications – Three Phase DC-AC inverters – Voltage control of DC-AC inverters using PWM – EV and PHEV battery chargers

Energy Sources for HEVs

Energy Storage-Battery based energy storage and simplified models of battery-fuel cells-their characteristics and simplified models-super capacitor based energy storage-its analysis and simplified models-flywheels and their modeling for energy storage in EV/HEV- Hybridization of various energy storage devices.

Text Books

1. Ali Emadi-Advanced Electric Drive Vehicles – CRC Press – 2014
2. Iqbal Hussein- Electric and Hybrid Vehicles: Design Fundamentals – CRC Press-2003.

Reference Books

1. MehrdadEhsani – YimiGao – Sebastian E. Gay – Ali Emadi – Modern Electric – Hybrid Electric and Fuel Cell Vehicles: Fundamentals – Theory and Design – CRC Press – 2004
2. James Larminie – John Lowry – Electric Vehicle Technology Explained – Wiley – 2003.
3. H. Partab: Modern Electric Traction –DhanpatRai& Co – 2007.

4 ENERGY MANAGEMENT AND AUDITING

Course Objectives

The objective of this course is to

- provide learners abasic Principles of Energy Auditing
- will learn about Energy Management
- Will acquire knowledge and skills on Energy Efficient Motors
- Will learn about Power Factor Improvement, Lighting and Energy Instruments
- Will learn about Economic Aspects and Analysis

Course Outcomes

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

- Understand the current energy scenario and importance of energy conservation.
- Understand the concepts of energy management.
- Understand the methods of improving energy efficiency in different electrical systems.
- Understand the concepts of different energy efficient devices.

Syllabus

Basic Principles of Energy Audit
Energy audit- definitions, concept, types of audit, energy index, cost index,pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

Energy Management
Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions, language.

Energy Efficient Motors

Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

Power Factor Improvement, Lighting and Energy Instruments

Power factor – methods of improvement, location of capacitors, Pf with non-linear loads, effect of harmonics on power factor, power factor motor controllers - good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers, application of PLC's.

Economic Aspects and Analysis

Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis- Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

Text Books

1. Energy Management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012.
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd – 2nd Edition, 1995.
3. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing Company Ltd, New Delhi.

Reference Books

1. Energy management by Paulo' Callaghan, Mc – Graw Hill Book company – 1st edition, 1998.
2. Energy management hand book by W.C. Turner, John wiley and son, 2001.
3. Energy management and good lighting practice: fuel efficiency booklet12 – EEO.

5 POWER STATION PRACTICE

Course Objectives

- The objective of this course is to
- Learn design of power station with renewable
- will learn about Substation Design
- Will acquire knowledge and skills on Power Station and Sub Station Earthing
- Will learn about Insulation Coordination and Location of Lightning Arrestor Will learn about HVDC and EHV Transmission

Course Outcomes

At the end of this course student will be able to

- Selection of locating generating stations
- Explain the concept of Lightning Arrestor
- Describe the Operation and control of HVDC Transmission system.
- Applications of HVDC System.

Syllabus

Design of Power Station

Introduction, selection of sizes and location of generating stations, interconnections issues with wind and Solar PV.

Substation Design

Determination of voltage regulation and losses in power system, shifting of distribution transformer centre, Substation layout, sizes and locations of sub stations, Substation equipments specifications ratings and its operation from design view point, Cathodic Protection, Gas Insulated Substation (GIS).

Power System Earthing – Power Station and Sub Station Earthing

Objectives, definitions, tolerable limits of body currents, soil resistivity, measurement of soil resistivity, earth resistance, measurement of earth resistance, tolerable step and touch voltage, actual step and touch voltage, design of earthing grid, impulse behaviour of earthing system.

Insulation Coordination and Location of Lightning Arrestor
Introduction, definitions, insulation-co-ordination curves, determination of line insulation, Basic Insulation level (BIL), Insulation levels of substation equipments, Lightning arrestor selection and location, Selection of arrestor voltage rating, arrestor discharge voltage and arrestor discharge current, protective margin.

HVDC Transmission
Merits and demerits of HVDC transmission, one line diagram, types of DC link, necessary equipment's, operation and control, applications, recent advances of HVDC in India.

EHV Transmission
Introduction, Need of EHV Transmission Lines, Advantages and Disadvantages of EHV Lines

Note: It is suggested that based on the above syllabus, visits for LT/HT Electrification and 220KV/ 400 KV substations should be carried out.

Text Books

1. Electrical Power System Design – M. V. Deshpande, TMH publication
2. Electrical Power System Design – B. R. Gupta, S. CHAND
3. Electrical Power System Planning – A. S. Pabla, TMH publication
4. Substation Design – Satnam& Gupta, DhanpatRai and Co.
5. A course in Electrical Power- Soni, Gupta and Bhatnagar, DhanpatRai& Sons.

6 ADVANCED CONTROL SYSTEM

Course Objectives

- Review of the state space representation of a control system:
- To learn control systems components
- To introduce the concept of controllability and observability.
- To learn State Variable Analysis
- To learn about different compensations

Course Outcomes

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

- Understand various design specifications.
- Design controllers using the state-space approach.
- Design a compensator for continuous time systems.
- Apply the concepts of controllability and observability in evaluating the performance of control system.
- Design an appropriate feedback controller and/or observer for physical plants.

Syllabus

Control Systems Components

DC & AC Tachometers-Synchros, AC AND DC Servo Motors - Stepper Motors and its use in Control Systems, Amplidyne Metadyne - Magnetic Amplifier – Principle, Operation and Characteristics Ward - Leonard Systems.

State Variable Analysis

concept of State Variables & State Models, State model for Linear Continuous Time Systems, State-Space Representation Using Physical Variables, State-Space Representation Using Phase Variables.

Diagonalization, Jordan Canonical Form

Solution of State Equations, Properties of State Transition Matrix, Computation of State-Transition Matrix (Using Laplace Transformation, Cayley-Hamilton Theorem).

Controllability & Observability

Concept of Controllability &Observability, Controllable Companion Form, Observable Companion Form (For SISO and MIMO Systems), Pole Placement by State Feedback.

Introduction to Design

Introduction-Preliminary Considerations of Classical Design - Lead Compensation, Lag Compensation, Realization of Compensating Networks, Cascade Compensation in Time Domain and Frequency Domain (Root Locus and Bode Plot Techniques).

Text Books

1. Control Systems Engineering, I J Nagrath, M.Gopal, New Age International Publishers.
2. Modern Control System Theory, M. Gopal, New Age International Publishers.

Reference Books

1. R. T. Stefani and G. H. Hostetter, “Design of feedback Control Systems”, Saunders College Pub, 1994.

7 DIGITAL CONTROL SYSTEMS

Course Objectives

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

- Obtain discrete representation of LTI systems.
- Analyze stability of open loop and closed loop discrete-time systems.
- Design and analyze digital controllers.
- Design state feedback and output feedback controllers.

Course Outcomes

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

- Obtain discrete representation of LTI systems.
- Analyze the stability of open loop and closed loop discrete-time systems.
- Design and analyze digital controllers.
- Design state feedback and output feedback controllers.

Syllabus

Discrete –Time Systems
The Structure of a Digital Control System, Analog Systems with Piecewise Constant Inputs, Difference Equations, The Z-Transform, Z-Transform Solution of Difference Equation, The Time Response of a Discrete-Time System, Frequency Response of Discrete-Time Systems.

Modeling of Digital Control Systems
ADC Model, DAC Model, Transfer Function of the ZOH, Effect of Sampler on Transfer Function of a Cascade, Transfer Function for the DAC, Analog Subsystem, ADC Combination, Closed-Loop Transfer Function, Analog Disturbances in a Digital System, Steady-State Error and Error Constants.

Stability of Digital Control Systems
Definitions of Stability, Stable Z-Domain Pole Locations, Stability Conditions, Stability Determination, Jury Test.

State Space Representation

Discrete-Time State Space Equations, Solution of Discrete-Time State Space Equations, Z-Transfer function from State Space Equations, Similarity Transformation, Stability of State Space Realizations, Controllability and Stabilizability, Observability and Detectability.

State Feedback Control

On State and Output Feedback, Pole Placement, Servo Problem, Principles of Observer, State Feedback and Pole Assignment Using Transfer Functions.

Text Books

1. Digital control systems by B.C.Kuo, Oxford University Press.

Reference Books

1. Digital Control Engineering: Analysis and Design**,** By M. Sami Fadali, Antonio Visioli, Academic Press; 1edition (February 16, 2009)
2. Digital control systems by K.Ogata.

8 HIGH VOLTAGE ENGINEERING

Course Objectives

- To learn break down in gases, liquid and materials
- To introduce and learn how to measure Measurements of High Voltages and Current
- To learn Lightning and Switching Over-voltages
- To learn about High Voltage Testing of Electrical Apparatus and High Voltage Laboratories

Course Outcomes

At the end of the course, the student will demonstrate

- Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials.
- Knowledge of generation and measurement of D. C., A.C., & Impulse voltages.
- Knowledge of tests on H. V. equipment and on insulating materials, as per the standards.
- Knowledge of how over-voltages arise in a power system, and protection against these over-voltages.

Syllabus

Breakdown in Gases

Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge

Breakdown in liquid and solid Insulating materials

Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

Generation of High Voltages

Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

Measurements of High Voltages and Current

Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

Lightning and Switching Over-voltages

Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching over voltages, Protection against over-voltages, Surge diverters, Surge modifiers.

High Voltage Testing of Electrical Apparatus and High Voltage Laboratories

Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

Text / Reference Books

1. M. S. Naidu and V. Kamaraju, “High Voltage Engineering”, McGraw Hill Education, 2013.
2. C. L. Wadhwa, “High Voltage Engineering”, New Age International Publishers, 2007.

9 SMART GRIDS

Course Objectives

To impart knowledge about the following topics:

- Smart Grid technologies, different smart meters and advanced metering infrastructure.
- The power quality management issues in Smart Grid.
- The high-performance computing for Smart Grid applications.

Course Outcomes

At the end of the course, the student will

- develop more understanding on the concepts of Smart Grid and its present developments.
- study about different Smart Grid technologies.
- acquire knowledge about different smart meters and advanced metering infrastructure.
- have knowledge on power quality management in Smart Grids.
- develop more understanding on LAN, WAN and Cloud Computing for Smart Grid applications.

Syllabus

Introduction to Smart Grid

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, National and International Initiatives in Smart Grid.

Smart Grid Technologies

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/VAR control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plugin Hybrid Electric Vehicles (PHEV).

Smart Meters and Advanced Metering Infrastructure

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) driver sand benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU), Intelligent Electronic Devices (IED)&their application for monitoring & protection.

Power Quality Management in Smart Grid
Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

High Performance Computing for Smart Grid Applications
Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broad band over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Text Books

1. Stuart Borlase "Smart Grid: Infrastructure, Technology and Solutions", CRCPress2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", Wiley2012.

References

1. VehbiC. Güngör , Dilan Sahin, Taskin Kocak, Salih Ergüt, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions On Industrial Informatics, Vol.7,No.4, November2011.
2. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang"SmartGrid –The New and Improved Power Grid: A Survey" ,IEEE Transaction on Smart Grids,vol.14,2012.
3. James Momohe "Smart Grid: Fundamentals of Design and Analysis,", Wiley-IEEE Press, 2012.

10 FLEXIBLE AC TRANSMISSION SYSTEMS

Course Objectives

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

- Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.
- Understand the working principles of FACTS devices and their operating characteristics.
- Understand the basic concepts of power quality.
- Understand the working principles of devices to improve power quality.

Course Outcomes

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

- Understand the characteristics of ac transmission and the effect of shunt and series reactive compensation.
- Understand the working principles of FACTS devices and their operating characteristics.
- Understand the basic concepts of power quality.
- Understand the working principles of devices to improve power quality.

Syllabus

Introduction

Electrical Transmission Networks, Conventional Control Mechanisms-Automatic Generation Control, Excitation Control, Transformer Tap-Changer Control, Phase-Shifting Transformers; Advances in Power-Electronic Switching Devices, Principles and Applications of Semiconductor Switches; Limitations of Conventional Transmission Systems, Emerging Transmission Networks, HVDC and FACTS options.

Flexible AC Transmission Systems (FACTS)

Transmission Interconnections, Power Flow in AC System, Factors Limiting the Loading Capability of Transmission Lines, Power Flow and Dynamic Stability Considerations, Importance of Controllable Parameters, Types of FACTS Controllers.

FACTS Converters

Types of Converter, Concept and operation of Voltage sourced converters, Current Sourced converters, Operation of Single-Phase and Three-Phase Bridge Converters, Description of Three-Level VSC and PWM Converters, Transformer Connections for 12-pulse, 24-pulse and 48-pulse operation.

Shunt, Series Type FACTS Controllers (Operation and Theoretical Descriptions only)
Objective of Shunt Compensation, Methods of Controllable Shunt VAR Generation (Variable Impedance type, Switching Converter type and Hybrid type), Objective of Series Compensation, Methods of Controllable Series VAR Generation (Variable Impedance type, Switching Converter type and Hybrid type).

UPFC and IPFC
Unified Power Flow Controller (UPFC) – Principle of operation, Transmission Control Capabilities, Independent Real and Reactive Power Flow Control;Principle of operation and Characteristics of Interline Power Flow Controller (IPFC), UPFC and IPFC control structures (only block diagram description).

Text Books

1. Narain G. Hingorani and Laszlo Gyugyi, Understanding FACTS: Concepts and Technology ofFlexible AC Transmission Systems,IEEE Press, Wiley-Interscience, New Jersey, 2000.
2. R Mohan Mathur and Rajiv K Varma, Thyristor-Based FACTS Controllers for Electrical Transmission Systems, IEEE Press, Wiley-Interscience, New Jersey, 2002.

Reference Books

1. K R Padiyar, FACTS Controllers in Power Transmission and Distribution, New Age International Publishers, New Delhi, 2007.
2. AnriqueAcha, Claudio R. Fuerte-Esquivel, Hugo Ambriz-Pérez and César Angeles-Camacho, FACTS: Modelling and Simulation in Power Networks, John Wiley & Sons, West Sussex, 2004.

11 ELECTRICAL DISTRIBUTION SYSTEMS

Course Objectives

To study different factors of Distribution system.

- To study and Design the substations and distribution systems.
- To study the concepts of voltage drop and power loss.
- To study the distribution system protection and its coordination.
- To study the effect of compensation for power factor improvement.
- To study the effect of voltage control on distribution system.

Course Outcomes

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

- Distinguish various load models in the distribution system
- Describe the primary feeder ratings and voltage levels.
- Design an optimum location of the substation.
- Analyze the distribution system and its associated coordination procedures.
- Select appropriate voltage control method in the distribution systems

Syllabus

Distribution System Basics

Brief description about electrical power transmission and distribution systems, Factors effecting the system planning, Distribution system planning methods, Planning models, Factors for future planning, Distribution system loading characteristics – demand, demand interval, Maximum demand, diversified demand, Non-coincident demand, demand factor, connected load, utilization factor, plant factor, load factor, diversity factor, coincidence factor, load diversity, contribution factor, loss factor; relation between load and loss factors, Tariff structures (As per text book and practically existing at the institution location are to be covered).

Distribution Systems

Types of distribution sub-transmission, Substation bus schemes and comparison, Factors effecting the substation location, Rating of a distribution substation for square and hexagonal shaped

distribution substation service area, Factors effecting the primary feeder rating, types of primary feeders, Factors affecting the primary feeder voltage level, Factors affecting the primary feeder loading, Tie-lines, Radial feeder with uniformly and non-uniformly distributed loading.

Distribution System Components

Approximate line segment model, Various types of loads, Definitions of various terms related to system loading, Detailed description of distribution transformer loading, feeder loading, Modelling of star and delta connected loads, two-phase and single-phase loads, shunt capacitors, Voltage regulators, Line-drop compensator.

Modern Distribution Systems

Distribution system automation, Architecture and implementation strategies for distribution automation, Distribution management system functions, Real-time control system, Outage management, Decision support applications, Concepts of distributed generation, Various types of distributed generators.

Advanced topics in Distribution Systems

Basic reliability indices, Calculation of SAIDI, SAIFI and MAIFI, Distribution automation communication protocols: MODBUS, DNP 3.0, IEC 60870-5-101, UCA 2.0, IEC 61850; Brief description of Smart-grid, Micro-grid, and Nano-grid with simple examples.

Text Books

1. Distribution System Modelling and Analysis, William H. Kersting, CRC Press, Newyork, 2002.
2. Electric Power Distribution System Engineering, TuranGonen, McGraw-Hill Inc., New Delhi, 1986.

Reference Books

1. Control and Automation of Electrical Power Distribution Systems, James Northcote-Green and Robert Wilson, CRC Taylor & Francis, New York, 2007.

12 ELECTRICAL DRIVES AND TRACTION

Course Objectives

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

- Analyze the appropriate type of traction system.
- Select a suitable drive for speed control of AC motors.
- Select a suitable drive for speed control of DC motors.
- Determine the tractive effort, power and specific energy consumption of electric traction

Course Outcomes

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

- Analyze the appropriate type of traction system.
- Select a suitable drive for speed control of AC motors.
- Select a suitable drive for speed control of DC motors.
- Determine the tractive effort, power and specific energy consumption of electric traction.

Syllabus

Electric Drive

Definition, Components of electric drive system, Advantages and applications of drives, factors governing the selection of motors, classification of drives, Drive characteristics and nature of load conditions, selection of motor for particular drive, Dynamics of motor load combination, Multi quadrant operation, Nature, classification and components of load torques.

Speed Control of DC Motor Drives

Speed Control methods, Single phase rectifier fed uncontrolled and controlled drives, chopper fed drives, closed loop control and Phase locked loop control of DC drives.

Speed Control of AC Motor Drives

Speed control methods of induction motors, phase controlled drives; frequency controlled drives, slip power recovery schemes, voltage current and frequency control and closed loop control. Variable frequency control of synchronous motor drives, self-controlled synchronous motor drives.

Electric Traction I

Definition and features of traction, Classification of traction systems, Types and choice of track electrification systems, Review of characteristics and suitability of traction motors. Transmission of drive and auxiliary equipment, Loco wheel arrangement and riding qualities, Train lighting system.

Electric Traction II

Speed time curves and speed distance curves, Tractive effort, specific energy consumption, mechanics of train movement, coefficient of adhesion.

Control of Traction Motors

Control of traction motors, rheostaticcontrol, series parallel control, drum controllers, constant current systems, multiple unit control, thyristor and feedback controls. Magnetic levitation suspension systems.

Text Books

1. Fundamentals of Electrical Drives by GK Dubey
2. Power Electronics: Circuits, Systems and Applications by MH Rashid
3. A First Course on Electric Drives by SK Pillai
4. Utilization of Electrical Energy by E. Open Shaw Taylor and VVL Rao

Reference Books

1. Electrical Drives and Traction by N. Prema Kumar
2. Electrical Drives by VedamSubramanyam
3. Modern Elecric Traction by H. Partab

13 HVDC TRANSMISSION

Course Objectives

To Understand basic concepts of HVDC Transmission.

- To analyze the converter configuration.
- To Know the control of converter and HVDC Transmission.
- To Understand the significance of reactive power control and AC/Dc load flow.
- To Know different converter faults, protection and effect of harmonics.
- To leave low pass and high pass filters.

Course Outcomes

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

- Understand the advantages of dc transmission over ac transmission.
- Understand the operation of Line Commutated Converters and Voltage Source Converters.
- Understand the control strategies used in HVDC transmission system.
- Understand the improvement of power system stability using an HVDC system.

Syllabus

General aspects of DC transmission and comparison of it with AC transmission Introduction, General aspects of transmission, Transmission links, types- Monopolar, Homopolar, Bipolar and Back-to-Back, Constitution of dc and ac links. Technical aspects, Economic aspects, Reliability aspects and Environmental aspects of HVDC Transmission (HVDCT), Advantages and disadvantages of HVDCT, Applications of DC Transmission, HVDC light.

Converters

Definition, Thury system, Valves, Valve characteristics, Components of circuits, Properties of converter circuits, Pulse number, Single phase and three phase converters, Assumptions in converter circuit, Greatz circuit, Bridge converter with grid control without overlap, Bridge converter with grid control with overlap less than 60^0

HVDC Links and Converters

Characteristics of converter circuits – Rectifier and inverter characteristics, complete characteristics of rectifier and inverter, Equivalent circuit of HVDC Link, Brief description of 12-pulse, 24-pulse and 48-pulse converters transformer configurations, Choice of converter circuit for HVDC transmission.

HVDC Converter control

Desired features and means of control, control of the direct current transmission link, Constant current control, Constant ignition angle control, Constant extinction angle control, Converter firing-angle control-IPC and EPC, frequency control and Tap changer control, Starting, Stopping and Reversal of power flow in HVDC links.

Mis-operation and Protection of DC links

Malfunction of converter valves, Arc-back, Arc-through, Misfire, Quenching, Commutation failure, Valve blocking and bypass, short circuits within the converter station. DC reactors, valve dampers, line dampers, circuit breakers.

Text Books

1. E.W. Kimbark, Direct current transmission, Vol. I, Wiley Interscience, New York, 1971.
2. P Kundur, Power System Stability and Control, McGraw Hill Inc., New York, 1994.

Reference Books

1. K. R. Padiyar, HVDC Power Transmission Systems: Theory and System Interactions, New Age International Publishers, New Delhi, 2009.
2. Erich Uhlmann, Power Transmission by Direct Current, Springer-Verlag, Berlin/Heidelberg, 1975.

14 POWER SYSTEM PROTECTION

Course Objectives

To provide the basic principles and operation of various types of circuit breakers.

- To study the classification, operation and application of different types of electromagnetic protective relays.
- To explain protective schemes, for generator and transformers.
- To impart knowledge of various protective schemes used for feeders and bus bars.
- To explain the principle and operation of different types of static relays.
- To study different types of over voltages in a power system and principles of different protective schemes for insulation co–ordination

Course Outcomes

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

- Understand the different components of a protection system.
- Evaluate fault current due to different types of fault in a network.
- Understand the protection schemes for different power system components.
- Understand the basic principles of digital protection.
- Understand system protection schemes, and the use of wide-area measurements.

Syllabus

Introduction to Protection Scheme

Need for Protective systems - Nature and causes of Faults -Types of faults - Effect of faults - fault statistics - Evolution of protective relays - Zones of protection - Primary and Back -up Protection - Essential qualities of Protection -Classification of Protective schemes -Automatic reclosing - current transformer for Protection - potential transformer - basic relay terminology.

Relays

General considerations - sensing of faults - construction of electro-magnetic attraction and induction types relays - Buchholz and negative sequence relay -concept of reset, pick up, inverse time and definite time characteristics, over current, over voltage, directional, differential and distance relays on R-X diagram

Static Relays

Introduction, advantage and limitation of static relays, static over current, directional, distance and differential relays. Electronic relays - static relays functional circuits: comparators, level detectors, logic and training circuits, microprocessor and computer-based protection schemes.

Protection

Types & detection of faults and their effects, alternator protection scheme - Power transformer protection, generator-transformer unit protection scheme, bus bar protection - Transmission line protection, Pilot relaying schemes, power line carrier protection.

Switchgear

Theory of current interruption- energy balance and recovery rate theory, arc quenching, recovery and restriking voltages - Types of circuit breakers - Rating selection and testing of circuit breakers/operating mechanisms - LT switchgear, HRC fuses, types construction and applications.

Text Books

1. Badriram & Vishwakarma, “Power System Protection”, Tata McGraw-Hill Education, 2011.
2. Paithankar Y. G., S. R. Bhide., “Fundamentals of power system protection”, PHI Learning Pvt. Ltd., 2004.

Reference Books

1. RavindraNath.B, and Chandar.M, “Power systems protection and switchgear”, New age international (P) Ltd. 2005.
2. RaoSunil.S, “Switchgear and protection”. Khanna Publishers, 1999.
3. Paithankar.Y.G,” Transmission Network Protection: Theory and Practice”, Marcel Deicker, Inc.1998.

15 POWER SYSTEM OPERATION AND CONTROL

Course Objectives

To understand optimal dispatch of generation with and without losses.

- To study the optimal scheduling of hydro thermal systems.
- To study the optimal unit commitment problem.
- To study the load frequency control for single area system with and without controllers
- To study the load frequency control for two area system with and without controllers
- To understand the reactive power control and compensation of transmission lines.

Course Outcomes

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

- Evaluate optimal generation schedule with and without losses.
- Compute loss coefficients and transmission losses.
- Find the solution for short term hydrothermal scheduling problems.
- Determine the steady state changes in frequency in single area and two area load frequency control.
- Suggest suitable voltage control method for different applications.

Syllabus

Optimal System Operation

Characteristics of various steam units, combined cycle plants, cogeneration plants, Hydro-electric units, Steam units economic dispatch problem with and without considering losses and solution using Lagrange multiplier method only.

Hydro-Thermal Coordination

Hydro-electric plant models, Scheduling energy, Short-term hydrothermal scheduling.

Unit Commitment

Constraints in unit commitment, Generation of state, optimizing the states using Priority-list method, Unit commitment problem solution using Priority-list method and Dynamic Programming.

Optimal Power Flow

Optimal power flow problem formulation for loss and cost minimization, Solution of optimal power flow problem using Newton's method and Linear Programming technique.

Automatic Generation Control

Control System structure, Automatic Load–frequency control of single area system with and without control, Steady state and dynamic responses of single area ALFC loop, Automatic Load-frequency control of two area system, Tie-line bias control of two area and multi-area system.

Voltage Control

Automatic voltage regulator, Exciter types, Exciter modelling, Generator modelling, Static and Dynamic response of AVR loop.

Power System Security

Introduction, Factors affecting the power system security, Contingency analysis procedure, Linear sensitivity factors: Line outage distribution factors and Generation shift factors, and its derivation; AC power flow method, contingency selection.

State Estimation

Weighted Least Square State Estimation, Basic concepts about network observability, Pseudo-measurements, Bad data detection and identification.

Text Books

1. Power Generation, Operation and Control, Allen J. Wood and Bruce F. Wollenberg, John Wiley & Sons, Inc., New York, 2nd edition, 1996.
2. Electric Energy Systems Theory: An Introduction, Olle I. Elgerd, TMH Publishing Company Ltd., New Delhi, 2nd edition, 1983.

Reference Books

1. Power System Analysis and Design by J.Duncan Glover and M.S.Sarma., Thompson, 3rdEdition.
2. Power System Analysis by Grainger and Stevenson, Tata McGraw Hill.
3. Power System Analysis by HadiSaadat – TMH Edition.
4. Power System stability & control, PrabhaKundur,TMH

OPEN ELECTIVES

1.DIGITAL LOGIC DESIGN

Course Objectives

- Introduce the concept of digital and binary systems
- Be able to design and analyze combinational logic circuits.
- Be able to design and analyze sequential logic circuits.
- Understand the basic software tools for the design and implementation of digital circuits and systems.
- Reinforce theory and techniques taught in the classroom through experiments and projects in the laboratory.

Course Outcomes

- Apply the simplification of Boolean expressions using K – Map method and designing Combinational circuits.
- Outline the combinational building blocks & memory elements.
- Design the combinational and sequential circuits using hardware description language.
- Solve the asynchronous sequential circuits for given applications
- Explain the applications of digital electronics

Syllabus

Numbering Systems

Basic structure and brief description of Digital computers and Digital systems - Binary, Octal, Decimal and Hex numbering systems – Number base Conversions – (n-1)'s and n's complements of the various numbering systems – Binary arithmetic – Various methods to represent signed binary numbers.

Binary Codes

BCD, Excess-3 codes – Binary arithmetic using BCD and Excess-3 codes – Gray code – Error detecting codes : parity checking and Hamming code – Error correcting codes: Hamming code – Basic idea of 2421, 84-2-1, ASCII codes.

Boolean Algebra and Boolean Functions

Boolean theorems and postulates – Logic gates – Truth table - Boolean functions – Dual of a function – Complement of a function – Canonical and standard forms – Simplification of Boolean

functions using Boolean theorems and postulated, Karnaugh map (K-map) with maximum of 5 variables – Quine-McCluskey Tabular method.

Combinational Logic Circuits- I

Boolean function implementation using AND-OR logic, multilevel NAND and multilevel NOR implementation – Transformation of multilevel NAND and NOR circuits to AND-OR diagram – Combinational logic design - Half adder – Full adder – Half subtractor – Full subtractor – Parallel adder – Parallel adder/subtractor –Carry look ahead adder – BCD adder – Magnitude comparator – Even and odd functions– Parity generator and checker – code converters.

Combinational Logic Circuits- II

Decoders – Encoders – Demultiplexer – Multiplexer – Read Only Memory (ROM) – PLA – PAL – implementation of the Boolean functions using decoders, multiplexers, ROMs, PLA, and PAL.

Sequential Logic Circuits: Differences between combinational logic and sequential logic – Flip-flops (R-S, J-K, D, T, Master-slave J-K flip) – Truth tables and excitation tables of the flip-flops, Conversions of flip-flops – state diagram – Mealy and Moore models – Design of sequential circuits with various flip-flops – Design of synchronous counters – Serial adder.

Micro Computer Components Design with Flip-flops: Register – Register with parallel load – Shift register – Bidirectional shift register with parallel load – Ripple counters (Binary and BCD) – Binary counters with parallel load.

Text Books

1. M. Morris Mano, Digital Design, Prentice-Hall of India Pvt. Limited, New Delhi, 2nd Edition. 2000.

Reference Books

1. Zvi Kohavi, Switching and Finite Automata Theory, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2nd Edition, 2008.
2. Frederick J. Hill and Gerald R. Peterson, Introduction to Switching Theory and Logic Design, John Wiley & sons, Inc. New York, 3rd edition, 1981.

2.COMPUTER ARCHITECTURE AND ORGANIZATION

Course Objectives

- To understand the architecture of a modern computer with its various processing units. Also the Performance measurement of the computer system.
- To understand the memory management system of computer.
- To Understand the various instructions, addressing modes
- To Understand the concept of I/O organization

Course Outcomes

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

- Explain about the concept of arithmetic micro-operations.
- Describe the vector and pipeline processing.
- Explain the addressing modes of CPU.

Syllabus

Register Transfer and Micro operations

Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations, Arithmetic Logic Shift Unit.

Basic Computer Organization and Design

Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output and Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Micro programmed Control

Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

Central Processing Unit

Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC)

Pipeline and Vector Processing

Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISK Pipeline, Vector Processing, Array Processors.

Input/output Organization
Peripheral Devices, I/O interface, Asynchronous data transfer, Modes of transfer, priority Interrupt, Direct memory access, Input-Output Processor (IOP), Serial Communication.

Memory Organization
Memory Hierarchy, Main memory, Auxiliary memory, Associate Memory, Cache Memory, and Virtual memory, Memory Management Hardware.

Text Books

1. Computer System Architecture, M. Morris Mano, Prentice Hall of India Pvt. Ltd., Third Edition, Sept. 2008.

Reference Books

1. Computer Architecture and Organization, William Stallings, PHI Pvt. Ltd., Eastern Economy Edition, Sixth Edition, 2003.
2. Computer Organization and Architecture, Linda Null, Julia Lobur, Narosa Publications ISBN81- 7319-609-5
3. Computer System Architecture", John. P.Hayes.

3.CONTROL SYSTEMS

Course Objectives

- To model an electrical system and also a mechanical system using differential equations.
- To obtain the transfer function (input-output relation).
- To obtain the time and frequency response considering these transfer function models.
- Characterization of these responses and
- Also analyze stability of these physical systems.

Course Outcomes

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

- Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
- Develop mathematical models for physical systems.
- Employ the time domain analysis to quantify the performance of linear control systems and specify suitable controllers.
- Understand the concept of stability and its assessment for linear-time invariant systems.
- Quantify time and frequency domain specifications to determine stability margins.
- Apply state variable theory to determine the dynamic behavior of linear control systems.

Syllabus

Basic Structure of a Feedback Control System

Introduction to Mathematical Modeling of Physical Systems – Equations of Electrical Networks – Modeling of Mechanical Systems – Equations of Mechanical Systems, Analogous Systems.

Transfer Functions of Linear Systems

Impulse Response of Linear Systems – Block Diagrams of Control Systems – Signal Flow Graphs (Simple Problems) – Reduction Techniques for Complex Block Diagrams and Signal Flow Graphs (Simple Examples). Feedback Characteristics of Control Systems.

Time Domain Analysis of Control Systems

Time Response of First and Second Order Systems with Standard Input Signals – Steady State Error Constants – Effect of Derivative and Integral Control on Transient and Steady State Performance of Feedback Control Systems.

Stability

Concept of Stability and Necessary Conditions for Stability – Routh-Hurwitz Criterion, Relative Stability Analysis, the Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus (Simple Problems to understand theory).

Frequency Domain Analysis of Control Systems

Correlation between Time and Frequency Responses – Polar Plots – Bode Plots – Log Magnitude versus Phase Plots – All Pass and Minimum Phase Systems – Nyquist Stability Criterion – Assessment of Relative Stability – Constant M and N Circles-The Nichols Chart.

Text Books

1. Automatic Control Systems, Benjamin C. Kuo, PHI Publication (5^{th} Edition).

Reference Books

1. Modern Control Engineering, Ogata, PHI.
2. Control Systems Engineering, I. J. Nagrath and M. Gopal, Wiley Eastern Ltd.
3. Control Systems Principles and Design M.Gopal, McGrawHill

4.COMPUTER NETWORKS

Course Objectives

- Understand state-of-the-art in network protocols, architectures, and applications.
- Process of networking research
- Constraints and thought processes for networking research
- Problem Formulation—Approach—Analysis

Course Outcomes

After the completion of the course the student should be able to:

- Understand OSI and TCP/IP models
- Analyze MAC layer protocols and LAN technologies
- Design applications using internet protocols
- Understand routing and congestion control algorithms
- Understand how internet works

Syllabus

Introduction Computer Networks

Network Topologies WAN, LAN, MAN. Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models Physical Layer – Fourier Analysis – Bandwidth Limited Signals – The Maximum Data Rate of a Channel - Guided Transmission Media, Digital Modulation and Multiplexing: Frequency Division Multiplexing, Time Division Multiplexing, Code Division Multiplexing Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols

The Data Link Layer

Services Provided to the Network Layer – Framing – Error Control – Flow Control, Error Detection and Correction – Error-Correcting Codes – Error Detecting Codes, Elementary Data Link Protocols-A Utopian Simplex Protocol-A Simplex Stop and Wait Protocol for an Error free channel-A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols-A One Bit Sliding Window Protocol-A Protocol Using GoBack-N- A Protocol Using Selective Repeat.

Medium Access Control Sub layer

The Channel Allocation Problem-Static Channel Allocation-Assumptions for Dynamic Channel Allocation, Multiple Access Protocols Aloha-Carrier Sense Multiple Access Protocols-Collision-

Free Protocols-Limited Contention Protocols-Wireless LAN Protocols, Ethernet-Classic Ethernet Physical Layer-Classic Ethernet MAC Sublayer Protocol-Ethernet Performance-Fast Ethernet Gigabit Ethernet-10-Gigabit Ethernet-Retrospective on Ethernet, Wireless Lans-The 802.11 Architecture and Protocol Stack The 802.11 Physical Layer-The802.11 MAC Sublayer Protocol-The 805.11 Frame Structure Services.

Design Issues

The Network Layer Design Issues – Store and Forward Packet Switching Services Provided to the Transport layer- Implementation of Connectionless Service Implementation of Connection Oriented Service-Comparison of Virtual Circuit and Datagram Networks, Routing Algorithms-The Optimality principle-Shortest path Algorithm, Congestion Control Algorithms-Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding.

Transport Layer

The Internet Transport Protocols: Udp, the Internet Transport Protocols: TCP Application Layer – The Domain Name System: The DNS Name Space, Resource Records, Name Servers, Electronic Mail: Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery

Text Books

1. Tanenbaum and David J Wetherall, Computer Networks, 5th Edition, Pearson Edu, 2010 2. Computer Networks: A Top Down Approach, Behrouz A. Forouzan, FirouzMosharraf, McGraw Hill Education.

Reference Books

1. Larry L. Peterson and Bruce S. Davie, “Computer Networks - A Systems Approach” (5th ed), Morgan Kaufmann/ Elsevier, 2011.

5.RENEWABLE ENERGY SOURCES

Course Objectives

- To study the solar radiation data, extraterrestrial radiation, radiation on earth‘s surface.
- To study solar thermal collections
- To study solar photo voltaic systems.
- To study maximum power point techniques in solar pv and wind energy
- To study wind energy conversion systems, Betz coefficient, tip speed ratio.
- To study basic principle and working of hydro, tidal, biomass, fuel cell and geothermal systems.

Course Outcomes

- At the end of this course, students will demonstrate the ability to
- Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
- Understand the basic physics of wind and solar power generation.
- Understand the power electronic interfaces for wind and solar generation.

Syllabus

Energy Sources
Classification, Indian energy scenario, prediction regarding fossil fuels, generation of non-conventional and renewable energy resources, Description of renewable energy sources, Achievements of renewable energy in India, Use of renewable energy in agriculture in India.

Solar Energy
Environmental impact of solar power, principles of solar radiation, solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surfaces, solar radiation data, instruments for measuring solar radiation, sun shine.

Solar Energy Collectors

Principles of solar energy conversion, Flat plate and Concentrating type collectors, energy balance and collector efficiency, solar thermal plants, thermal energy storage for solar heating and cooling, limitations and applications.

Photovoltaic Technology

Present status, solar cells, cell technology, characteristics of PV systems, equivalent circuit, array design, Integrated PV systems, components, sizing and economics, peak power operation, MPPT, Standalone and grid integrated systems.

Wind Energy

Wind power sources, wind characteristics, site selection, criterion, momentum theory, Components of wind energy systems, performance and limitations, classification of wind energy collectors, aerodynamic forces acting on blades, applications and environmental impacts.

Nonconventional Energy

Detailed description of nonconventional energy sources of bio energy, chemical energy, MHD, geothermal energy, ocean energy systems, General features, Basic principles of operation, classification, applications and environmental impacts.

Renewable Energy Generation in Power Systems

Distributed Generation, Renewable energy penetration, Point of common coupling (PCC), Connection voltage, Voltage Effects, Steady state voltage rise, Thermal Limits, Other Embedded Generation Issues, Islanding.

Text Books

1. Non-Conventional Energy Sources by GD Rai, Khanna Publishers.
2. Renewable Energy in Power Systems by Leon Freris and David Infield, John Wiley & Sons, Ltd.

Reference Books:

1. Advanced renewable energy systems; Part 1 by S. C. Bhatia, Woodhead Publishing India Pvt Ltd.
2. Renewable Energy Sources and Methods by Anne Maczulak, Green technology info print publication.

6.ELECTRICAL GIS

Course Objectives

- To distinguish between the operation of air and gas insulated sub-stations.
- To learn to develop the layout of a GIS sub-station.
- To analyze the significance of various factors like fast transient phenomenon, insulation diagnostics & problems in GIS sub-station.

Course Outcomes

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

- Distinguish between the operation of air and gas insulated sub-stations.
- Develop the layout of a GIS sub-station.
- Analyze the significance of various factors like fast transient phenomenon, insulation diagnostics & problems in GIS sub-station.

Syllabus

Introduction to GIS, Properties of SF_6 and Layout of GIS Stations

Characteristics of GIS - Introduction to SF_6 - Properties of SF_6 Gas - Specifications of SF_6 Gas for GIS applications - Handling of SF_6 Gas before use - Safe handling of SF_6 Gas in Electrical Equipment - Equipment for handling the SF_6 Gas - SF_6 and Environment, advantage of GIS Stations - Comparison with Air Insulated Substations - Economics of GIS - User Requirements for GIS - Main features of a GIS - Planning and Installation - Components of a GIS Station.

Design and Construction of GIS Station

Introduction - Rating of GIS components - Design Features - Estimation of different types of Electrical Stresses -Design Aspects of GIS components - Insulation Design for Components - Insulation Design for GIS - Thermal Considerations in the Design of GIS - Effect of very Fast Transient Over-voltages (VFTO) on the GIS design - Insulation Coordination systems - Gas handling and Monitoring System Design.

Testing of GIS and Special Problems in GIS

Introduction – Various Tests on GIS – Design Approach for manufacturing and Type Tests – Quality Assurance in Manufacturing, Shipping and Erection – On-site Testing of GIS – Dielectric Tests – Commonly Used On-site Test Methods - Experience during On-site Testing – Condition

Monitoring and Diagnostic Methods. Introduction - particles their effects and their control- Insulating Spacers and their Reliability - SF6 Gas Decomposition.

GIS Diagnostics, GIS Service Experience and Maintenance Procedures
Introduction - Characteristics of imperfections in insulation - Insulation Diagnostic methods - PD Measurement and UHF Method.

Fast Transient Phenomena in GIS and Future Trends in GIS Technology
Introduction - Disconnector Switching in Relation to Very fast Transients - Origin of VFTO Propagation and Mechanism of VFTO - VFTO Characteristics - Effects of VFTO - Testing of GIS for VFTO.

Text Books

1. M. S. Naidu," Gas Insulated Substations"- IK International Publishing House.

Reference Books

1. G.F. Montillet, E. Mikes et al. "Underground transmission and distribution GIS solutions" IEEE/PES T&D Exposition and Conference, Dallas USA, 2003.
2. E. Mikes, Ch. Tschannen, et al. "GIS substation extensions and upgrades" CEPSI Paper T1-068, 2000, Manila, Philippines.
3. CIGRE WG 23.10; Paper 23-102, 1998, Report on the Second International Survey on High-Voltage Gas Insulated Substations (GIS) Service Experience, Paris, France 1998.
4. E. Mikes, H. Aeschbach et al. "Innovative GIS based solutions for substations" CIGRE SC23 Colloquium Venezuela, Paper 3.1, 2001.
5. D. Dufournet, C. Lindner et al. "Technical Trends in Circuit Breaker Switching Technologies" CIGRE SC A3 Colloquium paper, Sarajevo, Bosnia, 2003.

7 .ENERGY MANAGEMENT AND AUDITING

Course Objectives

- To understand energy efficiency, scope, conservation and technologies.
- To Design energy efficient lighting systems.
- To estimate/calculate power factor of systems and propose suitable compensation techniques.
- To understand energy conservation in HVAC systems.
- To calculate life cycle costing analysis and return on investment on energy efficient technologies.

Course Outcomes

Student will be able to

- Explain energy efficiency, conservation and various technologies.
- Design energy efficient lighting systems.
- Calculate power factor of systems and propose suitable compensation techniques.
- Explain energy conservation in HVAC systems.
- Calculate life cycle costing analysis and return on investment on energy efficient technologies.

Syllabus

Basic Principles of Energy Audit

Energy audit- definitions, concept, types of audit, energy index, cost index, pie charts, Sankey diagrams, load profiles, Energy conservation schemes- Energy audit of industries- energy saving potential, energy audit of process industry, thermal power station, building energy audit.

Energy Management

Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting- Energy manger, Qualities and functions, language.

Energy Efficient Motors

Energy efficient motors, factors affecting efficiency, loss distribution, constructional details, characteristics - variable speed, variable duty cycle systems, RMS hp- voltage variation-voltage unbalance- over motoring- motor energy audit.

Power Factor Improvement, Lighting and Energy Instruments

Power factor – methods of improvement, location of capacitors, Pf with non-linear loads, effect of harmonics on power factor, power factor motor controllers - good lighting system design and practice, lighting control, lighting energy audit - Energy Instruments- wattmeter, data loggers, thermocouples, pyrometers, lux meters, tongue testers, application of PLC's.

Economic Aspects and Analysis

Economics Analysis-Depreciation Methods, time value of money, rate of return, present worth method, replacement analysis, life cycle costing analysis- Energy efficient motors- calculation of simple payback method, net present worth method- Power factor correction, lighting - Applications of life cycle costing analysis, return on investment.

Text Books

1. Energy Management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications. 2012
2. Energy Efficient Electric Motors by John. C. Andres, Marcel Dekker Inc. Ltd – 2nd Edition, 1995
3. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill Publishing Company Ltd, New Delhi.

Reference Books

1. Energy management by Paulo' Callaghan, Mc – Graw Hill Book company – 1st edition, 1998.
2. Energy management hand book by W.C. Turner, John wiley and son, 2001.
3. Energy management and good lighting practice: fuel efficiency booklet12 – EEO.

8.MICROPROCESSORS & MICRO-CONTROLLERS

Course Objectives

- To understand the organization and architecture of Microprocessor
- To understand addressing modes to access memory
- To understand 8051 micro controller architecture
- To understand the programming principles for 8086 and 8051
- To understand the interfacing of MP with I/O as well as other devices

Course Outcomes

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

- Identify a detailed structure of the Microprocessor.
- illustrate how the different peripherals (8255, 8253 etc.) are interfaced with Microprocessor.
- distinguish and analyze the properties of Microprocessors & Microcontrollers.
- analyze the data transfer information through serial & parallel ports

Syllabus

8085 Microprocessor

Introduction to microprocessors, microcomputers – Architecture of 8085 microprocessor – pin-out diagram of 8085 – Detailed description of the 8085 pins – addressing modes – Memory structure and its requirements – Basic concepts in memory interfacing – Address decoding – Memory mapping – Machine cycles and bus timings for memory read, memory write, I/O read, I/O write operations – Memory mapped I/O and I/O mapped I/O.

8085 Instructions and programming

Difference between Machine language, Assembly language and High level language – Brief description of the 8085 instruction set – 8085 programming using data transfer group, arithmetic group, logical group, branch transfer group, stack and subroutines – counters and delay - code conversions.

Interfacing peripherals to 8085

Function of D/A and A/D converters – Interfacing D/A and A/D converters and necessary programming – Detailed description and interfacing of 8251 USART, 8253/8254 programmable

timer, 8255 PPI, 8257 DMA controller, 8259 programmable interrupt controller, 8279 programmable keyboard/display interface.

8051 Microcontroller

Introduction to microcontrollers – Comparison between microprocessors and microcontrollers – Functional block diagram of 8051 microcontroller and its description – 8051 pin-out diagram and description of 8051 pins – Interfacing external memory to 8051 – implementing counters and timers in 8051 – Serial data transfer using 8051 – Various interrupts and its programming in 8051.

Advanced topics in Microprocessors

Architecture of 8086 microprocessor – Addressing modes – RS232 communication standard – Interfacing Stepper motor, elevator, traffic controller to 8085 microprocessors.

Text Books

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming, and Applications, New Age International Publishers, New Delhi, 2nd edition, 1996.
2. Kenneth J. Ayala, The 8051 Microcontroller: Architecture, Programming, & Applications, Penram International Publishing (I) Pvt. Ltd., Mumbai, 2nd edition, 2006.
3. Douglas V. Hall, Microprocessor and Interfacing: Programming and hardware, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1997.

Reference Books:

1. B. Ram, Fundamentals of Microprocessors and Microcomputers, DhanpatRai& sons, New Delhi, 4th edition, 1998.
2. Muhammad Ali Mazidi and Janice GillispieMazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education (Singapore) Pte. Ltd., New Delhi, 2003.
3. A K Ray and K M Bhurchandi, Advanced Microprocessors and Peripherals : Architecture, Programming and Interfacing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2002.

9.ADVANCED CONTROL SYSTEM

Course Objectives

- To familiarize the state space representation in controllable, observable, diagonal and Jordan canonical forms and introduce the concept of controllability and observability tests through canonical forms.
- Design of state feedback controller by pole placement technique and State Observer design.
- Analysis of a nonlinear system using describing function approach and the Lypanov's method of stability analysis of a system.
- Formulation of Euler Lagrange equation for the optimization of typical functional and solutions.
- Formulation of linear quadratic optimal regulator (LQR) problem by parameter adjustment and solving Riccatti equation.

Course Outcomes

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

- Understand various design specifications.
- Design controllers using the state-space approach.
- Design a compensator for continuous time systems.
- Apply the concepts of controllability and observability in evaluating the performance of control system.
- Design an appropriate feedback controller and/or observer for physical plants.

Syllabus

Control Systems Components
DC & AC Tachometers-Synchros, AC AND DC Servo Motors - Stepper Motors and its use in Control Systems, AmplidyneMetadyne - Magnetic Amplifier – Principle, Operation and Characteristics Ward - Leonard Systems.

State Variable Analysis
concept of State Variables & State Models, State model for Linear Continuous Time Systems, State-Space Representation Using Physical Variables, State-Space Representation Using Phase Variables.

Diagonalization, Jordan Canonical Form
Solution of State Equations, Properties of State Transition Matrix, Computation of State-Transition Matrix (Using Laplace Transformation, Cayley-Hamilton Theorem).

Controllability & Observability
Concept of Controllability & Observability, Controllable Companion Form, Observable Companion Form (For SISO and MIMO Systems), Pole Placement By State Feedback.

Introduction to Design
Introduction-Preliminary Considerations of Classical Design - Lead Compensation, Lag Compensation, Realization of Compensating Networks, Cascade Compensation in Time Domain and Frequency Domain (Root Locus and Bode Plot Techniques).

Text Books
1. Control Systems Engineering, I.J.Nagrath, M.Gopal, New Age International Publishers.
2. Modern Control System Theory,M.Gopal, New Age International Publishers.

Reference Text Books
1. R. T. Stefani and G. H.Hostetter, “Design of feedback Control Systems”, Saunders College Pub, 1994.

10.DIGITAL CONTROL SYSTEMS

Course Objectives

- To understand the structure of digital control systems
- To understand the theory of z–transforms and application for the mathematical analysis of discrete time systems.
- To represent the discrete–time systems in state–space model and evaluation of state transition matrix.
- To study, design and analyze digital controllers.
- To be able to design state feedback and output feedback controllers.

Course Outcomes:

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

- Obtain discrete representation of LTI systems.
- Analyze the stability of open loop and closed loop discrete-time systems.
- Design and analyze digital controllers.
- Design state feedback and output feedback controllers.

Syllabus

Discrete –Time Systems

The Structure of a Digital Control System, Analog Systems with Piecewise Constant Inputs, Difference Equations, The Z Transform, Z Transform Solution of Difference Equation, The Time Response of a Discrete Time System, Frequency Response of Discrete Time Systems.

Modeling of Digital Control Systems

ADC Model, DAC Model, Transfer Function of the ZOH, Effect of Sampler on Transfer Function of a Cascade, Transfer Function for the DAC, Analog Subsystem, ADC Combination, Closed Loop Transfer Function, Analog Disturbances in a Digital System, Steady State Error and Error Constants.

Stability of Digital Control Systems

Definitions of Stability, Stable Z Domain Pole Locations, Stability Conditions, Stability Determination, Jury Test.

State Space Representation

Discrete Time State Space Equations, Solution of Discrete Time State Space Equations, Z-Transfer function from State Space Equations, Similarity Transformation, Stability of State Space Realizations, Controllability and Sterilizability, Observability and Detectability.

State Feedback Control
On State and Output Feedback, Pole Placement, Servo Problem, Principles of Observer, State Feedback and Pole Assignment Using Transfer Functions.

TEXT BOOKS
1. Digital control systems by B.C.Kuo, Oxford University Press.

REFERENCE BOOKS
1. Digital Control Engineering: Analysis and Design**,** By M. Sami Fadali, Antonio Visioli, Academic Press; 1edition (February 16, 2009)
2. Digital control systems by K.Ogata.

11. ELECTRICAL WIRING

Course Objectives

By studying this course, a student is expected to
- Examine the electrical wiring diagrams.
- Demonstrate the various wiring systems and material required for wiring.
- Choose various electrical accessories and protective schemes for electrical wiring installations.
- Apply knowledge in designing Illumination schemes to various installations.
- Summarize the costing of electrical installations for residential and commercial buildings.

Course Outcomes

At the end of the course, student is able to
- Interpret the electrical wiring diagrams.
- Prepare various wiring systems and material required for wiring.
- Complete the selection of electrical accessories and protection schemes for electrical wiring installations.
- Plan the illumination schemes for various installations.
- Appraise the costing of electrical installations for residential and commercial buildings**.**

Syllabus

Electrical Symbols and Panel Boards
Symbols: Need for electrical symbols, List of symbols, Electrical diagrams, Methods of representation for wiring diagrams, Panel Boards: Design conditions, Standard sizes of boards, examples.

Wiring Systems and Materials
Wiring Systems: Selection of wiring, System of wiring, Separation of Power and Lighting circuits, Testing of wiring installations, Necessity of earthing, Factors governing resistance of earth electrode, rules for earthing, double earthing, methods of improving the earth resistance, Material: Properties of good conductor, classification of conductors, difference between wire and cable, current rating and fusing current of cable, necessity of stranding cables, types of cables, selection of cable for wiring installation, sizes and types of wires, wire splicing and terminations.

Electrical Accessories and Protective Devices

Electrical Accessories: Switchers, ceiling roses, socket outlets, plugs, terminal blocks, appliance connector, main switch, splitter units, distribution fuse boards, Neutral links, insulators and its qualities, MCB and its specifications, Protective Devices: Features of good protective device, fuses, silver and copper as fuse elements, Earth leakage circuit breaker, points to remember while providing earthing, precautions against shocks, Over load trip.

Wiring and Illumination Schemes

Wiring: connection diagrams of one lamp controlled by one switch, Strain-case wiring, corridor wiring, tube light wiring, etc., Illumination schemes: Illumination terminology, Laws of illumination, types of lighting arrangements, lighting system considerations for different occupancies, design considerations of a good lighting scheme, Examples, street lighting, flood lighting, recommended values of Illumination.

Types of Electrical Installations

Electrical Installations for residential buildings: Installation plan, Schematic and wiring diagram, selection of number of sub-circuits, selection of sizes of wires, Calculation of wire length, Schedule of materials, Costing of electrical installations, examples, Electrical Installations for commercial buildings: selection of sub-circuits, size and rating of switch boards and distribution boards, size of cables and conduits, busbar and its chamber, mounting of switchboards and distribution boards, costing of electrical wiring installation, example.

Text Books

1. K B Raina and S K Bhattacharya, Electrical Design, Estimating and Costing, New Age international Publishers, New Delhi.
2. S L Uppal and G C Garg, Electrical Wiring Estimating & Costing, Khanna Publishers, New Delhi, 6th Edition, 2018.

Reference Books

1. J B Gupta, A course in Electrical Installation Estimating and Costing, S K Kataria & Sons, New Delhi, 9th Edition, 2012.
2. Frederic P Hartwell and Herbert P. Richter, Practical Electrical Wiring: Residential, farm, Commercial and Industrial, Park Publishing Inc., Wisconsin, 22nd edition, 2014.
3. Ray C Mullin and Phil Simmons, Electrical Wiring: Residential, Delmar Cengage Learning, New York, 17th edition, 2012.

12.ARTIFICIAL INTELLGENCE AND MACHINE LEARNING

Course Objectives

- To obtain an overview and present state of AI
- To understand different types of Strategies viz., Uniform, Informed and Local search
- To analyze the types of learning.
- To compare between Linear and Logistic Regression.
- To study Neural networks and learn programming exercises.

Course Outcomes

- Obtain a general overview of AI.
- Analyze the different types of Search strategies.
- Gain knowledge about the types of learning
- Compare between Linear and Logistic Regression
- Understanding of Neural networks and programming exercises.

Syllabus

Introduction to Artificial Intelligence

What to Expect from AI, History of AI, the Present State of AI, Definition of AI Thinking VS Acting and Humanly VS Rationally.

Uniform Search

Notion of a State, Search Problem and Examples, Basic Search Strategies, Iterative Deepening DFS, Bidirectional Search.

Informed Search

Best First Search, Greedy Best First Search and A* Search, Analysis of A* Algorithm, Proof of optimality of A*, Iterative Deepening A* and Depth First Branch & Bound.

Local Search

Satisfaction Vs Optimization, The Example of N-Queens, Hill Climbing, Drawbacks of Hill Climbing, Hill Climbing With random Walk & Random Restart, Hill Climbing with Simulated Annealing.

Introduction to Machine Learning
Different Types of Learning, Hypothesis Space and Inductive Bias, Evaluation and Cross-Validation

Linear Regression
Introduction to Decision Trees, Learning Decision Tree, Over fitting, Python Exercise on Decision Tree and Linear Regression, Logistic Regression

Introduction Support Vector Machine
Neural Network and Back propagation Algorithm, k-Nearest Neighbour, Feature Selection, Feature Extraction, Collaborative Filtering, Python Exercise on kNN and PCA.

Text Books

1. Stuart Russell & Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall, Third Edition (2009)
2. Ian GoodFellow, YoshuaBengio& Aaron Courville, Deep Learning, MIT Press (2016)
3. Machine Learning, Tom Mitchell, First Edition, McGaw Hill, 1997.
4. Introduction to Machine Learning Edition 2, by EthemAlpaydin.

Reference Books

1. Introduction to Artificial Intelligence, NPTEL, SWAYAM Portal
2. Introduction to Machine Learning, NPTEL, SWAYAM Portal.

HSS ELECTIVES

1. Organizational Behaviour

Course Objectives

- To understand the basic concepts of organizational behavior, its foundations and importance.
- To enable students to have a basic perspective of Motivation and Motivation theories.
- To acquaint the students about group behavior in organizations, including communication, leadership conflicts and organizational change and how these are linked to and impact organizational performance.

Course Outcomes

- Indentifying fundamental aspects of organizational dynamics.
- Evaluate main theories of motivation and formulating suitable motivational strategies.
- Analyze the behavior of individuals and groups in organizations.
- Understanding of Leadership theories and Leadership behaviour.
- Apply relevant theories, concepts to address important Organizational Behaviour questions.

Syllabus

Organizational Behavior
Concept of Organization - Concept of Organisational Behaviour - Nature of Organisational Behaviour - Role of Organisational behaviour - Disciplines contributing to Organisational Behaviour.

Motivation
Definition - Nature of Motivation - Role of Motivation - Theories of Motivation : Maslow's Need Hierarchy Theory, Herzberg's Motivation Hygiene Theory and Mc Gregor's Theory X and Theory Y.

Group Dynamics
Meaning - Concept of Group - Types of groups -Formal and Informal groups - Group development - Group cohesiveness and factors affecting group cohesiveness.

Leadership

Concept of Leadership - Difference between Leadership and Management - Importance of Leadership - Leadership styles: Autocratic leadership, Participative leadership and Free Rein leadership.

Communication

Meaning - Communication Process - Forms of communication: Oral, Written and Non- Verbal communication - Direction of communication : Downward, Upward and Horizontal communication.

Organisational conflicts

Concept of conflict - Reasons for conflict - Types of Conflict: Intrapersonal conflict, Interpersonal conflict, Intragroup conflict, Intergroup conflict, Interorganisational conflict - Conflict management.

Organisational Change

Nature - Factors inOrganisational change -Planned change: Process of planned change - Resistance to change: Factors in resistance to change - Overcoming resistance to change.

Text Books.

1. 1.L.M.Prasad: Organisational Beaviour, Sultan Chand & Sons, New Delhi -110002.
2. 2.K. Aswathappa: Organisational Behaviour, Himalaya Publishing House, New Delhi.

Reference Books

1. Stephen Robbins: Organisational Behaviour, Pearsons Education, New Delhi.

2. INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course Objectives

- To familiarize the students with the concepts of Management.
- To relate the concepts of Management with industrial organizations.
- To explain the factors affecting productivity and how productivity can be increased in an Industrial undertaking.
- To set forth a basic framework for understanding Entrepreneurship.

Course Outcomes

On completion of the course, the students will be able to:

- Understand the roles, skills and functions of management.
- Distinguish the different types of business organizations.
- Identify the factors involved in Production Operations Management.
- Diagnose organizational problems and take suitable decisions.
- Establish good Human Resource Management practices.
- Acquire necessary knowledge and skills required for organizing and carrying out entrepreneurial activities.

Syllabus

Basic Concepts of Management
Management: - Definition, Nature and Importance; Functions of the Management; Levels of Management; F.W Taylor's Scientific Management; Henry Fayol's Principles of Management;

Forms of Business Organizations
Introduction, Types of Business organizations: Private Sector- Individual Ownership, Partnership, Joint stock companies and Co-Operative organizations; Public sector- Departmental Organizations, Public Corporations and Government Companies; The Joint sector Management.

Production and operations Management
Plant location- Factors to be considered in the selection of Plant location; Break - even analysis- Significance and managerial applications; Importance of Production Planning and Control and its

Functions; Human Resource Management and Functions of Human Resource Manager (in brief); Functions of Marketing; Methods of Raising Finance.

Entrepreneurship

Definition, Characteristics and Skills, Types of Entrepreneurs, Entrepreneur vs. Professional Managers, Growth of Entrepreneurs, Nature and Importance of Entrepreneurs, Women Entrepreneurs, Problems of Entrepreneurship.

Entrepreneurial Development and Project Management: Institutions in aid of Entrepreneurship Development, Idea generation: Sources and Techniques; Stages in Project formulation; Steps for starting a small enterprise - Incentives for Small Scale Industries by Government.

Text Books

1. Sharma,S.C, and Banga, T.R., Industrial Organization & Engineering Economics, Khanna Publishers, Delhi, 2000.
2. Vasant Desai, The Dynamics of Entrepreneurial Development and Management (Planning for future Sustainable growth), Himalayan Publishing House, 2018.

Reference Books

1. Aryasri, A.R., Management Science, McGraw HIll Education (India Private Limited , New Delhi 2014.
2. Sheela, P., and Jagadeswara Rao, K., Entrepreneurship, Shree Publishing House, Guntur, Andhra Pradesh, 2017.

3. OPERATIONS RESEARCH

Course Objectives

- Formulate a real-world problem as a mathematical programming model.
- Provide knowledge of optimization techniques and approaches.
- Understand and study inventory problems.
- Know the network models.
- Put on knowledge in solving replacement problems and different queueing models

Course Outcomes

- Learned to translate a real-world problem into a mathematical formulation.
- Formulate and Solve Transportation, Assignment and sequencing problems.
- Resolve inventory problems.
- Able to solve maximum flow and shortest path problems.
- Capable to solve replacement problems and analyze queueing models.

Syllabus

Introduction
Definitions of Operations Research; Phases of Operations Research; Types of Operations Research models; applications, merits and demerits of Operations Research.

Allocation
Linear Programming problem formulation; Basic assumptions; Graphical solution; Simplex method; Artificial variable technique; Two phase method; Big M method; Duality principle; Primal and Dual relation.

Transportation
Formulation; Solution methods; Unbalanced transportation problems - North west corner rule; Least cost entry method; Vogel's approximation method; Optimal solution; degeneracy.

Assignment
Formulation; Variations in Assignment problem; Travelling salesman problem.

Sequencing
Sequencing of - *n* jobs through two machines; *n* jobs through three machines; *n* jobs through *m* machines; 2 jobs through *m* machines.

Inventory Control
Introduction; Types of Inventory; Inventory costs; Deterministic models - Economic order quantity (EOQ) and Economic Production Quantity (EPQ) with and without shortages; Quantity discounts; P system; Q system; Inventory control Techniques.

Network Analysis
Network definitions; Time estimates in network analysis; Labeling using Fulkerson's rule; Forward pass computations; Backward pass computations; Project management using Critical Path Method(CPM) and Programme Evaluation and Review Technique(PERT).

Replacement
Introduction, Replacement of items that deteriorate with time - Value of
money unchanging and changing, Replacement of items that fail completely.

Queueing models
Introduction; Single channel poisson arrivals; Exponential service times; Unrestricted queue with infinite population and finite population models; Multi channel poisson arrivals; Exponential service times with infinite population and restricted queue.

Text Books

1. Hamdy A Taha, "Operations Research- An Introduction" by TAHA, Prentice Hall, 2009.
2. F.S. Hiller, G.J. Liberman,B. Nag and P.Basu "Introduction To Operations Research,
3. Mc Graw Hill Education (India), 2012.
4. S.D.Sharma, "Operations Research", Kedarnadh Ramnadh & Co.,2017.

Reference Books

1. R. Pannerselvam, "Operations Research", PHI..
2. Richard Bronson, Schaum's Series," Operations Research", Mc Graw Hill
3. N.V.S.Raju, "Operations Research- Theory and Practice" BS publications.
4. V.K. Kapoor, "Operations Research" Sultan Chand & Sons.