



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA – 533 003, Andhra Pradesh, India
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE STRUCTURE-R19

II Year – I SEMESTER

S. No	Course Code	Subjects	Category	L	T	P	Credits
1		Electrical Circuit Analysis - II	EE	3	--	--	3
2		Electrical Machines-I	EE	3	--	--	3
3		Electronic Devices and Circuits	ES	3	--	--	3
4		Electro Magnetic Fields	EE	3	--	--	3
5		Thermal and Hydro Prime movers	ES	3	--	--	3
6		Managerial Economics & Financial Analysis	BS	3	--	--	3
7		Thermal and Hydro Laboratory	ES	--	--	3	1.5
8		Electrical Circuits Laboratory	EE	--	--	3	1.5
9		Essence of Indian Traditional Knowledge	MC	3	--	--	0
Total Credits				24	0	6	21

II Year – II SEMESTER

S. No	Course Code	Subjects	Category	L	T	P	Credits
1		Electrical Measurements & Instrumentation	EE	3	--	--	3
2		Electrical Machines-II	EE	3	--	--	3
3		Digital Electronics	ES	3	--	--	3
4		Control Systems	EE	3	--	--	3
5		Power Systems-I	EE	3	--	--	3
6		Signals and Systems	EE	3	--	--	3
7		Electrical Machines -I Laboratory	EE	--	--	3	1.5
8		Electronic Devices & Circuits Laboratory	EE	--	--	3	1.5
9		Professional Ethics and Human Values	MC	3	0	0	0
Total Credits				21	0	6	21



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II Year – I SEMESTER		L	T	P	C
		3	0	0	3
	ELECTRICAL CIRCUIT ANALYSIS-II				

Preamble :

This course aims at study of three phase systems, transient analysis, network synthesis and fourier analysis for the future study and analysis of power systems.

Learning Objectives:

- To study the concepts of balanced and unbalanced three-phase circuits.
- To study the transient behavior of electrical networks with DC, pulse and AC excitations.
- To study the performance of a network based on input and output excitation/response.
- To understand the realization of electrical network function into electrical equivalent passive elements.
- To understand the application of fourier series and fourier transforms for analysis of electrical circuits.

UNIT-I:

Balanced Three phase circuits

Phase sequence, star and delta connection of sources and loads, relation between line and phase voltages and currents.

Analysis of three phase balanced and unbalanced circuits. Loop method, Star-Delta transformation technique, two wattmeter method for measurement of three phase power.

UNIT-II:

Transient Analysis in DC and AC circuits

Transient response of R-L, R-C, R-L-C circuits for DC and AC excitations, solution using differential equations and Laplace transforms.

UNIT-III:

Two Port Networks

Two port network parameters – Z, Y, Transmission and Inverse Transmission parameters, Hybrid and Inverse hybrid parameters.

Relationships between parameter sets simplification of cascaded and parallel networks.

UNIT-IV:

Fourier analysis



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Fourier theorem – trigonometric form and exponential form of Fourier series, conditions of symmetry – line spectra and phase angle spectra, analysis of electrical circuits to non- sinusoidal periodic waveforms.

UNIT-V:

Fourier Transforms

Fourier integrals and Fourier transforms – properties of Fourier transforms physical significance of the Fourier transform and its application to electrical circuits.

Learning Outcomes:

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

- solve three- phase circuits under balanced and unbalanced condition.
- find the transient response of electrical networks for different types of excitations.
- find parameters for different types of network.
- realize electrical equivalent network for a given network transfer function.
- extract different harmonics components from the response of an electrical network.

Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,Mc Graw Hill Company,6 th edition
2. Network synthesis: Van Valkenburg: Prentice-Hall of India Private Ltd.

Reference Books:

1. Fundamentals of Electrical Circuits by Charles K.Alexander and Mathew N.O.Sadiku, Mc Graw Hill Education (India)
2. Introduction to circuit analysis and design by Tildon Glisson. Jr, Springer Publications.
3. Circuits by A.Bruce Carlson , Cengage Learning Publications
4. Network Theory Analysis and Synthesis by Smarajit Ghosh, PHI publications
5. Networks and Systems by D. Roy Choudhury, New Age International publishers
6. Electric Circuits by David A. Bell, Oxford publications
7. Circuit Theory (Analysis and Synthesis) by A.Chakrabarthy,Dhanpat Rai&Co.



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II Year – I SEMESTER		L	T	P	C
		3	0	0	3
	ELECTRICAL MACHINES – I				

Preamble:

This is a basic course on rotating electrical machines. This course covers the topics related to principles, performance, applications and design considerations of dc machines and transformers.

Learning objectives:

- Understand the construction, principle of operation and performance of DC machines.
- Learn the characteristics, performance, methods of speed control and testing methods of DC motors.
- To predetermine the performance of single phase transformers with equivalent circuit models.
- Understand the methods of testing of single-phase transformer.
- Analyze the three phase transformers and achieve three phase to two phase conversion.

UNIT-I:

Construction and Operation of DC machines

Construction and principle of operation of DC machine – emf equation for generator – classification of DC machines based on excitation – OCC of DC shunt generator – applications of DC Generators

UNIT-II:

Performance of DC Machines

Torque and back- emf equations of dc motors – Armature reaction and commutation – characteristics of separately-excited, shunt, series and compound motors – losses and efficiency – applications of dc motors.

UNIT-III:

Starting, Speed Control and Testing of DC Machines

Necessity of a starter – starting by 3 point and 4 point starters – speed control by armature voltage and field control.

Testing of DC machines – brake test, Swinburne's method – principle of regenerative or Hopkinson's method – retardation test – separation of losses.

UNIT-IV:

Single-phase Transformers

Types and constructional details – principle of operation – emf equation – operation on no load and on load – phasor diagrams of transformers - equivalent circuit – regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – all day efficiency.



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UNIT-V

Testing of Transformers and 3-Phase Transformers

Tests on single phase transformers – open circuit and short circuit tests – Sumpner's test – separation of losses- parallel operation with equal voltage ratios – auto transformer –comparison with two winding transformers.

Polyphase connections - Y/Y, Y/ Δ , Δ /Y, Δ / Δ and open Δ – Scott connection.

Learning outcomes:

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

- assimilate the concepts of electromechanical energy conversion.
- mitigate the ill-effects of armature reaction and improve commutation in dc machines.
- understand the torque production mechanism and control the speed of dc motors.
- analyze the performance of single phase transformers.
- predetermine regulation, losses and efficiency of single phase transformers.
- parallel transformers, control voltages with tap changing methods and achieve three-phase to two-phase transformation.

Text Books:

1. Electrical Machines by P.S. Bhimbra, Khanna Publishers
2. Electric Machinery by A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, TMH

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, Mc Graw Hill Publications, 4th edition
2. Electrical Machines by R.K.Rajput, Lakshmi publications, 5th edition.
3. Electrical Machinery by Abijith Chakrabarthy and Sudhipta Debnath, Mc Graw Hill education 2015
4. Electrical Machinery Fundamentals by Stephen J Chapman Mc Graw Hill education 2010
5. Electric Machines by Mulukutla S.Sarma & Mukesh k.Pathak, CENGAGE Learning.
6. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria & Sons



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II Year – I SEMESTER		L	T	P	C
		3	0	0	3
	ELECTRONIC DEVICES AND CIRCUITS				

Preamble:

This course introduces the concepts of semi-conductor physics and operation of various semi-conductor devices. Realization of rectifiers, amplifiers and oscillators using semi-conductor devices, transistors and their analysis is introduced in this course.

Learning Objectives:

- The basic concepts of semiconductor physics are to be reviewed.
- Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
- The application of diodes as rectifiers with their operation and characteristics with and without filters are discussed.
- The principal of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics are explained.
- The need of transistor biasing and its significance is explained. The quiescent point or operating point is explained.
- Small signal equivalent circuit analysis of BJT and FET transistor amplifiers in different configuration is explained.

UNIT-I:

Semiconductor Physics : Insulators, Semiconductors, and Metals classification using energy band diagrams, mobility and conductivity, electrons and holes in intrinsic semi conductors, extrinsic semi conductors, drift and diffusion, charge densities in semiconductors, Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors

Junction Diode Characteristics : Open circuited P-N junction, Biased P-N junction, P-N junction diode, current components in PN junction Diode, diode equation, V-I characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance, energy band diagram of PN junction Diode.

UNIT-II:

Special Semiconductor Diodes: Zener Diode, Breakdown mechanisms, Zener diode applications, LED, Photodiode, Tunnel Diode, SCR, UJT. (Construction, operation and characteristics of all the devices are required to be considered).



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Rectifiers and Filters: Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, rectifier circuits-operation, input and output waveforms, Filters, Inductor filter, Capacitor filter, comparison of various filter circuits in terms of ripple factors.

UNIT- III: Transistor Characteristics:

BJT: Junction transistor, transistor current components, transistor equation, transistor configurations, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through reach through, Photo transistor, typical transistor junction voltage values.

FET: FET types, construction, operation, characteristics, parameters, MOSFET-types, construction, operation, characteristics, comparison between JFET and MOSFET.

UNIT- IV: Transistor Biasing and Thermal Stabilization : Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self bias, Stabilization against variations in V_{BE} , I_c , and β , Stability factors, (S , S' , S''), Bias compensation, Thermal runaway, Thermal stability. FET Biasing- methods and stabilization.

UNIT- V: Small Signal Low Frequency Transistor Amplifier Models:

BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, analysis of CB, CE and CC amplifiers using exact and approximate analysis, comparison of transistor amplifiers.

FET: Generalized analysis of small signal model, analysis of CG, CS and CD amplifiers, comparison of FET amplifiers.

Learning Outcomes

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

- understand the concepts of Semiconductor Technology.
- appraise the construction & operation of electronic devices.
- develop the biasing circuits using the electronic devices.
- model the amplifier circuits.
- analyse the characteristics of the devices.

Text Books:

1. Electronic Devices and Circuits- J. Millman, C. Halkias, Tata Mc-Graw Hill, Second Edition.
2. Electronics devices & circuit theory- Robert L. Boylestad and Loui Nashelsky, Pearson/Prentice hall, tenth edition



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References Books:

1. Electronic Devices and Circuits- Salivahanan, Kumar, Vallavaraj, Tata Mc-Graw Hill, Second Edition..
2. Electronic Devices and Circuits – David Bell, Oxford



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II Year – I SEMESTER		L	T	P	C
		3	0	0	3
	ELECTROMAGNETIC FIELDS				

Preamble:

Electromagnetic field theory is the pre-requisite for most of the subjects in the gamut of electrical engineering. The study of this subject enables students to understand and interpret the phenomenon pertinent to electrical engineering using microscopic quantities such as electric and magnetic field intensities, scalar and vector potentials.

Learning objectives:

- To study the production of electric field and potentials due to different configurations of static charges.
- To study the properties of conductors and dielectrics, calculate the capacitance of different configurations. Understand the concept of conduction and convection current densities.
- To study the magnetic fields produced by currents in different configurations, application of Ampere's law and the Maxwell's second and third equations.
- To study the magnetic force and torque through Lorentz force equation in magnetic field environment like conductors and other current loops.
- To develop the concept of self and mutual inductances and the energy stored.
- To study time varying and Maxwell's equations in different forms and Maxwell's fourth equation for the induced EMF

UNIT – I:

Electrostatics

Scalar and vector fields, overview of coordinate system, calculus of scalar and vector fields in Cartesian coordinates – Coulomb's Law – Electric Field Intensity (EFI) – EFI due to a line and a surface charge, work done in moving a point charge in an electrostatic field, electric potential – properties of potential function – potential gradient, Gauss's law – Laplace's and Poisson's equations.

UNIT – II:

Conductors – Dielectrics and Capacitance

Electric dipole – dipole moment – potential and EFI due to an electric dipole, Torque on an Electric dipole in an electric field conductors and Insulators – their behaviour in electric field.

Polarization, boundary conditions between conductors to dielectric. Capacitance of parallel plates, spherical and coaxial cable, energy stored and energy density in a static electric field, equation of continuity.



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UNIT – III:

Magneto statics and Ampere's Law

Biot-Savart's law, Magnetic Field Intensity (MFI) – MFI due to a straight current carrying filament, MFI due to circular, square and solenoid current – carrying wire – relation between magnetic flux, magnetic flux density and MFI. Maxwell's second Equation, $\text{div}(\mathbf{B})=0$, Ampere's circuital law and its applications viz. MFI due to an infinite sheet of current and a long filament carrying conductor, point form of Ampere's circuital law, field due to a rectangular loops, Maxwell's third equation, $\text{Curl}(\mathbf{H})=\mathbf{J}$.

Magnetic force, moving charges in a magnetic field – Lorentz force equation, force on a current element in a magnetic field, force on a straight and a long current carrying conductor in a magnetic field, force between two straight long and parallel current carrying conductors, magnetic dipole and dipole moment – a differential current loop as a magnetic dipole – Torque on a current loop placed in a magnetic field.

UNIT – IV:

Self and mutual inductance

Self and mutual inductance – determination of self-inductance of a solenoid and toroid and mutual inductance between a straight long wire and a square loop wire in the same plane – energy stored and density in a magnetic field.

UNIT – V:

Time Varying Fields

Time varying fields: Faraday's laws of electromagnetic induction – its integral and point forms, Maxwell's fourth equation, $\text{Curl}(\mathbf{E})=-\partial\mathbf{B}/\partial t$, statically and dynamically induced EMF.

Learning outcomes:

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

- determine electric fields and potentials using Gauss's law or solving Laplace's or Poisson's equations, for various electric charge distributions.
- calculate and design capacitance, energy stored in dielectrics.
- calculate the magnetic field intensity due to current, the application of Ampere's law and the Maxwell's second and third equations.
- determine the magnetic forces and torque produced by currents in magnetic field
- determine self and mutual inductances and the energy stored in the magnetic field.
- calculate induced EMF, understand the concepts of displacement current and Poynting vector.

Text Books:

1. "Engineering Electromagnetics" by William H. Hayt & John. A. Buck Mc. Graw-Hill Companies, 7th Edition.2006.



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Reference Books:

1. “ Principles of Electro Magnetics” by Sadiku, Oxford Publications, 4th edition
2. “Introduction to Electro Dynamics” by D J Griffiths, Prentice-Hall of India Pvt.Ltd, 2nd edition
3. “Electromagnetic Field Theory” by Yaduvir Singh, Pearson.
4. Fundamentals of Engineering Electromagnetics by Sunil Bhooshan, Oxford higher Education.



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II Year – I SEMESTER		L	T	P	C
		3	0	0	3
	THERMAL AND HYDRO PRIME MOVERS				

Part-A: Thermal Prime Movers

Course Objectives: To make the student understand the types of prime movers, which can be connected to generators for power production and should obtain the skills of performing the necessary calculations with respect to the functioning of the prime movers.

UNIT I:

Objectives: To make the student learn about the constructional features, operational details of various types of internal combustion engines through the details of several engine systems and the basic air standard cycles, that govern the engines. Further, the student shall be able to calculate the performance of different types of internal combustion engines.

I.C Engines: Classification, working principles – valve and port timing diagrams – air standard cycles – Engine systems line fuel injection, carburetion, ignition, cooling and lubrication – Engine performance evaluation.

UNIT II:

Objectives: To train the student in the aspects of steam formation and its utilities through the standard steam data tables and charts. To make the student correlate between the air standard cycles and the actual cycles that govern the steam turbines. To train the student to calculate the performance of steam turbines using velocity diagrams.

Properties of Steam and use of Steam Tables- T-S and H-S Diagrams. Analysis of various Thermodynamic and processes undergone by Steam.

Vapor Power Cycles: Carnot Cycle-Rankine Cycle- Thermodynamic variables Effecting Efficiency and output of Rankine Cycle-. Analysis of simple Rankine Cycle and Re-heat cycle.

Steam Turbines: Schematic layout of steam power plant – Classification of steam Turbines – Impulse Turbine and Reaction Turbine - Compounding in Turbines – Velocity Diagrams for simple Impulse and Reaction Turbines – Work done & Efficiency.



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UNIT III:

Objectives: To impart the knowledge of gas turbine fundamentals, the governing cycles and the method to improve the efficiency of gas turbines.

Gas Turbines: Simple gas turbine plant-ideal cycle, closed cycle - open cycle – Efficiency, Work ratio and optimum pressure ratio for simple gas turbine cycle. Actual cycle, analysis of simple cycles & cycles with inter cooling, reheating and regeneration.

Part-B: Hydro Prime Movers

UNIT IV:

Objectives: to teach the student about the fundamental of fluid dynamic equations and its applications fluid jets. To impart the knowledge of various types of pumps, their constructional features, working and performance.

IMPACT OF JETS AND PUMPS: Impulse momentum equation, Impact of Jet on stationary and moving vanes (flat and curved). Pumps: Types of pumps, Centrifugal pumps: Main components, Working principle, Multi stage pumps, Performance and Characteristic curves.

UNIT V:

Objectives: To make the student learn about the constructional features, operational details of various types of hydraulic turbines. Further, the student shall be able to calculate the performance of hydraulic turbines.

HYDRAULIC TURBINES: Classifications of turbines; Working principle, Efficiency calculation and Design principles for Pelton Wheel, Francis and for Kaplan turbines; Governing of turbines; Performance and characteristic curves.

HYDRO POWER: Components of Hydro electric power plant; pumped storage systems, Estimation of water power potential ; Estimation of load on turbines load curve, load factor, capacity factor, utilization factor, diversity factor, load- duration curve, firm power, secondary power, prediction of load.

Text Books:

1. Thermal Engineering by Rajput, Lakshmi publications.
2. Thermal engineering by M.L.Mathur and F.S.Mehta, Jain Brothers.



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3. Hydraulics & Fluid Mechanics, P.N.Modi and S.M.Seth, Standard Book House, Delhi.

Reference Books:

1. Fluid Mechanic & Hydraulic Machinery, A.K.Jain, Khanna Publishers, Delhi.
2. “Fluid Mechanics” by Victor.L.Streeter.
3. “Introduction to Fluid Mechanics” Edward.J.Shaughnessy Jr.
4. “Fluid Mechanics & Its Applications”, Vijay Gupta, Santosh.k.Gupta
5. “Fluid Mechanic & Fluid Power Engineering”, Dr.D.S.Kumar
6. “Water Power Engineering”, M.M.Desumukh



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II Year – I SEMESTER		L	T	P	C
		3	0	0	3
MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS					

Course Objectives:

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

Unit-I

Introduction to Managerial Economics and demand Analysis:

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

Unit – II:

Theories of Production and Cost Analyses:

Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

Unit – III:

Introduction to Markets, Theories of the Firm & Pricing Policies:

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.



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Unit – IV:

Introduction to Accounting & Financing Analysis:

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)

Unit – V:

Capital and Capital Budgeting: Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

Course Outcomes:

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

TEXT BOOKS:

A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

REFERENCES:

1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
3. N.P Srinivasn and M. SakthivelMurugan, Accounting for Management, S. Chand & Company Ltd,
4. MaheswariS.N,AnIntroduction to Accountancy, Vikas Publishing House Pvt Ltd
5. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,



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II Year – I SEMESTER		L	T	P	C
		0	0	3	1.5
	THERMAL AND HYDRO LABORATORY				

Course Objective: To impart practical knowledge on the performance evaluation methods of various internal combustion engines, flow measuring equipment and hydraulic turbines and pumps.

NOTE: TO CONDUCT MINIMUM OF 12 EXPERIMENTS BY CONDUCTING MINIMUM OF SIX FROM EACH SECTION.

SECTION A - THERMAL ENGINEERING LAB

1. I.C. Engines valve / port timing diagrams.
2. I.C. Engines performance test on 4 -stroke Diesel engine.
3. I.C. Engines performance test on 2-stroke petrol engine.
4. Evaluation of engine friction by conducting Morse test on 4-stroke multi cylinder petrol engine
5. Determination of FP by retardation and motoring test on IC engine
6. I.C. Engine heat balance on petrol / Diesel engines.
7. Economical speed test of an IC engine
8. Study of boilers

SECTION B –HYDRAULIC MACHINES LAB

1. Impact of jets on Vanes.
2. Performance Test on Pelton Wheel.
3. Performance Test on Francis Turbine.
4. Performance Test on Kaplan Turbine.
5. Performance Test on Single Stage Centrifugal Pump.
6. Performance Test on Reciprocating Pump.
7. Calibration of Venturimeter.
8. Calibration of Orifice meter.
9. Determination of loss of head due to sudden contraction in a pipeline.



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II Year – I SEMESTER		L	T	P	C
		0	0	3	1.5
	ELECTRICAL CIRCUITS LABORATORY				

Learning objectives:

To verify and demonstrate various theorems, locus diagrams, resonance and two port networks.
 To determine self and mutual inductance of a magnetic circuit, parameters of a given coil and measurement of 3- phase power.

Any 10 of the following experiments are to be conducted:

- 1) Verification of Thevenin's and Norton's Theorems.
- 2) Verification of superposition theorem and maximum power transfer theorem
- 3) Verification of compensation theorem
- 4) Verification of reciprocity, Millmann's Theorems
- 5) Determination of time constants of R-L, R-C networks using CRO.
- 6) Series and parallel resonance
- 7) Determination of self, mutual inductances and coefficient of coupling
- 8) Z and Y Parameters
- 9) Transmission and hybrid parameters
- 10) Parameters of a choke coil.
- 11) Determination of cold and hot resistance of an electric lamp.
- 12) Measurement of 3-phase power by two Wattmeter method for unbalanced loads

Learning outcomes:

The Student should be able to apply various theorems, determination of self and mutual inductances, two port parameters of a given electric circuits. Able to draw locus diagrams, waveforms and phasor diagrams for lagging and leading networks.



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COURSE STRUCTURE-R19

II Year – I SEMESTER		L	T	P	C
		3	0	0	0
ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE					

Course Objectives:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system

- The course aim of the importing basic principle of third process reasoning and inference sustainability is at the course of Indian traditional knowledge system
- To understand the legal framework and traditional knowledge and biological diversity act 2002 and geographical indication act 2003
- The courses focus on traditional knowledge and intellectual property mechanism of traditional knowledge and protection
- To know the student traditional knowledge in different sector

Course Outcomes:

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

- Understand the concept of Traditional knowledge and its importance
- Know the need and importance of protecting traditional knowledge
- Know the various enactments related to the protection of traditional knowledge
- Understand the concepts of Intellectual property to protect the traditional knowledge

UNIT I

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge

Learning Outcomes:

At the end of the unit, the student will able to:

- Understand the traditional knowledge.
- Contrast and compare characteristics importance kinds of traditional knowledge.
- Analyze physical and social contexts of traditional knowledge.
- Evaluate social change on traditional knowledge.

UNIT II

Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.

Learning Outcomes:

At the end of the unit, the student will able to:

- Know the need of protecting traditional knowledge.
- Apply significance of tk protection.



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- Analyze the value of tk in global economy.
- Evaluate role of government

UNIT III

Legal framework and TK: A: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmers Rights Act, 2001 (PPVFR Act); B: The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indications act 2003.

Learning Outcomes:

At the end of the unit the student will able to:

- Understand legal framework of TK.
- Contrast and compare the ST and other traditional forest dwellers
- Analyze plant variant protections
- Evaluate farmers right act

UNIT IV

Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.

Learning Outcomes:

At the end of the unit, the student will able to:

- Understand TK and IPR
- Apply systems of TK protection.
- Analyze legal concepts for the protection of TK.
- Evaluate strategies to increase the protection of TK.

UNIT V

Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.

Learning Outcomes:

At the end of the unit, the student will able to:

- Know TK in different sectors.
- Apply TK in engineering.
- Analyze TK in various sectors.
- Evaluate food security and protection of TK in the country.



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Reference Books:

- 1) Traditional Knowledge System in India, by Amit Jha, 2009.
- 2) Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.
- 3) Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002
- 4) "Knowledge Traditions and Practices of India" Kapil Kapoor, Michel Danino

e-Resources:

- 1) <https://www.youtube.com/watch?v=LZP1StpYEPM>
- 2) <http://nptel.ac.in/courses/121106003/>



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COURSE STRUCTURE-R19

II Year – II SEMESTER				
	L	T	P	C
	3	0	0	3
ELECTRICAL MEASUREMENTS AND INSTRUMENTATION				

Preamble:

This course introduces the principle of operation of basic analog and digital measuring instruments for measurement of current, voltage, power, energy etc. Measurement of resistance, inductance and capacitance by using bridge circuits will be discussed in detail. It is expected that student will be thorough with various measuring techniques that are required for an electrical engineer.

Learning Objectives:

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

UNIT-I:

Analog Ammeter and Voltmeters

Classification – deflecting, control and damping torques,– PMMC, moving iron type and electrostatic instruments, Construction, Torque equation, Range extension, Effect of temperature, Errors and compensations, advantages and disadvantages. Instrument transformers: Current Transformer and Potential Transformer-construction, theory, errors-Numerical Problems.

UNIT –II:

Analog Wattmeters and Power Factor Meters

Electrodynamometer type wattmeter (LPF and UPF), Power factor meters: Dynamometer and M.I type (Single phase and Three phase), construction, theory, torque equation, advantages and disadvantages -Numerical Problems.

UNIT – III:

Measurements of Electrical parameters

DC Bridges: Method of measuring low, medium and high resistance – sensitivity of Wheat stone's bridge, Kelvin's double bridge for measuring low resistance, Loss of charge method for measurement of high resistance, Megger – measurement of earth resistance - Numerical Problems.



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AC Bridges: Measurement of inductance – quality factor, Maxwell’s bridge, Hay’s bridge, Anderson’s bridge, measurement of capacitance and loss angle, Desauty’s bridge, Schering Bridge, Wagner’s earthing device, Wien’s bridge- Numerical Problems.

UNIT – IV:

Transducers

Definition, Classification, Resistive, Inductive and Capacitive Transducer, LVDT, Strain Gauge, Thermistors, Thermocouples, Piezo electric and Photo Diode Transducers, Digital shaft encoders, Hall effect sensors- Numerical Problems.

UNIT – V:

Digital meters

Digital voltmeter – Successive approximation DVM, Ramp type DVM and Integrating type DVM – Digital frequency meter, Digital multimeter, Digital tachometer, Digital Energy Meter, LCR Q meter, Power Analyzer-Measurement of phase difference, Frequency, hysteresis loop using lissajous patterns in CRO- Numerical Problems.

Learning Outcomes:

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

- choose right type of instrument for measurement of ac and dc Electrical quantities.
- choose right type of instrument for measurement of power and power factor.
- select right type for measurement of R, L,C.
- understand the effectiveness of Transducer.
- able to understand Digital Meters.

Text Books:

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

Reference Books:

1. Electrical & Electronic Measurement & Instruments by A.K.Sawhney Dhanpat Rai & Co.Publications.
2. Electrical and Electronic Measurements and instrumentation by R.K.Rajput, S.Chand.
3. Electrical Measurements by Buckingham and Price, Prentice – Hall
4. Electrical Measurements by Forest K. Harris. John Wiley and Sons
5. Electrical Measurements: Fundamentals, Concepts, Applications by Reissland, M.U, New Age International (P) Limited, Publishers.
6. Electrical and Electronic Measurements by G.K.Banerjee, PHI Learning Private Ltd, New Delhi–2012.



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II Year – II SEMESTER		L	T	P	C
		3	0	0	3
	ELECTRICAL MACHINES – II				

Preamble:

This course covers the topics on 3-phase induction motor, 1-phase induction motor and synchronous machines which have wide application in power systems. The main aim of the course is to provide a detailed analysis of operation and performance of 3-phase induction motor, 1-phase induction motor and synchronous machines. In addition, it also covers voltage regulation and parallel operation of synchronous generators.

Learning objectives:

- Understand the principle of operation and performance of 3-phase induction motor.
- Quantify the performance of induction motor and induction generator in terms of torque and slip.
- To understand the torque producing mechanism of a single phase induction motor.
- To understand the principle of emf generation, the effect of armature reaction and predetermination of voltage regulation in synchronous generators.
- To study parallel operation and control of real and reactive powers for synchronous generators.
- To understand the operation, performance and starting methods of synchronous motors.

UNIT-I:

3-phase induction motors

Construction details of cage and wound rotor machines – production of rotating magnetic field – principle of operation – rotor emf and rotor frequency – rotor current and power factor at standstill and during running conditions – rotor power input, rotor copper loss and mechanical power developed and their interrelationship – equivalent circuit – phasor diagram

UNIT-II:

Characteristics, starting and testing methods of induction motors

Torque equation – expressions for maximum torque and starting torque – torque slip characteristic – double cage and deep bar rotors – crawling and cogging – speed control of induction motor with V/f control method – no load and blocked rotor tests – circle diagram for predetermination of performance – methods of starting – starting current and torque calculations – induction generator operation (Qualitative treatment only)

UNIT – III:

Single Phase Motors

Single phase induction motors – constructional features and equivalent circuit – problem of starting – double revolving field theory



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COURSE STRUCTURE-R19

Starting methods, AC series motor.

UNIT-IV:

Construction, operation and voltage regulation of synchronous generator

Constructional features of non-salient and salient pole type armature windings – distributed and concentrated windings – distribution, pitch and winding factors – E.M.F equation – improvements of waveform and armature reaction – voltage regulation by synchronous impedance method – MMF method and Potier triangle method – phasor diagrams – two reaction analysis of salient pole machines and phasor diagram.

Parallel operation with infinite bus and other alternators – synchronizing power – load sharing – control of real and reactive power – numerical problems.

UNIT-V:

Synchronous motor – operation, starting and performance

Synchronous motor principle and theory of operation – phasor diagram – starting torque – variation of current and power factor with excitation – synchronous condenser – mathematical analysis for power developed – hunting and its suppression – methods of starting – applications.

Learning outcomes:

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

- explain the operation and performance of three phase induction motor.
- analyze the torque-speed relation, performance of induction motor and induction generator.
- explain design procedure for transformers and three phase induction motors.
- implement the starting of single phase induction motors.
- perform winding design and predetermine the regulation of synchronous generators.
- avoid hunting phenomenon, implement methods of starting and correction of power factor with synchronous motor.

Text Books:

1. Electrical Machines by P.S. Bhimbra, Khanna Publishers
2. Electric Machinery by A.E.Fitzgerald, Charles kingsley, Stephen D.Umans, TMH

Reference Books:

1. Electrical Machines by D. P.Kothari, I .J .Nagarth, Mc Graw Hill Publications, 4th edition
2. Electrical Machines by R.K.Rajput, Lakshmi publications, 5th edition
3. Electrical Machinery by Abijith Chakrabarthi and Sudhipta Debnath, Mc Graw Hill education 2015
4. Electrical Machinery Fundamentals by Stephen J Chapman Mc Graw Hill education 2010
5. Electric Machines by Mulukutla S.Sarma & Mukesh k.Pathak, CENGAGE Learning.
6. Theory & Performance of Electrical Machines by J.B.Guptha. S.K.Kataria & Sons



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7. Alternating Current Machines by A.F.Puchstein, T.C. Lloyd, A.G. Conrad, ASIA Publishing House
7. Performance and design of AC machines – M.G. Say.



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II Year – II SEMESTER		L	T	P	C
		3	0	0	3
DIGITAL ELECTRONICS					

Preamble:

This course covers the topics related to representation numbers in different radix formats, complements and codes. It also introduces the basic gates and their realization in SOP and POS form. Boolean algebra and various logic gates minimization process is introduced. Design principles of combinational and sequential circuits are explained to make the students thorough in design of these circuits.

Course Objectives:

- To solve a typical number base conversion and analyze new error coding techniques.
- Theorems and functions of Boolean algebra and behavior of logic gates.
- To optimize logic gates for digital circuits using various techniques.
- To understand concepts of combinational circuits.
- To develop advanced sequential circuits.

UNIT – I:

Review of Number Systems & Codes:

Representation of numbers of different radix, conversion from one radix to another radix, $r-1$'s complements and r 's complements of signed numbers, problem solving. 4 bit codes, BCD, Excess-3, 2421, 84-2-1 9s & 10s complement code etc.,

Logic operations and error detection & correction codes; Basic logic operations -NOT, OR, AND, Universal building blocks, EX-OR, EX-NOR - Gates, Standard SOP and POS, Forms, Gray code, error detection, error correction codes (parity checking, even parity, odd parity, Hamming code) NAND-NAND and NOR-NOR realizations.

UNIT – II:

Minimization Techniques

Boolean theorems, principle of complementation & duality, De-morgan theorems, minimization of logic functions using Boolean theorems, minimization of switching functions using K-Map up to 6 variables, tabular minimization, problem solving (code-converters using K-Map etc..).

UNIT – III:

Combinational Logic Circuits Design



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Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders, 4-bit binary subtractor, adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit, look-ahead adder circuit, Design of decoder, demultiplexer, 7 segment decoder, higher order demultiplexing, encoder, multiplexer, higher order multiplexing, realization of Boolean functions using decoders and multiplexers, priority encoder, 4-bit digital comparator.

UNIT – IV:

Sequential Circuits I

Classification of sequential circuits (synchronous and asynchronous); basic flip-flops, truth tables and excitation tables (NAND RS latch, NOR RS latch, RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals). Conversion from one flip-flop to another. Design of ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift register.

UNIT – V:

Sequential Circuits II

Finite state machine; Analysis of clocked sequential circuits, state diagrams, state tables, reduction of state tables and state assignment, design procedures. Realization of circuits using various flip-flops. Mealy to Moore conversion and vice-versa.

Course Outcomes:

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

- classify different number systems and apply to generate various codes.
- use the concept of Boolean algebra in minimization of switching functions
- design different types of combinational logic circuits.
- apply knowledge of flip-flops in designing of Registers and counters
- the operation and design methodology for synchronous sequential circuits and algorithmic state machines.
- produce innovative designs by modifying the traditional design techniques.

Text Books:

1. Zvi Kohavi and Niraj K. Jha, “ Switching and finite Automata Theory”, Cambridge University Press, 3rd edition, 2010.
2. Switching Theory and Logic Design by Hill and Peterson Mc-Graw Hill TMH edition.
3. Digital Design by M. Morris Mano, Micheal D. Ciletti, Pearson Publication 4th edition. PHI.



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4. Digital Principles And Applications by Albert Paul Malvino, Donald P Leach TMH edition.

Reference Books:

1. Switching Theory and Logic Design by A. Anand Kumar
2. Modern Digital Electronics by RP Jain, TMH
3. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers
4. Digital electronics logic and design-Cherry Bhargava, BS Publications, 2019.

Web Links:

1. <https://www.youtube.com/watch?v=CeD2L6KbtVM>
2. Lecture series on Digital Circuits & Systems by Prof.S.Srinivasan, Department of Electrical Engineering, IIT Madras.For more details on NPTEL visit <http://nptel.iitm.ac.in>
3. https://www.youtube.com/watch?v=K73N9ES_8nI
4. <https://www.youtube.com/watch?v=62WxkICo2Bc>



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COURSE STRUCTURE-R19

II Year – II SEMESTER		L	T	P	C
		3	0	0	3
	CONTROL SYSTEMS				

Preamble:

This course introduces the elements of linear control systems and their analysis. Classical methods of design using frequency response. The state space approach for design, modeling and analysis of simple PD, PID controllers.

Learning 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 discuss basic aspects of design and compensation of linear control system using Bode plot.
- To present the Frequency Response approaches for the analysis of linear time invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.
- Ability to formulate state models and analyze the systems. To learn the concepts of Controllability and Observability.

UNIT – I:

Mathematical Modeling of Control Systems

Classification of control systems, open loop and closed loop control systems and their differences, Feedback characteristics, transfer function of linear system, differential equations of electrical networks, translational and rotational mechanical systems, transfer function of DC servo motor – AC servo motor – synchro, transmitter and receiver – block diagram algebra – representation by signal flow graph – reduction using Mason's gain formula.

UNIT-II:

Time Response Analysis

Standard test signals – time response of first and second order systems – time domain specifications, steady state errors and error constants, P, PI,

Stability and Root Locus Technique



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The concept of stability – Routh’s stability criterion –limitations of Routh’s stability, Root locus concept – construction of root loci (simple problems).Effect of addition of poles and zeros root locus

UNIT–III:

Frequency Response Analysis

Introduction to frequency domain specifications – Bode diagrams – transfer function from the Bode diagram – phase margin and gain margin – stability analysis from Bode plots.

Polar plots, Nyquist stability criterion.

UNIT–IV:

Classical Control Design Techniques

Lag, lead, lag-lead compensators, design of compensators using Bode plots.

UNIT–V:

State Space Analysis of LTI Systems

Concepts of state, state variables and state model, state space representation of transfer function, diagonalization, solving the time invariant state equations, State Transition Matrix and it’s Properties, concepts of controllability and observability.

Learning Outcome:

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

- derive the transfer function of physical systems and determination of overall transfer function using block diagram algebra and signal flow graphs.
- determine time response specifications of second order systems and to determine error constants.
- analyze absolute and relative stability of LTI systems using Routh’s stability criterion and the root locus method.
- analyze the stability of LTI systems using frequency response methods.
- design Lag, Lead, Lag-Lead compensators to improve system performance from Bode diagrams.
- represent physical systems as state models and determine the response. Understanding the concepts of controllability and observability.

Text Books:

1. Modern Control Engineering by Kotsuhiko Ogata, Prentice Hall of India.
2. Automatic control systems by Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

Reference Books:

1. Control Systems principles and design by M.Gopal, Tata Mc Graw Hill education Pvt Ltd., 4th Edition.
2. Control Systems by Manik Dhanesh N, Cengage publications.
3. Control Systems Engineering by I.J.Nagarath and M.Gopal, Newage International Publications, 5th Edition.
4. Control Systems Engineering by S.Palani, Tata Mc Graw Hill Publications.



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COURSE STRUCTURE-R19

II Year – II SEMESTER		L	T	P	C
		3	0	0	3
	POWER SYSTEMS-I				

Preamble:

Electrical Power plays significant role in day to day life of entire mankind. The aim of this course is to allow the students to understand the concepts of the generation and distribution of power along with economic aspects.

Learning 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 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.

UNIT-I:

Thermal Power Stations

Selection of site, general layout of a thermal power plant showing paths of coal, steam, water, air, ash and flue gasses, ash handling system, Brief description of components: boilers, super heaters, economizers, electrostatic precipitators, steam turbines: impulse and reaction turbines, condensers, feed water circuit, cooling towers and chimney.

UNIT-II:

Nuclear Power Stations

Location of nuclear power plant, working principle, nuclear fission, nuclear fuels, nuclear chain reaction, nuclear reactor components: moderators, control rods, reflectors and coolants, types of nuclear reactors and brief description of PWR, BWR and FBR. Radiation: radiation hazards and shielding, nuclear waste disposal.

UNIT-III:

Substations

Classification of substations:

Air Insulated Substations – indoor & outdoor substations, substations layouts of 33/11 kV showing the location of all the substation equipment.

Bus bar arrangements in the sub-stations: simple arrangements like single bus bar, sectionalized single bus bar, double bus bar with one and two circuit breakers, main and transfer bus bar system with relevant diagrams.



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Gas Insulated Substations (GIS) – advantages of gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, constructional aspects of GIS, installation and maintenance of GIS, comparison of air insulated substations and gas insulated substations.

UNIT-IV:

Underground Cables

Types of cables, construction, types of insulating materials, calculation of insulation resistance, stress in insulation and power factor of cable.

capacitance of single and 3-Core belted Cables: Grading of cables – capacitance grading and intersheath grading.

UNIT-V:

Economic Aspects of Power Generation & Tariff

Economic Aspects –load curve, load duration and integrated load duration curves, discussion on economic aspects: connected load, maximum demand, demand factor, load factor, diversity factor, power capacity factor and plant use factor, base and peak load plants.

Tariff Methods– costs of generation and their division into fixed, semi-fixed and running costs, desirable characteristics of a tariff method, tariff methods: simple rate, flat rate, block-rate, two-part, three-part, and power factor tariff methods.

Learning Outcomes:

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

- identify the different components of thermal power plants.
- identify the different components of nuclear Power plants.
- identify the different components of air and gas insulated substations.
- identify single core and three core cables with different insulating materials.
- analyse the different economic factors of power generation and tariffs.

Text Books:

1. A Text Book on Power System Engineering by M.L.Soni, P.V.Gupta, U.S.Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co. Pvt. Ltd.
2. Generation, Distribution and Utilization of Electric Energy by C.L.Wadhawa New age International (P) Limited, Publishers.

Reference Books:

1. Electrical Power Distribution Systems by V. Kamaraju, Tata Mc Graw Hill, New Delhi.
2. Elements of Electrical Power Station Design by M V Deshpande, PHI, New Delhi.



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II Year – II SEMESTER		L	T	P	C
		3	0	0	3
	SIGNALS AND SYSTEMS				

Preamble:

This course introduces the fundamental concepts of various types signals and their properties and mathematical operations on the signals. Fourier series, Fourier and Hilbert transforms are introduced to analyze the signals. Sampling theorem and Parseval's theorem are introduced to design and analysis of filters. Laplace and Z-transforms are used for the analysis of signals.

Course Objectives:

- To introduce the terminology of signals and systems.
- To introduce Fourier tools through the analogy between vectors and signals.
- To introduce the concept of sampling and reconstruction of signals.
- To analyze the linear systems in time and frequency domains.
- To study z-transform as mathematical tool to analyze discrete-time signals and systems.

UNIT- I:

Introduction

Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function, signum function and ramp function. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions.



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UNIT –II:

Fourier Series And Fourier Transform:

Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform.

UNIT –III:

Sampling Theorem

Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling.

UNIT-IV:

Analysis of Linear Systems

Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

Cross-correlation and auto-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation.

UNIT –V:

Laplace Transforms

Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Relation between L.T's, and F.T. of a signal.

Z-Transforms

Fundamental difference between continuous-time and discrete-time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence.



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Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms.

Course Outcomes:

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

- characterize the signals and systems and principles of vector spaces, Concept of orthogonality.
- analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform and Laplace transform.
- apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct back.
- understand the relationships among the various representations of LTI systems
- understand the Concepts of convolution, correlation, Energy and Power density spectrum and their relationships.
- apply z-transform to analyze discrete-time signals and systems.

Text Books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.
3. Signals & Systems- Narayan Iyer and K Satya Prasad, Cenage Pub.

Reference Books:

1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition.
2. Principles of Linear Systems and Signals – BP Lathi, Oxford University Press, 2015
3. Signals and Systems – Signals and Systems – M.J. Roberts, 3rd Edition, MC Graw-Hill, 2019.
4. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.
5. Signals and Systems – T K Rawat , Oxford University press, 2011



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II Year – II SEMESTER		L	T	P	C
		0	0	3	1.5
ELECTRICAL MACHINES – I LABORATORY					

Learning objectives:

- To plot the magnetizing characteristics of DC shunt generator and understand the mechanism of self-excitation.
- To control the speed of DC motors.
- To determine and predetermine the performance of DC machines.
- To predetermine the efficiency and regulation of transformers and assess their performance.

Any 10 of the following experiments are to be conducted

1. Magnetization characteristics of DC shunt generator.
2. Brake test on DC shunt motor.
3. Hopkinson's test on DC shunt machines.
4. Swinburne's test and Predetermination of efficiencies as Generator and Motor.
5. Speed control of DC shunt motor by Field and Armature Control.
6. Retardation test on DC shunt motor..
7. Separation of losses in DC shunt motor.
8. OC & SC test on single phase transformer.
9. Sumpner's test on single phase transformer.
10. Scott connection of transformers
11. Parallel operation of Single phase Transformers
12. Separation of core losses of a single phase transformer
13. Heat run test on a bank of 3 Nos. of single phase Delta connected transformers

Learning outcomes:

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

- Determine and predetermine the performance of DC machines and Transformers.
- Control the speed of DC motor.
- Obtain three phase to two phase transformation.



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II Year – II SEMESTER				
	L	T	P	C
	0	0	3	1.5
ELECTRONIC DEVICES & CIRCUITS LABORATORY				

Electronic Workshop Practice:

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Coils, Gang condensers, Relays, Bread Boards.
2. Identification, Specifications and Testing of active devices, Diodes, BJTs, JFETs, LEDs, LCDs, SCR, UJT.
3. Soldering Practice- Simple circuits using active and passive components.
4. Study and operation of Ammeters, Voltmeters, Transformers, Analog and Digital Multimeter, Function
5. Generator, Regulated Power Supply and CRO..

List of Experiments

Any 10 of the following experiments are to be conducted

1. P.N Junction Diode Characteristics
 Part A: Germanium Diode (Forward bias & Reverse bias)
 Part B: Silicon Diode (Forward Bias only)
2. Zener Diode Characteristics
 Part A: V-I Characteristic
 Part B: Zener Diode as Voltage Regulator
3. Rectifiers (without and with c-filter)
 Part A: Half-wave Rectifier
 Part B : Full-wave Rectifier
4. BJT Characteristics (CE Configuration)
 Part A: Input Characteristics
 Part B: output Characteristics
5. FET Characteristics
 Part A: Drain Characteristics
 Part B: Transfer Characteristics
6. SCR Characteristics
7. UJT Characteristics
8. Transistor Biasing
9. CRO Operation and its Measurement
10. BJT-CE Amplifier
11. Emitter Follower –CC Amplifier



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12.FET-CS Amplifier

Note: The students are required to perform the experiment to obtain the V-I characteristics and to determine the relevant parameters from the obtained graphs.

Equipment required:

- 1.Regulated Power supplies
- 2.Analog/Digital Storage Oscilloscopes
- 3.Analog/Digital Function Generators
- 4.Digital Multimeters
- 5.Decade Résistance Boxes/Rheostats
- 6.Decade Capacitance Boxes
- 7.Ammeters (Analog or Digital)
- 8.Voltmeters (Analog or Digital)
- 9.Active & Passive Electronic Components



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II Year – II SEMESTER				
	L	T	P	C
	3	0	0	0
PROFESSIONAL ETHICS AND HUMAN VALUES				

Course Objectives:

- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of others
- To create awareness on assessment of safety and risk

Course outcomes:

Students will be able to:

- Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field
- Identify the multiple ethical interests at stake in a real-world situation or practice
- Articulate what makes a particular course of action ethically defensible
- Assess their own ethical values and the social context of problems
- Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human subjects
- Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work
- Integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

UNIT I

Human Values: Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others –Living Peacefully –Caring –Sharing –Honesty –Courage-Cooperation– Commitment – Empathy –Self Confidence Character –Spirituality.

Learning outcomes:

1. Learn about morals, values & work ethics.
2. Learn to respect others and develop civic virtue.
3. Develop commitment
4. Learn how to live peacefully

UNIT II

Engineering Ethics: Senses of ‘Engineering Ethics-Variety of moral issued –Types of inquiry – Moral dilemmas –Moral autonomy –Kohlberg’s theory-Gilligan’s theory-Consensus and controversy –Models of professional roles-Theories about right action-Self-interest –Customs and religion –Uses of Ethical theories –Valuing time –Cooperation –Commitment.

Learning outcomes:

1. Learn about the ethical responsibilities of the engineers.
2. Create awareness about the customs and religions.



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3. Learn time management
4. Learn about the different professional roles.

UNIT III

Engineering as Social Experimentation: Engineering As Social Experimentation –Framing the problem –Determining the facts –Codes of Ethics –Clarifying Concepts –Application issues – Common Ground -General Principles –Utilitarian thinking respect for persons.

Learning outcomes:

1. Demonstrate knowledge to become a social experimenter.
2. Provide depth knowledge on framing of the problem and determining the facts.
3. Provide depth knowledge on codes of ethics.
4. Develop utilitarian thinking

UNIT IV

Engineers Responsibility for Safety and Risk: Safety and risk –Assessment of safety and risk – Risk benefit analysis and reducing risk-Safety and the Engineer-Designing for the safety-Intellectual Property rights (IPR).

Learning outcomes:

1. Create awareness about safety, risk & risk benefit analysis.
2. Engineer's design practices for providing safety.
3. Provide knowledge on intellectual property rights.

UNIT V

Global Issues: Globalization –Cross-culture issues-Environmental Ethics –Computer Ethics – Computers as the instrument of Unethical behavior –Computers as the object of Unethical acts – Autonomous Computers-Computer codes of Ethics –Weapons Development -Ethics and Research –Analyzing Ethical Problems in research.

Learning outcomes:

1. Develop knowledge about global issues.
2. Create awareness on computer and environmental ethics
3. Analyze ethical problems in research.
4. Give a picture on weapons development.



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Text Books:

- 1) “Engineering Ethics includes Human Values” by M.Govindarajan, S.Natarajan and, V.S.Senthil Kumar-PHI Learning Pvt. Ltd-2009
- 2) “Engineering Ethics” by Harris, Pritchard and Rabins, CENGAGE Learning, India Edition, 2009.
- 3) “Ethics in Engineering” by Mike W. Martin and Roland Schinzinger –Tata McGraw-Hill– 2003.
- 4) “Professional Ethics and Morals” by Prof.A.R.Aryasri, DharanikotaSuyodhana-Maruthi Publications.
- 5) “Professional Ethics and Human Values” by A.Alavudeen, R.Kalil Rahman and M.Jayakumaran-LaxmiPublications.
- 6) “Professional Ethics and Human Values” by Prof.D.R.Kiran-
“Indian Culture, Values and Professional Ethics” by PSR Murthy-BS Publication