

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 behaviour 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 - relation between line and phase voltages and currents - analysis of balanced three phase circuits - measurement of active and reactive power.

UNIT-II Unbalanced Three phase circuits

Analysis of three phase unbalanced circuits: Loop method – Star-Delta transformation technique, Two wattmeter methods for measurement of three phase power.

UNIT-III 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-IV Two Port Networks

Two port network parameters – Z, Y, ABCD and Hybrid parameters and their relations, Cascaded networks - Poles and zeros of network functions.

UNIT-V Network synthesis

Positive real function - basic synthesis procedure - LC immittance functions - RC impedance functions and RL admittance function - RL impedance function and RC admittance function - Foster and Cauer methods.

UNIT-VI Fourier analysis and Transforms

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.

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

Learning Outcomes:

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

Text Books:

1. Engineering Circuit Analysis by William Hayt and Jack E.Kemmerley,McGraw 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, McGraw Hill Education (India)
2. Introduction to circuit analysis and design by TildonGlisson. Jr, Springer Publications.
3. Circuits by A.Bruce Carlson , Cengage Learning Publications
4. Network Theory Analysis and Synthesis by SmarajitGhosh, 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,DhanpatRai&Co.

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 unifying principles of electromagnetic energy conversion.
- 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:

Electromechanical Energy Conversion and introduction to DC machines

Principles of electromechanical energy conversion – singly excited and multi excited system – Calculation of force and torque using the concept of co-energy.

Construction and principle of operation of DC machine – EMF equation for generator – Classification of DC machines based on excitation – OCC of DC shunt generator.

UNIT-II:

Performance of D.C. 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 D.C. Machines

Necessity of 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 – lagging, leading and unity power factors loads - phasor diagrams of transformers – equivalent circuit – regulation – losses and efficiency – effect of variation of frequency and supply voltage on losses – All day efficiency.

UNIT-V

Single-phase Transformers Testing

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 - equivalent circuit – comparison with two winding transformers.

UNIT-VI

3-Phase Transformers

Polyphase connections - Y/Y, Y/ Δ , Δ /Y, Δ / Δ and open Δ -- Third harmonics in phase voltages - three winding transformers: determination of Z_p , Z_s and Z_t -- transients in switching - off load and on load tap changers -- Scott connection.

Learning outcomes:

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

Text Books:

1. Electrical Machines – 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. Nagrath, McGraw Hill Publications, 4th edition
2. Electrical Machines by R.K. Rajput, Lakshmi publications, 5th edition.
3. Electrical Machinery by Abijith Chakrabarti and Sudipta Debnath, McGraw Hill education 2015
4. Electrical Machinery Fundamentals by Stephen J Chapman McGraw Hill education 2010
5. Electric Machines by Mulukutla S. Sarma & Mukesh K. Pathak, CENGAGE Learning.
6. Theory & Performance of Electrical Machines by J.B. Gupta. S.K. Kataria & Sons

BASIC ELECTRONICS AND DEVICES**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 and their analysis is also introduced in this course.

Unit-I:**Objective:**

To learn the basics of semiconductor physics.

Review of Semi Conductor Physics: Insulators, Semi conductors, and Metals classification using Energy Band Diagrams, Mobility and Conductivity, Electrons and holes in Intrinsic Semi conductors, Extrinsic Semi Conductor, (P and N Type semiconductor) Hall effect, Generation and Recombination of Charges, Diffusion, Continuity Equation, Injected Minority Carriers, Law of Junction, Introduction to fermi level in Intrinsic, Extrinsic semi conductors with necessary mathematics

Outcome:

Students are able to understand the basic concepts of semiconductor physics, which are useful to understand the operation of diodes and transistors.

Unit-II:**Objective:**

To study the construction details, operation and characteristics of various semiconductor diodes.

Junction Diode Characteristics

Operation and characteristics of p-n junction diode. Current components in p-n diode, diode equation. Temperature dependence on V–I characteristic, diffusion capacitance and diode resistance (static and dynamic), energy band diagram of p-n diode.

Special Diodes: Avalanche and Zener break down, Zener characteristics, tunnel diode, characteristics with the help of energy band diagrams, Varactor diode, LED, PIN diode, Photo diode

Outcome:

Students are able to explain the operation and characteristics of PN junction diode and special diodes.

Unit-III:**Objective:**

To understand the operation and analysis of rectifiers with and without filters. Further study the operation of series and shunt regulators using zener diodes.

Rectifiers and Regulators

Half wave rectifier, ripple factor, full wave rectifier (with and without transformer), harmonic components in a rectifier circuit, inductor filter, capacitor filter, L-section filter, Π - section filter, and comparison of various filter circuits in terms of ripple factors. Simple circuit of a regulator using Zener diode. Types of regulators-series and shunt voltage regulators, over load voltage protection.

Outcome:

Ability to understand operation and design aspects of rectifiers and regulators.

Unit-IV:**Objective:**

To study the characteristics of different bipolar junction transistors and their biasing stabilization and compensation techniques. To analyze transistor amplifiers using h-parameters.

Transistors

Junction transistor, transistor current components, transistor as an amplifier and switch. Characteristics of transistor (CE, CB and CC configurations). Transistor biasing and thermal stabilization (to fixed bias, collector to base bias, self bias). Compensation against variation in base emitter voltage and collector current. Thermal runaway. Hybrid model of transistor. Analysis of transistor amplifier using h-parameters

Outcome:

Students are able to understand the characteristics of various transistor configurations. They become familiar with different biasing, stabilization and compensation techniques used in transistor circuits.

Unit- V:**Objective:**

To understand the basics of FET,Thyristors, Power IGBTs and Power MOSFETs.

Power semiconductor devices

Principle of operation and characteristics of Thyristors, Silicon control rectifiers, power IGBT and power MOSFET their ratings. Comparison of power devices.

FET: JFET Characteristics (Qualitative explanation), MOFET Characteristics–static and Transfer (enhancement and depletion mode), low frequency model of FET, FET as an amplifier.

Outcome:

Students are able to understand the operation and characteristics of FET, Thyristors, Power IGBTs and Power MOSFETs.

Unit VI :**Objective:**

To understand the concepts of positive and negative feedbacks and their role in amplifiers and oscillators.

Amplifiers and oscillators

Feedback Amplifiers -classification, feedback concept, transfer gain and general characteristics of negative feedback amplifiers, effect of feedback on input and output resistances. Methods of analysis of feedback amplifiers.

Power Amplifiers – Classification, push-pull amplifiers, Introduction to harmonics (distortion factor).

Oscillators – Condition for oscillation, RC-phase shift oscillator. Wein bridge oscillator, Crystal oscillator. Frequency and amplitude stability of oscillators.

Outcome:

Students are able to understand the merits and demerits of positive and negative feedback and the role of feedback in oscillators and amplifiers.

TEXT BOOKS:

1. Electronic Devices and Circuits – J. Millman, C.C. Halkias, Tata Mc-Graw Hill

REFERENCE BOOKS:

1. Electronic Devices and Circuits by David A. Bell, Oxford University Press
2. Electronic Devices and Circuits – Salivahanan, Kumar, Vallavaraj, TATA McGraw Hill, Second Edition
3. Electronic Devices and Circuits – R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, 9th Edition, 2006

ELECTROMAGNETIC FIELDS**Preamble:**

Electromagnetic fields are 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 various configurations and 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 e.m.f.

UNIT – I Electrostatics:

Electrostatic Fields – 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 – Maxwell's first law, $\text{div}(\mathbf{D}) = \rho_v$ Laplace's and Poisson's equations and Solution of Laplace's equation in one variable.

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 – Behaviour of conductors in an electric field – Conductors and Insulators

Polarization – Boundary conditions between conduction to Dielectric and dielectric to dielectrics capacitance – capacitance of parallel plates, spherical and coaxial cables with composite dielectrics –Energy stored and energy density in a static electric field – Current density – conduction and Convection current densities – Ohm's law in point form – Equation of continuity

UNIT – III Magneto statics and Ampere's Law:

Static magnetic fields – Biot-Savart's law – Oersted's experiment - 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 circular loop, rectangular and square loops, Maxwell's third equation, $\text{Curl}(\mathbf{H}) = \mathbf{J}$.

UNIT – IV Force in Magnetic fields:

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 – V 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 – VI 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 EMFs – Simple problems -Modification of Maxwell's equations for time varying fields – Displacement current – Poynting Theorem and Poynting vector.

Learning outcomes:

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

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.

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 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

UNIT III:

Objectives: To impart the knowledge of gas turbine fundamentals, the governing cycles and the methods 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: Classification of turbines; Working principle, Efficiency calculation and Design principles for Pelton Wheel, Francis and for Kaplan turbines; Governing of turbines; Performance and characteristic curves.

UNIT VI:

Objectives: To train the student in the areas of types of hydro electric power plants, estimation and calculation of different loads by considering various factors.

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.
3. “Hydraulics & Fluid Mechanics”, P.N. Modi and S.M. Seth, TEXT BOOKS House, Delhi
4. “Fluid Mechanics & Hydraulic Machinery” A.K.Jain, , Khanna Publishers, Delhi.

Reference Books:

1. “Fluid Mechanics” by Victor.L.Streeter
2. “Introduction to Fluid Mechanics” Edward .J. Shaughnessy Jr.
3. “Fluid Mechanics & Its Applications”, Vijay Gupta, Santhosh.k.Gupta
4. “Fluid Mechanics & Fluid power Engineering, Dr D.S.Kumar
5. “Water Power Engineering” M.M Desumukh

II Year - I Semester

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MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS
(Common to all Branches)

Course Objectives:

- The Learning objectives of this paper is 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, 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:

Production and Cost Analyses:

Concept of Production function- Cobb-Douglas Production function- Leontief 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(simple 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.

Unit – IV:

Types of Business Organization and Business Cycles:

Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms – Business Cycles : Meaning and Features – Phases of a Business Cycle.

Unit – V:

Introduction to Accounting & Financing Analysis:

Introduction to Double Entry Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow statements (Simple Problems)

Unit – VI:

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 Outcome:

- *The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product and the knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
- *One 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 and to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

TEXT BOOKS

1. Dr. N. AppaRao, Dr. P. Vijay Kumar: 'Managerial Economics and Financial Analysis', Cengage Publications, New Delhi – 2011
2. Dr. A. R. Aryasri – Managerial Economics and Financial Analysis, TMH 2011
3. Prof. J.V.Prabhakararao, Prof. P. Venkatarao. 'Managerial Economics and Financial Analysis', Ravindra Publication.

REFERENCES:

- 1.Dr. B. Kuberudu and Dr. T. V. Ramana: Managerial Economics & Financial Analysis, Himalaya Publishing House, 2014.
2. V. Maheswari: Managerial Economics, Sultan Chand.2014
3. Suma Damodaran: Managerial Economics, Oxford 2011.
4. VanithaAgarwal: Managerial Economics, Pearson Publications 2011.
5. Sanjay Dhameja: Financial Accounting for Managers, Pearson.
6. Maheswari: Financial Accounting, Vikas Publications.
7. S. A. Siddiqui& A. S. Siddiqui: Managerial Economics and Financial Analysis, New Age International Publishers, 2012
8. Ramesh Singh, Indian Economy, 7th Edn., TMH2015
9. Pankaj Tandon A Text Book of Microeconomic Theory, Sage Publishers, 2015
10. Shailaja Gajjala and Usha Munipalle, Univerties press, 2015

THERMAL AND HYDRO LAB

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 A MINIMUM OF 12 EXPERIMENTS BY CONDUCTING A 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 FHP by retardation and motoring test on IC engine
6. I.C. Engines 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.

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) Locus Diagrams of RL and RC Series Circuits
- 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:

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 diagram for lagging and leading networks.