

BASIC ELECTRICAL ENGINEERING

UNIT I -INTRODUCTION TO ELECTRICAL ENGINEERING

Basic definitions - Evolution in human comforts, What is engineering ?, Matter, Charge, Voltage and current. **Circuit concepts** - Electric networks, Network terminology, Classification of electric network. **Ohm's law and Kirchhoff's laws** - Ohm's law, How to remember ohm's law, Limitations of Ohm's Law, Problem based on Ohm's law, Kirchhoff's laws, Branch current method, Problem based on Kirchhoff's law. **Electrical power and energy** - Electrical power, Electrical energy. **Resistance** - Resistance parameter, Resistors, Basic definitions, Types of resistor, Resistances in series, Resistance in series circuit, Problem based on equivalent resistance in series circuit, Resistance in Parallel, Problems based on equivalent resistance in parallel circuit. **Inductance** - Inductance Parameter, Inductors, Inductor types, Inductors connected in series without mutual inductance, Inductors are in series with mutual inductance, Problems based on inductance in series, Inductors connected in parallel without mutual inductance, Inductors connected in parallel with mutual inductance, Problems based on inductance in parallel. **Capacitance** - Capacitance parameter, Introduction to capacitor, Classification of capacitor, Capacitors in series, Problems based on capacitance in series, Capacitors connected in parallel, Problems based on capacitance in parallel. **Constant voltage and current sources** - The ideal voltage source, Problems based on constant voltage source, Ideal current source, Problems based on constant current source, Types of sources. **Dependent and independent sources** - Electrical energy sources, Circuit transformation, Star and delta connection, Star to delta conversion, Problems on circuit transformation, Problems based star to delta conversion, Problems based star to delta conversion, Problems based delta to star conversion. **Thevenin's theorem for DC excitation** - Thevenin's theorem, Problems based on Thevenin's theorem for dc excitation. **Thevenin's theorem in sinusoidal excitation** - Thevenin's theorem (AC), Problems based on Thevenin's theorem for sinusoidal excitation. **Maximum power transfer theorem for DC excitation** - Maximum power transfer theorem, Case , Problems based on maximum power transfer theorem for dc excitation. **Maximum power transfer theorem for sinusoidal excitation** - Maximum power transfer theorem (AC), Problems based on maximum power transfer theorem for sinusoidal excitation, Exercise based on maximum power transfer theorem for sinusoidal excitation. **Superposition theorem for DC source** - Problems based on superposition theorem for dc excitation. **Superposition theorem for sinusoidal excitation** - Superposition Theorem for AC circuits, Problems based on superposition theorem for sinusoidal excitation.

UNIT II-ALTERNATING QUANTITIES

Introduction to AC, Introduction - Generations of alternating current and voltage, Definitions of alternating quantities. **Definitions of alternating quantities** - Average value and root mean square (RMS) value, Calculation of average value by analytical method, Calculation of RMS value by analytical method, Sinusoidal waveform representation, Problems based on alternating quantities. **Phasor representation of alternating quantities** - Introduction to j-operator, Different forms of representing a complex number, Phase and phase difference, Conversion of rectangular into polar form, Problem

based on rectangular to polar form, Conversion of polar into rectangular form, Problem based on polar to rectangular form. **Concept of reactance, impedance, susceptance and admittance** - Concept of reactance, impedance, admittance and susceptance. **Real and reactive power** - AC power circuit analysis, Effective values of current and voltage (rms value), Apparent power, Complex power, Pure resistance in AC Circuits, Definition of vector, Problems based on pure resistance in AC circuits. **Pure inductance in AC Circuits** - AC through pure inductive circuit, Problem based on pure inductance in AC circuits. **Pure capacitance in AC circuits** - AC through pure capacitance, Problems based on pure capacitance in AC circuits, Exercise based on pure capacitance in AC circuits. **RL, RC and RLC series circuits** - AC through R-L circuit, Problems based on RL series circuits, Exercise based on RL series circuits. **AC through R-C circuit** - Problems based on RC series circuits, Exercise based on RC series circuits. **AC through R-L-C circuit** - Power factor, Problems based on RLC series circuits, Power factor in ac circuits, Problems based on RLC series circuits. **AC through RC parallel circuit** AC through parallel R-C circuit. **AC through RL parallel circuit** - AC Through parallel R-L circuit. **Parallel RLC circuit** - Parallel RLC circuit, Solving parallel circuit by 'J' notation method, Problems based on parallel circuit by 'J' notation.

UNIT III - TRANSFORMERS

Principle of single phase transformers - Necessity of transformer, Transformer and its principle, Step-up and step-down transformer. **Construction of single phase transformer** - Types of transformer, Essential parts of a transformer, Construction of transformer, Winding, Types of transformers according to the magnetic core, Difference between core type and shell type transformer, Ideal transformer. **Ideal transformer** - Elementary theory of ideal transformer. **EMF equation** - EMF equation of transformer, Problems based on EMF equation of transformer. **Transformer ratio** - Voltage transformation ratio, Problems based on voltage transformer ratio, Exercise based on voltage transformer ratio. **Working of transformer on No load** - Transformer on No load, Importance in the study of transformer, Problems based on transformer on no load, Exercise based on transformer on no load. **Working of transformer on load** - Transformer On load, Problems based on transformer on load, Exercise based on transformer on load. **Real or Practical transformer** - Parameters referred to HV/LV windings, Magnetic leakage, Transformer with resistance and leakage reactance, Problems based on transformer leakage reactance, Exercise based on transformer leakage reactance. **Testing of transformers** - Transformer test, Open circuit or no load test, Short circuit (or) impedance test, Problems based on testing of transformer, Exercise based on testing of transformer. **Losses in a transformer** - Losses in a transformer, Problems based on losses in transformer. **Efficiency** - Transformer efficiency, Condition for maximum efficiency, Problems based on efficiency in transformer. **Voltage regulation** - Regulation of transformer, Problem based on voltage regulation of transformer, Applications of transformer.

UNIT IV–D.C AND A.C MACHINES

DC Generator construction - Construction of DC generator, Magnetic frame or yoke, Pole cores and pole shoes, Pole coils, Armature, Commutator, Brushes, Bearings, End covers or end housings, Shaft and Pulley. **Working principle of D.C. Generator** - Working operation of simple loop generator, Working principle of D.C. generator. **Lap and wave winding** - Armature windings, Terms used in armature winding, Coil or winding element, Terms used in armature winding, Type of D.C. armature windings. **EMF Equation** - E.M.F. equation of D.C. generator, Problems based on E.M.F equation of d.c. generator, Exercise based on E.M.F equation of d.c. generator, Flux distribution. **Types of generators** - What do you mean by excitation?, Classification of D.C. generators, Types of D.C. generator, Series generator, Problems based on d.c. series generator, Exercise based on d.c. series generator. **Types of generators** - D.C. shunt generator, Problems based on d.c. shunt generator, Exercise based on d.c. shunt generator, Compound generator, Problems based on compound generator, Exercise based on compound generator. **Armature reaction** - Armature reaction, Demagnetising and cross-magnetising conductors, Demagnetising AT per pole, Cross-Magnetising AT per pole, Compensating windings. **Characteristics of D.C. generators** - The D.C. generator have following characteristics in general, Load Characteristics D.C. Generators, Load characteristics of D.C. Shunt Generator, Load characteristics of D.C. Series Generator, Load Characteristics D.C. Compound Generators, **Applications of D.C. generators** - Applications of D.C. generators. **Working principle of D.C. Motor** - D.C. motor principle, Working of D.C. motor. **Back e.m.f** - Signification of the back E.M.F, Importance of back E.M.F. **Speed and torque equation** - Torque equation, Speed-torque equation, Problems based on motor torque and speed, Exercise based on torque. **Types of D.C. motor** - Classification of D.C. motor, D.C. series motor, Problems based on d.c. series motor, Exercise based on d.c. series motor, D.C. shunt motor, Problems based on d.c. shunt motor, Exercise based on d.c. shunt generator, D.C. compound motor. **Characteristics** - D.C. Motor characteristics, Characteristics of D.C. shunt motor, Characteristics of D.C. series motor, Characteristics of D.C. compound motor. **Losses, efficiency and power flow** - Classification of losses in d.c. motor, Problems based on efficiency of dc motor. **Application of d.c. motor** - Application of d.c. motor. **Introduction to three phase induction motor** - Introduction to three phase induction motor, Advantages and disadvantages of induction motor. **Construction of three phase induction motor** - Construction of three phase induction motor, The stator, Squirrel cage rotor, Phase wound or slip ring rotor, Comparison of squirrel cage and slip ring induction motor, Application of induction motor. **Production of rotating magnetic field** - Production of rotating magnetic field, Graphical representation of resultant rotating flux, Slip and slip speed, Problem based on slip and slip speed, Effect of slip on rotor parameters, Rotor reactance, resistance and impedance, Rotor current and power factor, Problem based on rotor frequency. **working Principle of three phase induction motor** - Working principle of three phase induction motor.

UNIT V–BASIC INSTRUMENTS

Classification of Instruments - Absolute and Secondary instruments, Analog instruments, Digital instruments, Secondary instruments, Uses of different types of Instruments, Differentiation between

secondary instruments. **Essential requirements of measurement** - Deflecting system, Working principle of measuring instruments, Need of damping torque, Classification of damping torque. **Moving Coil type instruments** - PMMC Instruments, Permanent Magnet Moving Coil Meter, Working Principle of PMMC Instrument, Working of PMMC Voltmeters and Ammeters, Common Errors in Moving Coil Instrument, Applications of Moving Coil Instruments. **Moving Iron type instruments** - Attraction type MI instruments, Repulsion Type M.I. Instruments, Expression for Deflecting Torque, Errors in M.I Instruments, Accuracy and standard of methods, Comparison of M.C and M.I meter. **Meters** - Introduction, Voltmeter, Ammeter, Measuring voltage and current in a circuit, Analog multimeter.