

ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT I – ELECTRICAL CIRCUITS AND INSTRUMENTS

Basic definitions - Evolution in human comforts, what is engineering, Matter, Charge, Voltage and current. **Circuit concepts** - Electric networks, Network terminology, Classification of electric network, Electrical energy sources. **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. **Resistive network** -Resistors, Resistance in series, Problem based on resistance in series, Problem based on equivalent resistance in series circuit, Resistance in Parallel, problems based on equivalent resistance in parallel circuit. **Analysis of series - parallel resistance** - Resistances in series and parallel combination, Problems based on equivalent resistance in series-parallel circuit. **Inductance network** - Inductors, Inductors connected in series without mutual inductance, Inductors are in series with mutual inductance, Problem based on inductance in series, Inductors connected in parallel without mutual inductance, Problem based on inductance in parallel. **Capacitive network** - Introduction to capacitor, Capacitors in series, Problem based on capacitance in series, Capacitors connected in parallel, Problem based on capacitance in parallel, problem based on capacitance in parallel. **Circuit transformation** - Star and delta connection, Star to delta conversion. **Problems on circuit transformation** - Problems based star to delta conversion, Problems based delta to star conversion. **Moving coil and Moving iron Instruments** - Introduction, Ammeters and Voltmeters, Measuring voltage and current in a circuit, PMMC Instruments, Attraction type MI instruments, Advantages and disadvantages of moving iron instruments, Comparison of MC and MI meter. **Ammeters and Voltmeters** - Working of PMMC voltmeters and ammeters, Measurement of voltage and current using MI voltmeter and ammeter, Electrodynamometer type instrument, Electro dynamometer type Ammeter and Voltmeter. **Dynamometer type wattmeter** - Electrodynamometer Type Wattmeter. **Dynamometer type energy meter** - Energy, Units and dimension formula for energy, Measurement of energy using energy meter, Single phase induction type energy meter, Working of single phase induction type energy meter, Three phase energy meter, Working of two element energy meter.

UNIT II – D.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 DC Generator** - Working operation of simple loop generator, working principle of DC generator. **EMF equation of a DC generator** - EMF equation of DC generator, Problem based on EMF equation of dc generator, Problems based on EMF equation of dc generator, Exercise based on EMF equation of dc generator, Flux distribution. **Excitation** - What do you mean by excitation ?, Classification of DC generators, Types of DC generator, Series generator, Problems based on dc series generator, Exercise based on dc series generator. **Types of DC generators** - DC shunt generator, Problems based on dc shunt generator, Exercise based on dc shunt generator, Compound generator, Problems based on long shunt compound generator, Problem based on compound generator, Exercise

based on long shunt lap wound compound generator. **Characteristics of DC generators** - The DC generator have following characteristics in general, Load Characteristics DC Generators, Load characteristics of DC Shunt Generator, Load characteristics of DC Series Generator, Load Characteristics DC Compound Generators. **Applications of DC generators** - Applications of DC generators. **Working principle of DC Motor** - DC motor principle, Working of DC motor. **Back emf** - Signification of the back EMF, Importance of back EMF. **Speed and torque equation** - Torque equation, Speed-torque equation, Problems based on motor torque and speed, Exercise based on torque. **Types of DC motor** - Classification of DC motor, DC series motor, Problems based on dc series motor, Exercise based on dc series motor, DC shunt motor, Problems based on dc shunt motor, Exercise based on dc shunt generator, DC compound motor. **Characteristics** - DC Motor characteristics, Characteristics of DC shunt motor, Characteristics of DC series motor, Characteristics of DC compound motor, Application of DC motor. **Starter** - Necessity of starter, three point starter, Function of no volt coil, Action of over load release, Speed control, Four point starter, Necessity of the starter for dc series motor, Drum controlled starter.

UNIT III – A.C MACHINES

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. **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. **Introduction to synchronous generator** - Introduction, Introduction to alternator, Types of alternators, Advantages of polyphase alternator, Difference between DC generator and alternator. **Principle of operation of alternator** - Working principle of synchronous generator, Mechanical and electrical angle, Frequency of induced EMF, Synchronous speed (N_s) **Construction of alternator** - Construction and classification of alternators, Stator, Rotor, Difference between salient pole and non-salient pole rotor, Advantages of stationary armature. **EMF equation** - EMF equation, Shape of the EMF wave, Problems based on EMF equation of alternator, Exercise based on EMF equation of alternator. **Voltage regulation** - Voltage regulation, Determination of voltage regulation, Regulation for large machines, EMF method or alternator test, Synchronous impedance method, Worked example using synchronous method / EMF method, Ampere - Turn method, General case: for any value of PF(Zero to 1)lagging or leading, Potier's triangle method or zero power factor method, Zero power factor test, ASA (American Standards Association) method. **Introduction to single phase induction motor** - Introduction to single phase induction motor, Construction, Working principle, Why is single phase induction motor not self starting, Starting of single phase induction motor. **Double field theory and Cross field revolving theory** - Double field

revolving theory, Cross field theory. **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. **Working Principle of three phase induction motor** - Working principle of three phase induction motor. **Production of rotating magnetic field** - Production of rotating magnetic field, Graphical representation of resultant rotating flux. **Slip and Effect of slip on rotor parameters** - Slip and slip speed, Problems 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, Problem based on rotor frequency. **Torque equation** - Torque of phase induction motor, Starting torque of three phase induction motor, Starting current I^{st} , Condition to obtain maximum starting torque, Torque of induction motor under running condition, Slip torque characteristics of three phase induction motor.

UNIT IV – DIODES AND TRANSISTORS

Electrical properties of materials - Types of materials, Electrical properties of materials. **Energy level diagrams of materials** - Energy bands in solids, Hole and its movements, Energy bands in conductors, semiconductors and insulators. **Classification of Semiconductors** - Types of Semiconductors, Comparison of Intrinsic and Extrinsic semiconductors. **Formation of n-type and p-type semiconductor** - Doped semiconductors, N-type semiconductor, Formation and conduction in N-type semiconductor, P-type semiconductor, Formation and conduction in P-type semiconductor. **Majority and Minority carriers** - Majority and minority carriers, Conduction in semiconductors. **PN junction diode** - Introduction to PN junction, Formation of PN junction, Formation of depletion region, Barrier potential, Band Structure of PN Junction. **Operation of PN junction diode** - Biasing of PN junction diode, Forward biasing of PN junction diode, Effect on the depletion region and barrier potential, Reverse biasing of PN junction diode, Breakdown in reverse biased, Comparison of breakdown mechanism, V-I characteristics of a diode. **Specifications and applications of diodes** - Diode - Variants, Diode numbering, Specifications of diodes, Applications of PN junction diodes. **Solved problems for semiconductor** - Problem to calculate reverse and forward resistance, Problem to calculate DC and dynamic forward resistance, Problem to calculate diode current, Problem to calculate forward diode current, Problem to calculate forward voltage drop. **Rectifiers** - Need of rectifier, Classification of rectifiers. **Halfwave rectifier** - Halfwave rectifier, Halfwave rectifier parameters, Average DC load current and Average DC load voltage, RMS value of load current and load voltage, DC power output and AC power input, Rectifier efficiency, Ripple factor and Load current, Peak Inverse Voltage (PIV) and Transformer Utilization Factor (TUF), Voltage regulation, Advantages and disadvantages of HWR. **Center tapped full wave rectifier** - Full wave rectifier, Maximum load current, Average DC load current and voltage, RMS value, power input and power output, Rectifier efficiency, Ripple factor, Load current, Peak Inverse Voltage (PIV), Transformer Utilization Factor (TUF), Voltage regulation, Advantages and disadvantages of Full Wave Rectifier (FWR). **Full wave bridge rectifier** - Bridge Rectifier (BR), Expression for various parameters, Advantages and disadvantages of Bridge Rectifier (BR), Comparison of half wave, full wave and full wave bridge rectifier. **Solved problems for rectifier** - Problem to calculate Ripple Factor,

Problem to calculate Ripple Voltage, Problem to calculate Load Voltage, Problem to calculate Capacitance, Problem to calculate Ripple Voltage, Problem to calculate Peak Rectified Voltage, Problem to design a halfwave rectifier, Problem to design a fullwave rectifier. **Transistor** - Introduction of transistor, Formation of transistor, Types of transistor, PNP transistor, NPN transistor, Transistor as an amplifier in CB configuration. **Transistor configurations** - Operation region of a transistor (CB configuration), Transistor configurations, Common base configuration, Common emitter configuration, Common collector configuration. **Characteristics of transistor** - Input characteristics of a transistor in a CB configuration, Output characteristics of a Transistor in CB configuration, Three regions in the output characteristics of CB-Configuration, Input characteristics of CE configuration, Output characteristics of CE configuration, Three regions in the output characteristics of CE-Configuration, Input and Output characteristics of CC configuration. **Transistor as an amplifier and switch** - Introduction of amplifier, Active devices used for amplification, Transistor as an amplifier, Introduction, Advantages of CE configuration, Regions of operation of a transistor, Salient points of CE amplifier, Transistor as a switch. **Solved problems for transistor** - Problem to calculate collector current and emitter current, Problem to calculate Base Current, Problem to calculate Base Current, Problem to calculate Collector Current, Problem to calculate Collector Current, Problem to calculate collector emitter voltage, Problem to calculate common emitter gain, Problem to calculate Emitter Current. **Silicon Controlled Rectifier (SCR)** - Silicon controlled rectifier, Power control using SCR, Operation of SCR, Characteristics of SCR, DC power control using SCR, Applications of SCR.

UNIT V – CATHODE RAY OSCILLOSCOPE

Cathode ray oscilloscope - Block Diagram of Simple Oscilloscope, Cathode Ray Tube (CRT). **Display device** - Fluorescent Screen, Basic Principle of Signal Display. **Electrostatic and Magnetic deflection** - Electrostatic Deflection and Sensitivity, Magnetic Deflection and Sensitivity, Comparison between Deflection Methods. **Electric and Magnetic Fields** - Parallel Electric and Magnetic Fields, Perpendicular Electric and Magnetic Fields. Application of CRO, Applications of measurement system, The front panel of CRO, Procedure of Measurement for time period and frequency, Procedure of Measurement for time phase, Sensitivity, Frequency response (Bandwidth), Voltage Measurement.,