ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS (Paper Code : 083001)

UNIT-1

1.1 Classification

Classification of materials into conducting, semi conducting and insulating materials through a brief reference to their atomic structure and energy bands.

UNIT-2

2.1 Conducting Materials – Introduction.

2.2 Resistance and factors affecting it such as alloying and temperature etc.

2.3 Classification of conducting material as low resistivity and high resistivity materials, Low resistance materials.

a. Copper- General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard-drawn and annealed copper, corrosion, contact resistance. Application in the field of electrical engineering.

b. Aluminium - General properties as conductor: Resistivity, temperature coefficient, density, mechanical properties of hard and annealed aluminium, solderability, contact resistance. Applications of aluminium in the field of electrical engineering.

c. Steel - General properties as conductor: Resistivity, corrosion, temperature coefficient, density, mechanical properties, solderability, Applications in the field of electrical engineering Introduction to bundle conductors and its applications Low resistivity

copper alloys: Brass, Bronze (cadmium and Beryllium), and their practical applications with reasons for the same.

2.4 Applications of special metals e.g. Silver, Gold, Platinum etc.

2.5 High resistivity materials and their applications e.g., manganin, constantin, nichrome, mercury, platinum, carbon and tungsten, Tantalum.

2.6 Superconductors and their applications.

UNIT-3

Review of Semi-conducting Materials :Semi Conducting material such as Germanium, Silicon, Carbon-their atomic structure/application/against , pure and impure semi conductors and their use for making electronic devices. Material used for special purpose semiconductor, diode, contacts, power transistor, substrate, integrated circuits and power handling devices.

UNIT-4

Insulating materials; General Properties-

4.1 Electrical Properties Volume resistivity, surface resistance, dielectric loss, dielectric strength (breakdown voltage) dielectric constant.

4.2 Physical Properties Hygroscopicity, tensile and compressive strength, abrasive resistance, brittleness.

4.3 Thermal Properties Heat resistance, classification according to permissible temperature rise. Effect of overloading on the life of an electrical appliance, increase in rating with the use of insulating materials having higher thermal stability, Thermal conductivity, Electro-thermal breakdown in solid dielectrics.

4.4 Chemical Properties Solubility, chemical resistance, weather ability.

4.5 Mechanical properties, mechanical structure, tensile structure

UNIT-5

Insulating Materials and their applications

5.1 Plastics a. Definition and classification b. Thermosetting materials: Phenol-formaldehyde resins (i.e. Bakelite) amino resins (urea formaldehyde and melamine - formaldehyde), epoxy resins - their important properties and applications c. Procedure of preparation of plastic (PVC) d. Thermo-plastic materials: Polyvinyl chloride (PVC), polyethelene, silicons, their important properties and applications.

5.2 Natural insulating materials, properties and their applications.

a. Mica and Mica products
b. Asbestos and asbestos products
c. Ceramic materials (porcelain and steatite)
d. Glass and glass products
e. Cotton
f. Silk
g. Paper (dry and impregnated)
h. Rubber, Bitumen
i. Mineral and insulating oil for transformers switchgear capacitors, high voltage insulated cables, insulating varnishes for coating and impregnation
j. Enamels for winding wires
k. Glass fibre sleeves

5.3 Gaseous materials; Air, Hydrogen, Nitrogen, SF6 their properties and applications.

UNIT-6

Magnetic Materials

6.1 Introduction - ferromagnetic materials, permeability, B-H curve, magnetic saturation, hysteresis loop including coercive force and residual magnetism, concept of eddy current and hysteresis loss, curie temperature, magnetostriction effect, method of reduction of eddy current loss and hysteresis loss.

6.2 Soft Magnetic Materials

a) Alloyed steels with silicon: High silicon, alloy steel for transformers, low silicon alloy steel for electric rotating machines.

b) Cold rolled grain oriented steels for transformer, Non-oriented steels for rotating machine.

c) Nickel-iron alloys.

d) Soft Ferrites.

6.3 Hard magnetic materials - Tungsten steel, chrome steel, hard ferrites and cobalt steel, their applications.

6.4 Special Materials

Thermocouple, bimetals, leads soldering and fuses material, mention their applications.

6.5. Introduction of various engineering materials necessary for fabrication of electrical machines such as motors, generators, transformers etc

LIST OF PRACTICALS

1. A market survey of different Electrical and Electronics materials available in market will be conducted by students. They will submit a report, which will include names, types, specifications, identification, testing of components, manufacturing details and related cost.

2. Case study/data manuals of different wires/cables/fuses/sockets etc. A report will be submitted by the students.

ELECTRICAL WORKSHOP PRACTICE
(Paper Code : 083002)

DETAILED CONTENTS

1. Study of electrical safety measures as mentioned in the Electricity Rules and shock treatment including first aid.

2. Types of wiring and to make different light control circuits in the following types of wiring Casing and capping, (PVC) conduct, baten wiring.

3. Study of ISI standard for MCBs and ELCBs Conduct one test on MCB on above basis.

4. Wiring of main distribution board with four outgoing circuits for light and fan loads including main switch and MCBs Types of wiring and to make different light control circuits in the following types of wiring –

   4.1 Casing and Capping (PVC) wiring.

   4.2 Conduit wiring (surface/concealed).

5. Construction of distribution and extension board with two 5A sockets and two I5A sockets, a fuse and indicator with series test lamp provision controlled by their respective switches.

6. Testing of domestic wiring installation using meggar.

7. Fault finding and repair of a tube light circuit.

8. Carry out pipe/ plate earthing for a small house and 3 phase induction motor. Testing the earthing using earth tester.

9. Connection of single phase and three phase motors through an appropriate starter.

10. Winding/ rewinding of a fan (ceiling and table) and choke.

11. Repair of domestic electric appliances such as electric iron, geyser, fan, heat convector, desert cooler, room heater, electric kettle, electric oven, electric furnace and weighing machine.

Note: Students may be asked to study control circuit of a passenger lift, automatic milling machine, etc. using relays.

ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS (Paper Code : 083003)

UNIT-1

1.1 Importance of measurement, Basic measuring systems, advantages and limitations of each measuring systems, generalized measurement system, Types of measuring instruments, Essentials of indicating instruments – deflecting, controlling and damping torque .

1.2 Transducers Theory, types of transducers construction and use of various transducers like resistance, inductance, capacitance, electromagnetic, piezoelectric type.

UNIT-2

2.1. Ammeters and Voltmeters (Moving coil and moving iron type) -

Concept of ammeters and voltmeters and difference between them. Extension of range of voltmeters and ammeter. Construction and working principles of moving Iron and moving coil instruments. Merits and demerits, sources of error and application of these instruments.

2.2. Wattmeters (Dynamometer Type) -

Construction, working principle, merits and demerits of dynamometer type wattmeter, sources of error. three phase power measurement by :

1. one wattmeter method
2. two wattmeter method
3. three wattmeter method

2.3. Energy meter (Induction type)

Construction, working principle, merits and demerits of single-phase and three-phase energy meters ,Errors and their compensation, Simple numerical problems .

UNIT-3

3.1 Measurement of Displacement and Strain

Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges and their different types such as bounded, unbounded wire and foil type etc. Gauge factor, sources of errors and its compensations. Use of electrical strain gauges, strain gauge bridges and amplifiers.

3.2 Force, Pressure Measurement, and Torque Measurement

Different types of force measuring devices and their principles, Load cells, - Manometers, diaphragms, Bourdon, bellows, manometer, diaphragm pressure gauges, basic principles, constructional brief and use, pickups, their principle, construction and applications. Use of pressure cells. Measurements of torque by brake, dynamometer, electrical strain gauges, speed measurements.

3.3 Flow measurement.

Basic principles of magnetic and ultrasonic flow meters, flow coefficient, Reynolds number and rotameter.

3.4 Measurement of Temperature

Bimetallic thermometer, pressure thermometers, thermoelectric thermometers, resistance thermometers, thermocouple, thermisters and pyrometer, errors in temperature measurements in rapidly moving fluids, industrial thermocouple.

UNIT-4

4.1 Miscellaneous Measuring Instruments

Construction, working principle and application of Meggar, Earth tester, Analog Multimeter, Digital multi-meter, basic principle, constructional brief, display system, Frequency meter (dynamometer type) single phase power factor meter (Electrodynamometer type). Working principle of synchroscope and phase sequence indicator, tong tester (Clamp-on meter).

4.2 Instrument Transformers: Construction, working and applications-

a) CT

b) PT

UNIT-5

Electronic Instruments

5.1 Cathode Ray Oscilloscope: Block diagram, working principle of CRO. Applications of CRO.

5.2 LCR meters and Q meter : Study of LCR meter and its applications Digital LCR and Q meter.

5.3 Signal conditioning and telemetry with small simple examples .

ELECTRONIC DEVICES AND CIRCUITS
(Paper Code : 083004)

Atomic structure

1.1. Introduction, Brief history of development of electronics, Active and passive components.

1.2. Semi-conductor Theory, Atomic structure, crystalline structure, Energy band theory of crystals, energy band structure of insulator, semiconductor and conductor, generation and recombination of electron hole pairs. Energy band structure of Silicon and Germanium, Concept of Doping, intrinsic and extrinsic semiconductors, Effect of temperature on intrinsic and extrinsic semiconductors.

Semiconductor Diodes

2.1 PN Junction, mechanism of current flow in PN junction, drift and diffusion currents, depletion layer, potential barrier, effect of forward and reverse biasing in a PN junction. Concept of junction capacitance in forward and reverse biased conditions.

2.2 Ideal diode, Semiconductor diode characteristics, static and dynamic resistance.

2.3 Use of diode as half wave and full wave rectifiers (centre tapped and bridge type), ripple factor, rectifier efficiency, Operation of filter circuits, Diode ratings/ specifications, Various types of diodes such as zener diode, varactor diode, Schottky diode, light emitting diode, tunnel diode, photo diode; their working characteristics and applications, Use of zener diode for voltage stabilization.

Bi-polar Junction Transistors

3.1 Concept of junction transistor, PNP and NPN transistors, their symbols and mechanism of current, Transistor configurations: common base (CB), common emitter (CE) and common collector (CC), current relation and their input/output characteristics; comparison of the three configurations.

3.2 Transistor biasing, its need, operating point, effect of temperature on the operating point of a transistor and need of stabilization of operating point, Different biasing circuits, limitations, Use of data book to know the parameters of a given transistor.

Transistor as an amplifier

4.1 Single-Stage Transistor Amplifiers, CE configuration, function of each component, working of single stage transistor amplifier, physical and graphical explanation, phase reversal, Frequency response of a single stage transistor amplifier

4.2 Multi-Stage Transistor Amplifiers, Need of multi-stage transistor amplifiers – different types of couplings, their purpose and applications, RC coupled two-stage amplifiers, circuit details, working, frequency response, applications, Loading effect in multistage amplifiers, Elementary idea about direct coupled amplifier, its limitations and applications, Transformer coupled amplifiers, its frequency response.

Field Effect Transistor & OP Amps

5.1 FET - Construction, operation, characteristics and applications of a N channel JFET and P channel JFET, JFET as an amplifier, JFET applications, Types, construction, operation, characteristics and applications of a MOSFET, Comparison between BJT, JFET and MOSFET.

5.2 Operational Amplifiers-Characteristics of an ideal operational amplifier and its block diagram, Definition of differential voltage gain, CMRR, PSRR, slew rate and input offset current, Operational amplifier as an inverter, scale changer, voltage follower, adder, subtractor, differentiator, and integrator .

LIST OF PRACTICALS

1. a) Identification and testing of electronic components such as resistor, inductor, capacitor, diode, transistor and different types of switches used in Electronic circuits.
   b) Measurement of resistances using multimeter and their comparison with colour code values.

2. V-I characteristics of a Semiconductor diode and to calculate its static and dynamic resistance.

3. a) V-I characteristics of a zener diode and finding its reverse breakdown voltage.
   b) Fabrication of a zeener diode voltage stabilizer circuit using PCB.

4. Observation of input and output wave shapes of a half wave rectifier.

5. Observation of input and output wave shapes of a full wave rectifier.

6. Plotting input and output characteristics of a transistor in CB configuration.

7. Plotting input and output characteristics of a transistor in CE configuration.

8. To study the effect of coupling capacitor on lower cutoff frequency and upper cutoff frequency by plotting frequency response of two stage RC coupled amplifier.

9. To plot V_I characteristics of a FET.

10. To use IC (op-amplifier) as
    i) Inverter
    ii) Adder
    iii) Subtractor
    iv) Intergrator

FUNDAMENTALS OF ELECTRICAL ENGINEERING
(Paper Code : 083005)

Unit – 1 : Basic Concepts of Electrical Energy

Basic Electrical Quantities – Basic concept of charge, current, voltage, resistance, power, energy and their units, Conversion of units of work, power and energy from one form to another, resistance, inductance and capacitance in series and parallel and their applications in solving electrical networking problems.

Unit – 2 : DC Circuits

Ohm's law, Kirchhoff's laws and their applications in solving electrical network problems. Network theorems such as superposition theorem, Thevenin's theorem, Norton's theorem and maximum power transfer theorem.

Unit – 3 : Batteries

Basic idea about primary and secondary cells, Working principle, construction and applications of Lead Acid, Nickel Cadmium and Silver Oxide Cells, Capacity and efficiency of lead acid battery, Charging methods used for lead acid accumulator, Care and maintenance of a lead acid battery, Grouping of cells in series and parallel (simple numerical problem), Testing of lead acid battery for fully charged conditions and their specifications, application of lead acid battery, idea about batteries used in UPS.

Unit – 4 : Magnetism and Electromagnetism

4.1 Introduction of Electromagnetism, Magnetic field around a straight current carrying conductor and a solenoid and methods to find its direction, force between two parallel current carrying conductors.

4.2 Force on a conductor placed in the magnetic field.

4.3 Series magnetic circuits, simple problems.

4.4 Concept of hysteresis, loop and hysteresis loss.

Unit – 5 : Electromagnetic Induction

5.1 Faraday's laws of Electromagnetic Induction.

5.2 Lenz's law.

5.3 Fleming's left and right hand rule.

5.4 Principle of self and mutual induction.

5.5 Principle of self and mutually induced e.m.f. and simple problems.

5.6 Inductances in series and parallel.

5.7 Energy stored in magnetic field.

5.8 Concept of eddy currents, eddy current loss.

Unit – 6 : A.C. Circuits

6.1 Concept of a.c. generation (single phase and three phase), difference between a.c. and d.c., Concept of alternating current and voltage, equation of instantaneous values, average value, r.m.s. value, form factor.

6.2 AC through pure resistance, inductance and capacitance.

6.3 Alternating voltage applied to RL, RC and RLC series and parallel circuits (impedance triangle, phasor diagram and their solution).

6.4 Concept of susceptance, conductance and admittance.

FUNDAMENTALS OF MECHANICAL AND CIVIL ENGINEERING (Paper Code : 083006)

MECHANICAL ENGINEERING

Theory

1. Transmission of Power

1.1 Transmission of power through belt, rope drives and pulleys, gears and chains.
1.2 Different type of pulleys and their application.
1.3 Chain drives and its comparison with belt drive.
1.1 Gear drives, types of gears, simple gear trains and velocity ratio.

2. Air Conditioning System

2.1 Basic principle of refrigeration and air conditioning.
2.2 Working of centralized air conditioner.
2.3 Concept of split air conditioner and its applications.

3. Pumps -Types and their uses

CIVIL ENGINEERING

Theory

4.Construction Materials

Properties and uses of various construction materials such as stones, bricks, lime, cement and timber along with their properties, physical/ field testing and uses, elements of brick, Masonry.

5.Foundations

i) Bearing capacity of soil and its importance

ii) Types of various foundations and their salient features, suitability of various foundations for heavy, light and vibrating machines, Walls and there classification, load bearing, non load bearing partition and cavity wall.

6.Concrete

Various ingredients of concrete, different grades of concrete, water cement ratio, workability, physical/ field testing of concrete, mixing of concrete.

7.RCC

Basics of reinforced cement concrete and its use (elementary knowledge), introduction to various structural elements of a building.

LIST OF PRACTICALS

1. Observe operation of a centrifugal pump and location of common faults.

2. Decide the type of foundation too be used for various types of electrical machinery and installation. Prepare a foundation for installation of a motor/ generator.

3. Identify various types of drives used in an IC engines and describe their function.

4. Observe operation of air conditioning system. Identify locations of faults.

5. Trace the various paths of hot gases, cool gases, control system in a split air conditioner model. Identify the possible location of faults/ malfunctioning.