Answers for PART - B Questions

Question 11 (a): State the properties and applications of nichrome.

- High electrical resistivity.
- High melting point (~1400°C).
- Good oxidation resistance.
- Mechanical strength remains stable at high temperatures.
- Used in heating elements (toasters, heaters).
- Used in resistance coils and wire-wound resistors.
- Used in laboratory heating appliances.
- Used in flame testing and dental prosthetics.

Question 11 (b): Explain the effects of annealing and hardening on copper with regard to electrical

- Annealing softens copper, reducing hardness and increasing ductility.
- Improves electrical conductivity due to reduced dislocation density.
- Restores flexibility and formability.
- Hardening increases strength and hardness.
- Reduced ductility after hardening.
- Electrical conductivity decreases slightly due to defects.
- Used to tailor mechanical properties for specific applications.
- Common in electrical wires, tubes, and plumbing.

Question 12 (a): Distinguish between P-type and N-type semiconductors in any eight aspects.

- P-type: Holes are majority carriers; N-type: Electrons are majority carriers.
- P-type is doped with trivalent elements (e.g., Boron); N-type with pentavalent (e.g., Phosphorus).
- P-type has positive charge carriers; N-type has negative charge carriers.
- Electrical conductivity is due to hole movement in P-type; due to electrons in N-type.

Answers for PART - B Questions

- Fermi level is closer to valence band in P-type; closer to conduction band in N-type.
- Acceptors are dopants in P-type; Donors in N-type.
- Positive ions dominate in P-type; negative ions in N-type.
- Used together to form PN junctions in electronics.

Question 12 (b): Explain the formation of N-type semiconductor with neat sketch.

- Formed by doping pure silicon with a pentavalent element like Phosphorus.
- Each Phosphorus atom provides one extra free electron.
- Electrons act as majority carriers, holes as minority.
- Improves conductivity compared to intrinsic semiconductors.
- Used in diodes, transistors, and ICs.

Question 13 (a): Explain thermoplastic and thermosetting resins with examples.

- Thermoplastics soften on heating and harden on cooling repeatedly.
- Can be reshaped multiple times.
- Examples: PVC, Polythene, Nylon.
- Thermosetting resins harden permanently after heating.
- Cannot be remolded once set.
- Examples: Bakelite, Epoxy, Melamine.
- Used in electrical insulation and kitchenware.
- High thermal and chemical resistance in thermosets.

Question 13 (b): Explain the properties and applications of PVC.

- Polyvinyl Chloride (PVC) is a thermoplastic polymer.
- High chemical resistance.

- Good electrical insulation properties.
- Durable and flame resistant.
- Used in pipes, cable insulation, flooring.
- Also used in clothing and medical equipment.
- Lightweight and cost-effective.
- Weather-resistant, suitable for outdoor applications.

Question 14 (a): Explain the process of impregnation with a neat sketch.

- Used to enhance insulation properties in electrical components.
- Component is immersed in insulating varnish or resin.
- Air is removed using vacuum to ensure deep penetration.
- Improves dielectric strength and mechanical stability.
- Common in motor windings, transformers.
- Enhances life and reliability of equipment.
- Reduces moisture absorption.
- Final curing done via heat or UV.

Question 14 (b): Explain the process of galvanizing with neat sketch.

- Galvanizing involves coating iron or steel with zinc.
- Provides corrosion protection.
- Hot-dip method: Metal is cleaned and dipped in molten zinc.
- Forms a metallurgical bond.
- Zinc acts as a sacrificial layer.
- Used in roofing sheets, pipes, fences.
- Increases longevity in harsh environments.

Answers for PART - B Questions

- Eco-friendly corrosion prevention method.

Question 15 (a): Explain the constructional details of lead-acid battery.

- Consists of positive plates (lead dioxide) and negative plates (spongy lead).
- Plates immersed in sulfuric acid electrolyte.
- Plates separated by insulating material.
- All cells connected in series in a container.
- Each cell produces ~2V.
- Recharges through electrochemical reactions.
- Durable and low cost.
- Used in automobiles, UPS, and inverters.

Question 15 (b): Determine the ampere-hour and watt-hour efficiencies for an accumulator...

- Given:
- Charging: 10 hrs @ 25 A, Voltage = 1.8 V -> Input AH = 250 AH, Input WH = 1.8×250 = 450 Wh.
- Discharging: 8 hrs @ 20 A, Voltage = 1.5 V -> Output AH = 160 AH, Output WH = 1.5×160 = 240 Wh.
- Ampere-hour efficiency = (160 / 250) × 100 = 64%
- Watt-hour efficiency = (240 / 450) × 100 = 53.33%