



**Instructions:**

- a) All parts are compulsory.
- b) Answers without relevant diagram / figure wherever necessary will not carry any marks.
- c) Direct answers to the numerical problems without detailed solutions will not carry any marks.

**Part A**

**I. Answer all of the following questions: 10 × 1 = 10**

1. Name the device used to detect charge on a body.
2. What is the work done in an equipotential surface?
3. Define magnetic dipole moment of a current loop.
4. Write the expression for displacement current.
5. Mention the expression for induced emf for self-induction.
6. What is relative refractive index?
7. What are coherent sources?
8. Write an expression for the De-Broglie wavelength of photon.
9. How does the conductivity of a semiconductor change with temperature?
10. What is the significance of modulation index?

**Part B**

**II. Answer any five of the following questions: 2 × 5 = 10**

11. Mention any two properties of charges.
12. What is electrostatic shielding? Mention one application of electrostatic shielding.
13. State and explain Kirchhoff's voltage law for electrical network.
14. Define the terms; Magnetic permeability and Magnetic susceptibility.
15. Write an expression for bandwidth in resonant AC circuit and explain the terms.
16. Represent diagrammatically unpolarized and plane polarized light.
17. Write the circuit symbol and truth table of OR gate.
18. Draw the block diagram of AM receiver.

**Part C**

**III. Answer any five of the following questions: 5 × 3 = 15**

19. Derive an expression for the energy stored in a charged capacitor.
20. What is the principle of potentiometer? Mention two applications of a potentiometer.
21. Explain how a galvanometer can be converted into a ammeter.
22. Derive an expression for instantaneous emf in an AC generator.
23. With a ray diagram, explain the phenomenon of total internal reflection and hence define critical angle.
24. Write three Cartesian sign conventions used in the mirrors.
25. Mention the laws of photoelectric effect.
26. What is a Light Emitting Diode? Mention its two applications.

**Part D**

- IV. Answer any two of the following questions: 5 × 2 = 10**
27. State Gauss law in electrostatics. Obtain an expression for electric field due to a uniformly charged infinite plane sheet.
  28. Define 'internal resistance' and 'emf' of a cell. Obtain an expression for current drawn by external resistance using Ohm's law.
  29. Derive an expression for magnetic dipole moment of a revolving electron in an hydrogen atom.
- V. Answer any two of the following questions: 5 × 2 = 10**
30. Obtain mirror equation.
  31. Explain  $\alpha$ -decay,  $\beta$ -decay,  $\gamma$  decay in nuclear reactions with suitable examples.
  32. With a circuit diagram, explain the working of a half-wave rectifier.
- VI. Answer any three of the following questions: 5 × 3 = 15**
33. Two point charges  $4\mu\text{C}$  and  $2\mu\text{C}$  are placed at the vertices A and B of right angled triangle ABC respectively. B is the right angle.  $AB=\sqrt{3}\text{cm}$ ,  $AC=\sqrt{2}\text{cm}$  and  $BC=\sqrt{1}\text{cm}$ . Calculate the magnitude and direction of the resultant electric intensity at C.
  34. A copper wire of  $10^{-6}\text{ m}^2$  area of cross section carries a current of 2A. If the number of electrons in cubic metre is  $8\times 10^{28}$ , calculate the current density and average drift velocity.
  35. An inductor of 200mH, a capacitor  $30\mu\text{F}$  and a resistor  $100\Omega$  are connected in series with a AC source 220V-50Hz. Calculate the inductor reactance and resonant frequency. Also find the current in the circuit.
  36. A small air bubble is found 0.04m inside the glass sphere of refractive index 1.5. When viewed normally from outside it is seen at depth of 0.03m. Calculate the radius of curvature of glass sphere.
  37. Calculate the potential energy and the total energy (in electron volt) of electron of  $\text{H}_2$  atom revolving in first Bohr orbit of radius  $0.5\text{\AA}$ .

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