



(English Version)

- General Instructions :**
1. All Parts from A to D are compulsory.
 2. For Part - A questions, only the first written answers will be considered for evaluation.
 3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
 4. Direct answers to numerical problems without relevant formula and detailed solutions will not carry any marks.

PART - A

1. Pick the correct option among the four given options for all of the following questions : (15 × 1 = 15)

1) Which one of the following charge cannot exist on a body?

a) $2e$

b) $3e$

~~c) $3.5e$~~

d) $-4e$

2) The equipotential surfaces of an isolated point charge are :

a) Coaxial cylindrical surfaces

b) Plane surfaces parallel to each other

~~c) Concentric spherical surfaces centred at the charge~~

d) Spherical surfaces but not centred on the charge



33 (NS)

3) Consider the following statements about a balanced Wheatstone's bridge.

Statement-I : The current through the galvanometer is zero.

Statement-II : If the positions of the galvanometer and the battery are interchanged in the circuit, the current in the galvanometer will be zero.

Among the above two statements :

- a) Only Statement-I is true
- ~~b) Only Statement-II is true~~
- c) Both the Statements are wrong
- ~~d) Both the Statements are true~~

4) The path traced by a charged particle moving perpendicular to a uniform magnetic field is :

- ~~a) circle~~
- b) straight line
- c) helix
- d) ellipse

5) A magnetic dipole of magnetic moment \vec{m} is placed in a uniform magnetic field \vec{B} such that the angle between \vec{m} and \vec{B} is θ . If the magnetic dipole is in stable equilibrium position, then :

- ~~a) $\theta = 0^\circ$~~
- b) $\theta = 90^\circ$
- c) $\theta = 180^\circ$
- d) $\theta = 45^\circ$

6) The working principle of an A.C. generator is :

- a) mutual induction
- b) eddy currents
- c) self induction
- ~~d) electromagnetic induction~~

7) Power factor of a series LCR circuit is maximum when :

- a) $X_L = X_C$ b) $X_C = 0$
c) $X_L > X_C$ d) $X_L < X_C$

8) Displacement current is produced due to :

- a) Constant electric field
b) Constant magnetic field
 c) Changing electric field
d) Changing magnetic field

9) For total internal reflection of light :

- a) light should be travelling from rarer medium to denser medium
 b) light should be travelling from denser medium to rarer medium
c) light should be incident along the normal
d) angle of incidence should be equal to 90°

10) The angle of minimum deviation of a prism depends on :

- (i) refractive index of the material of the prism
(ii) refractive index of surrounding medium
(iii) refracting angle of the prism

- a) Only option (i)
b) Only option (ii)
c) Only option (iii)

d) All (i), (ii) and (iii)



11) According to Huygen's principle, speed of the secondary wavelets is :

- a) twice that of the wave b) zero
c) same as that of the wave d) infinite

12) An α -particle, a proton, an electron and a neutron are moving with the same velocity. Then the particle having longest de Broglie wavelength is :

- a) proton b) electron
c) neutron d) α -particle

13) Let K be the kinetic energy, U be the potential energy and E be the total energy of an electron revolving around the nucleus in a hydrogen atom, then which of the following is correct?

a) $K > 0, U > 0, E > 0$

b) $K > 0, U < 0, E < 0$

c) $K > 0, U > 0, E < 0$

d) $K < 0, U < 0, E < 0$

14) An example for isobars is :



15) Which of the following pairs are elemental semiconductors?

a) Silicon and aluminium

b) Silicon and germanium

c) Germanium and cadmium

d) Aluminium and cadmium

ii. Fill in the blanks by choosing appropriate answer from the given options for all the following questions : (5 × 1 = 5)

(photons, diffraction, polarity, monopoles, greater than unity, less than unity)

16) According to Gauss's law in magnetism, magnetic Monopoles are not known to exist.

17) Lenz's law gives the polarity of induced emf.

18) For a step-down transformer, the ratio of primary current to secondary current is less than unity

19) The bending of light around the corners and entering into the geometric shadow region is called Diffraction

20) In interaction with matter, light behaves as if it is made up of packets of energy called photons

PART - B

iii. Answer any five of the following questions : (5 × 2 = 10)

21) Write any two properties of electric field lines.

22) What is electrostatic shielding? Mention one use of it.

23) How does the resistivity of a semiconductor vary if its temperature is increased? Also show the variation graphically.



- 24) A thin long straight wire carries a current of 5 A. Calculate the magnitude of the magnetic field at a distance of 0.25 m from the wire.
($\mu_0 = 4\pi \times 10^{-7} \text{ Hm}^{-1}$)
- 25) Write the expression for the motional emf induced in a straight conductor moving perpendicular to a uniform magnetic field. Explain the terms.
- 26) Name the electromagnetic waves used in :
- the radar systems of aircrafts.
 - the laser assisted eye surgery (LASIK).
- 27) Define impact parameter. What is the angle of scattering of an α -particle for zero impact parameter?
- 28) List out two differences between p-type and n-type semiconductors.

PART - C

IV. Answer any five of the following questions : (5 × 3 = 15)

- 29) Give Coulomb's law in vector form and explain the terms. Define SI unit of charge.
- 30) What is a capacitor? Mention any two factors on which capacitance of a parallel plate capacitor depends.
- 31) With the help of a circuit diagram, explain how to convert a galvanometer into a voltmeter.
- 32) Differentiate between diamagnetic and ferromagnetic materials.

- 33) Obtain the expression for energy stored in an inductor.
- 34) A refracting telescope has an objective lens of focal length 144 cm and the length of the tube is 150 cm. Calculate the magnification due to the telescope.
- 35) Write the experimental observations of photoelectric effect.
- 36) List three conclusions drawn from observations of binding energy per nucleon versus mass number curve.

PART – D

Answer any three of the following questions : (3 × 5 = 15)

- 37) Arrive at the expression for the electric field at a point due to an infinitely long uniformly charged straight wire using Gauss's law.
- 38) Obtain the expression for equivalent emf and equivalent internal resistance of two cells of different emfs and different internal resistances connected in series.
- 39) Derive the expression for the magnitude of the magnetic field at a point on the axis of a circular loop carrying current.
- 40) Derive mirror equation $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ for a concave mirror.
- 41) What is half wave rectifier? Describe with a circuit diagram, the working of a semiconductor diode as a half wave rectifier. Draw input and output waveforms.



VI. Answer any two of the following questions :

(2 × 5 = 10)

- 42) Two charges $5 \times 10^{-8} \text{ C}$ and $-3 \times 10^{-8} \text{ C}$ are located 16 cm apart in vacuum. Find the positions along the line passing through the two charges at which the electric potential is zero.
- 43) The power dissipated across a wire of length 0.5 m and area of cross-section $0.2 \times 10^{-6} \text{ m}^2$ is 10 W when a steady current flows through it. Calculate the following quantities :
- (Given : resistivity of the material of the wire is $1 \times 10^{-6} \Omega \text{ m}$)
- Resistance of the wire ;
 - The current flowing through the wire ;
 - The current density for the wire.
- 44) An inductor and a resistor are connected in series with 200 V, 50 Hz a.c. source. The current in the circuit is 2 A and voltage leads the current by $\frac{\pi}{3}$. Calculate the inductance of the inductor.
- 45) A beam of light consisting of two wavelengths 500 nm and 600 nm is used to obtain interference fringes in Young's double slit experiment. Distance between the slits is 1 mm and the screen is placed at a distance of 1.2 m from the slits.
- Find the least distance between the central maximum and the point where the bright fringes due to both the wavelengths coincide.
 - Find the distance of the third dark fringe from the central bright fringe for the first wavelength.