

ISC PHYSICS

MOCK TEST PAPER – 3

Time allowed: 3 Hours

Maximum Marks - 70

PART-I

Q1. All questions are compulsory. All carry equal marks.

[20]

A: Select the correct alternative. Each question has one option correct.

[5]

- (i) If refractive index of water is 1.330 and of glass is 1.596, what will be refractive index of glass with respect to water?
(a) 1.330 (b) 1.110
(c) 1.596 (d) 1.200
- (ii) The equation $\text{Zn} + 2\text{NH}_4\text{Cl} \longrightarrow 2\text{NH}_3 + \text{ZnCl}_2 + 2\text{H}_2 + 2\text{e}^-$ represents
(a) Dry cell (b) Daniel cell
(c) Leclanche cell (d) none
- (iii) When a current 1 A is passed through tangent galvanometer it gives 30° deflection. To make it deflect through 60° the current must be
(a) $2\sqrt{3}$ A (b) 2 A
(c) 4 A (d) 6 A
- (iv) What is the relation between half life and decay constant of a radioactive substance?
(a) $\lambda T = 1$ (b) $\lambda T = 1/2$
(c) $\lambda T = \log_e 2$ (d) $\lambda = -\log_e 2T$
- (v) When Ge crystal is doped with phosphorus atom it becomes
(a) Insulator (b) p type
(c) n type (d) super conductor

B: Answer in short:

- (vi) Draw a sketch showing incident, reflected and refracted light when light is incident at the Brewster angle on a glass slab.
- (vii) Draw a graph between frequency of the ac source and the current in the case of an LCR circuit.
- (viii) Why coherent sources are required to produce sustained interference?
- (ix) How does the focal length of a convex lens changes when green light is replaced by a yellow light?
- (x) What is the power of combination of two lenses, one convex with 15 cm focal length and other concave lens of focal length 30 cm?
- (xi) In a Young's double slit experiment the two sources have amplitude ratio 1:4. Find the ratio of maximum intensity to minimum intensity in an interference pattern.

- (xii) What is Lorentz force?
- (xiii) How a pile of glass plates can be used to obtain polarized light?
- (xiv) An achromatic combination uses material of dispersive power in the ratio 2:3. What will be the ratio of the focal length of the lenses?
- (xv) Show graphically the variation of voltage with current in PN diode.
- (xvi) Which process provides more energy per nucleon-nuclear fission or nuclear fusion? Why?
- (xvii) What is the principle behind nuclear reactor?
- (xviii) Express one unified atomic mass unit u into MeV.
- (xix) Write the truth table for OR gate.
- (xx) If relative permeability of a metal is 1.0034, what is magnetic susceptibility?

PART-II

SECTION A

Attempt any two questions. Each carries equal marks.

[18]

Q.2. (a) Using Gauss theorem derive the expression for infinite long wire carrying charge uniformly.

[3]

(b) To determine the internal resistance of a cell by potentiometer, a balance point is obtained at 763.0 cm when outer circuit of cell is open. The balance points shifts left by 115 cm when a resistance of 9.5 ohm is connected in outer circuit of cell. If the emf of cell is 2.0 V find the internal resistance of the cell.

[3]

(c) A particle of mass m and charge q is released from rest in a uniform magnetic field. Find

(i) Its speed after time t

(ii) The distance travelled by it in time t

(iii) Its kinetic energy after moving distance x .

[3]

Q.3. (a) Define mutual inductance. A coil of area 20 cm^2 is placed so that a magnetic field of 0.1 T is perpendicular to the plane of the coil. If the coil is rotated through 180° in 0.1 second, what is the induced emf in it?

[3]

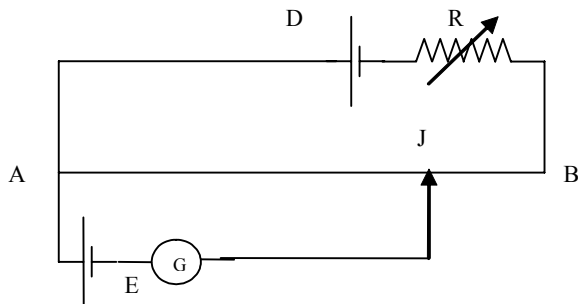
(b) An electron moving with a velocity of 10^8 m/s enters a magnetic field of 5×10^{-3} normally. Calculate the radius of the circular path and frequency of revolution of electron.

[3]

(c) A dry cell of potential difference 1.5 V and internal resistance 0.2Ω is connected across a resistance in series with a very low resistance ammeter. If ammeter reading is 2.5 A then calculate (i) the rate of chemical energy consumption in cell (ii) The rate of energy dissipation in cell and (iii) Rate of energy dissipation in resistance.

[3]

Q.4. (a) In the following figure AB is 1 meter wire of resistance 9 ohm connected to battery D of 4 V and internal resistance 1 ohm through a variable resistance R. E is a cell of 1.8 V emf connected to wire AB by jockey and centre zero galvanometer G. It is found that galvanometer shows null deflection when J is at 80 cm from A. Find the value of R.



- (b) An alternating emf of 110 V is applied to a circuit containing a resistance of 40 Ohm and an inductance L in series. The current is found to lag behind the voltage by an angle of $\tan^{-1}(0.75)$. Find

- The inductive reactance
- The impedance of the circuit, and
- The current flowing in circuit.

If the inductance has a value of 0.1 H find the frequency of applied voltage.

- (c) A bar magnet of magnetic moment 3 J/T is aligned with a uniform magnetic field of 0.22 T. Calculate the work done to rotate the magnet to turn by 90° and by 180° . Also calculate the torque on magnet in both cases.

SECTION B

Attempt any two questions. Each carries equal marks.

[16]

- Q.5.** (a) The distance between the slits and screen is 1 meter and wavelength is 550 nm in Young's double slit experiment. If separation between the slits is 1 mm find the distance between 4th bright fringe of upper side with 3rd dark fringe on the lower side. [3]
- (b) Prove the Snell's law of reflection using Huygens wave front theory with proper diagram. [3]
- (c) Find the angular width of central fringe if 600 nm light is used with aperture of slit being .1 mm. [2]
- Q.6.** (a) Draw a labelled diagram of a compound microscope when the final image is at the least distance of distinct vision. [3]
- (b) An achromatic doublet of focal length 60 cm is to be made from two lenses, the material of one having 4 times the dispersive power of the other. If the doublet is converging type find the focal length of each lens. [3]
- (c) What would be the distance raised of the apparent image if beaker containing coin is filled up to a height of 20 cm with water having refractive index 4/3? [2]
- Q.7.** (a) Derive the expression for focal length of two lenses in contact. [3]
- (b) Radii of curvature of a convex lens are 15 and 20 cm. If refractive index of glass is 1.5 find the focal length of the lens. If this lens is cut into two parts such that we have two Plano-convex lenses, what is the focal length of each? [3]
- (c) Draw a ray diagram to illustrating the measurement of angle of prism using spectrometer. [3]

SECTION C**Attempt any two questions. Each carries equal marks.****[16]**

- Q.8.** (a) If the applied potential difference is 50000 V what is the minimum wavelength of X-rays? [2]
- (b) Give two reasons why photoelectric effect could not be explained by using light as a wave. Explain stopping potential and threshold frequency. [3]
- (c) The half life of a radioactive substance is 30 days. What is the time taken for the three fourth of the original mass to disintegrate? [3]
- Q.9.** (a) Derive the expression for the radius of electron using Bohr's theory of hydrogen atom. If radius of electron in second orbit of hydrogen atom is 20 nm, what will be the radius of 4th orbit. [3]
- (b) If a wave of 700 nm falls on a metal having work function of 2.1 eV, what will be the maximum kinetic energy of electron emitted? [3]
- (c) What is mass defect? [2]
- Q.10.** (a) Derive the formula $N = N_0 e^{-\lambda t}$ hence show $T = 0.693/\lambda$. [3]
- (b) Draw labelled diagram to use NPN transistor as an amplifier in common emitter configuration clearly showing the input and output waveform. [3]
- (c) Draw the circuit to draw PN junction characteristics and draw the reverse bias graph. [2]