

PART - I

1. The wavelength λ_e of an electron and λ_p of a photon of same energy E are related by :

(a) $\lambda_p \propto \frac{1}{\sqrt{\lambda_e}}$ (b) $\lambda_p \propto \lambda_e$
(c) $\lambda_p \propto \lambda_e^2$ (d) $\lambda_p \propto \sqrt{\lambda_e}$

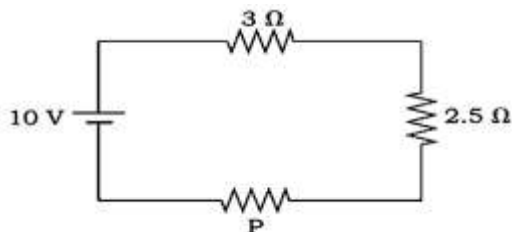
2. Two polaroids are kept with their transmission axes inclined at 30° . Unpolarised light of intensity I falls on the first polaroid. Intensity of light emerging from the second polaroid :

(a) $\frac{1}{8} I$ (b) $\frac{1}{4} I$
(c) $\frac{3}{8} I$ (d) $\frac{3}{4} I$

3. If the magnitude of the magnetic field is $3 \times 10^{-6} \text{ T}$, then the magnitude of the electric field for a electromagnetic wave is :

(a) 600 Vm^{-1} (b) 100 Vm^{-1}
(c) 900 Vm^{-1} (d) 300 Vm^{-1}

4. There is a current of 1.0 A in the circuit shown below. What is the resistance of P ?



(a) 3.5Ω (b) 1.5Ω
(c) 4.5Ω (d) 2.5Ω

5. A carbon resistor of $(47 \pm 4.7) \text{ k}\Omega$ is to be marked with rings of different colours for its identification. The colour code sequence will be :

- (a) Violet - Yellow - Orange - Silver
(b) Yellow - Green - Violet - Gold
(c) Green - Orange - Violet - Gold
(d) Yellow - Violet - Orange - Silver

6. In an hydrogen atom, the electron revolving in the second orbit, has angular momentum :

(a) $\frac{4h}{\pi}$ (b) h
(c) $\frac{2h}{\pi}$ (d) $\frac{h}{\pi}$

7. In Young's double-slit experiment, the slit separation is doubled. To maintain the same fringe spacing on the screen, the screen-to-slit distance D must be changed to :

(a) $\sqrt{2}D$ (b) $2D$
(c) $\frac{D}{\sqrt{2}}$ (d) $\frac{D}{2}$

8. A parallel plate capacitor stores a charge Q at a voltage V . Suppose the area of the parallel plate capacitor and distance between the plates are each doubled then which is the quantity that will change?

- (a) Voltage (b) Capacitance
(c) Energy density (d) Charge

9. An electromagnetic wave is propagating in a medium with velocity $\vec{v} = v\hat{i}$. The instantaneous oscillating electric field of this electromagnetic wave is along $+Y$ axis, then the direction of oscillating magnetic field of the electromagnetic wave will be along :

- (a) $+Z$ direction (b) $-Y$ direction
(c) $-Z$ direction (d) $-X$ direction

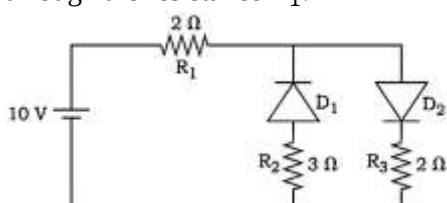
- 10.** For light incident from air on a slab of refractive index 2, the maximum possible angle of refraction is :
 (a) 60° (b) 30°
 (c) 90° (d) 45°
- 11.** The Zener diode is primarily used as :
 (a) Oscillator
 (b) Rectifier
 (c) Voltage regulator
 (d) Amplifier
- 12.** The flux linked with a coil at any instant t is given by $\Phi_B = 15t^2 - 50t + 250$. The induced emf at $t = 3s$ is :
 (a) -40 V (b) -190 V
 (c) 40 V (d) -10 V
- 13.** An example of Diamagnetic material is ____ .
 (a) Nickel (b) Water
 (c) Aluminium (d) Iron
- 14.** What is value of Forbidden Energy gap for silicon at room temperature ?
 (a) 0.3 eV (b) 0.7 eV
 (c) 0.9 eV (d) 1.1 eV
- 15.** The alloys used for muscle wires in Robots are :
 (a) Gold silver alloys
 (b) Shape memory alloys
 (c) Two dimensional alloys
 (d) Gold copper alloys

PART - II

- 16.** Define 'electric field'.
- 17.** How will you define Q-factor ?
- 18.** State Ampere's Circuital Law.
- 19.** Explain the reason for the glittering of diamond.
- 20.** The ratio of intensities of two waves in an interference pattern is 36: 1. What is the ratio of the amplitudes of the two interfering waves ?
- 21.** Define work function of a metal. Give its unit.
- 22.** What is meant by activity or decay rate ? Give its unit.
- 23.** Draw the circuit diagram of a full wave rectifier.
- 24.** If the resistance of coil is 3Ω at 20°C and $\alpha = 0.004/^\circ\text{C}$ then, determine its resistance at 100°C .

PART - III

- 25.** Derive an expression for electrostatic potential due to a point charge.
- 26.** State Kirchhoff's First and Second Rules.
- 27.** Explain the conversion of galvanometer into an ammeter.
- 28.** How will you induce an emf by changing the area enclosed by the coil ?
- 29.** What are Fraunhofer lines ? How are they useful in the identification of elements present in the Sun ?
- 30.** The given circuit has two ideal diodes connected as shown in figure below. Calculate the current flowing through the resistance R_1 .



- 31.** What is optical path ? Write down the equation for optical path and mention what each term represents.

32. Write any three Laws of Photoelectric Effect.

33. Calculate the amount of energy released in joules when 1 kg of ${}_{92}^{235}\text{U}$ undergoes fission reaction.

PART - IV

34. (a) (i) State Coulomb's Law in electrostatics.

(ii) State the differences between Coulomb force and Gravitational force.

OR

(b) Describe the Fizeau's method to determine the speed of light.

35. (a) Discuss the working of Cyclotron in detail.

OR

(b) Discuss the diffraction at single slit and obtain the condition for n^{th} minimum.

36. (a) Derive an expression for phase angle between the applied voltage and current in a series RLC circuit.

OR

(b) Describe Davisson-Germer experiment which demonstrated the wave nature of the electrons.

37. (a) Describe the microscopic model of current and obtain microscopic form of Ohm's Law.

OR

(b) Derive an expression for Radius and Velocity of an electron in the n^{th} orbit using Bohr atom model.

38. (a) (i) Write down the properties of electromagnetic waves.

(ii) The relative magnetic permeability of the medium is 2.5 and the relative electrical permittivity of the medium is 2.25. Compute the refractive index of the medium.

OR

(b) Describe the function of a transistor as an amplifier with the neat circuit diagram. Sketch the input and output waveforms.

