

Half Yearly Examination - 2023

Reg. No.

Class : 12
Time: 3.00 Hr

PHYSICS

Marks : 70

PART - I

15 × 1 = 15

Note: (i) Answer all the questions
(ii) Choose the most appropriate answer from the given four alternatives and write the option code and the corresponding answer

- In Young's double slit experiment using sodium light ($\lambda=5898 \text{ \AA}$) 92 fringes are seen. If sodium light is replaced by another light ($\lambda=5461 \text{ \AA}$) is used, the number of fringes observed is
a) 62 b) 67 c) 85 d) 99
- If voltage applied on a capacitor is increased from V to $2V$, choose the correct conclusion.
a) Q remains the same, C is doubled b) Q is doubled, C doubled
c) C remains same, Q doubled d) Both Q and C remain same
- A cylinder of radius R and length L is placed in a uniform electric field E parallel to the cylinder axis. The total flux for the surface of the cylinder is
a) zero b) $2\pi R^2 E$ c) $\frac{\pi R^2}{E}$ d) $(\pi R^2 - \pi R)E$
- A piece of copper and another of germanium are cooled from room temperature to 80 K . The resistance of
a) each of them increases b) each of them decreases
c) copper increases and germanium decreases d) copper decreases and germanium increases
- If the incident electromagnetic energy is totally reflected from the surface, then the momentum delivered to the surface is
a) $\frac{E}{C}$ b) $\frac{2E}{C}$ c) EC d) $\frac{E}{C^2}$
- A thin insulated wire forms a plane spiral of $N = 100$ tight turns carrying a current $I = 8 \text{ mA}$ (milli ampere). The radii of inside and outside turns are $a = 50 \text{ mm}$ and $b = 100 \text{ mm}$ respectively. The magnetic induction at the center of the spiral is
a) $5 \mu\text{T}$ b) $7 \mu\text{T}$ c) $8 \mu\text{T}$ d) $10 \mu\text{T}$
- In photoelectric effect, the kinetic energy of electron emitted from the metal surface depends on
a) intensity of light b) frequency of light
c) velocity of light d) Both intensity and velocity of light
- Which of the following is NOT true for electromagnetic waves?
a) it transport energy b) it transport momentum
c) it transport angular momentum d) in vacuum, it travels with different speeds which depend on their frequency
- The resistance of a conductor is 5 ohm at 50° C and 6 ohm at 100° C . Its resistance at 0° C is
a) 1 ohm b) 2 ohm c) 3 ohm d) 4 ohm
- For light incident from air on a slab of refractive index 2, the maximum possible angle of refraction is,
a) 30° b) 45° c) 60° d) 90°
- The relation between current gain α and β for a transistor is
a) $\alpha = \frac{\beta}{1 - \beta}$ b) $\beta = \frac{\alpha}{1 + \alpha}$ c) $\alpha = \frac{1 + \beta}{\beta}$ d) $\frac{1}{\alpha} - \frac{1}{\beta} = 1$
- Light transmitted by Nicol prism is,
a) partially polarised b) unpolarised c) plane polarised d) elliptically polarised
- Magnetic flux linked with a closed circuit of resistance 10 ohm varies with time t as $\Phi = 5t^2 - 4t + 1$. The induced emf in the circuit at $t = 0.2 \text{ s}$ is
a) 0.4 V b) 2.0 V c) -2.0 V d) -0.4 V
- A system consists of N_0 nucleus at $t = 0$. The number of nuclei remaining after half of a half-life (that is, at time $t = \frac{1}{2} T_{1/2}$)
a) $\frac{N_0}{2}$ b) $\frac{N_0}{\sqrt{2}}$ c) $\frac{N_0}{4}$ d) $\frac{N_0}{8}$
- The barrier potential of a silicon diode is approximately,
a) 0.7 V b) 0.3 V c) 2.0 V d) 2.2 V

PART - II

Answer any six questions. Question no. 24 is compulsory:

16. Define electric dipole and electric dipole moment.
17. State Fleming's left hand rule.
18. Derive equation $P = VI$ for Power in an electric circuit.
19. Define Q-factor?
20. Why does sky looks reddish during sunset and sunrise?
21. Compute polarising angle for glass and water having refractive index 1.5 and 1.33 respectively.
22. Define work function of a metal. Give its unit.
23. Differentiate P-type and N-type semiconductors.
24. The radius of the 5th orbit of hydrogen atom is 13.25 \AA . Calculate the de Broglie wavelength of the electron orbiting in the 5th orbit.

PART - III

6 × 3 = 18

Answer any six questions. Question no. 31 is compulsory:

25. Derive the relation between f and R for a spherical mirror.
26. The wavelength of light from sodium source in vacuum is 5893 \AA . What are its wavelength, speed and frequency when this light travels in water which has a refractive index 1.33
27. Mention the applications of photo cell.
28. Explain radio carbon dating.
29. Draw the circuit diagram of half wave rectifier and explain its working.
30. Obtain the expression for energy stored in parallel plate capacitor.
31. A copper wire of cross section area 0.5 mm^2 carries a current of 0.2 A . If the free electron density of copper is $8.4 \times 10^{28} \text{ m}^{-3}$ then compute the drift velocity of free electrons.
32. How will you convert a galvanometer into a voltmeter?
33. Distinguish between step up and step down transformer.

PART - IV

5 × 5 = 25

Answer all the questions:

34. a) State Gauss law. Obtain an expression for electric field due to an infinitely long charged wire. (Or)
- b) Obtain an expression for the force on a current carrying conductor placed in a magnetic field. Discuss its special cases.
35. a) Describe the microscopic model of current and obtain general form of Ohm's law. (Or)
- b) Write down Maxwell equations in integral form.
36. a) Find out the phase relationship between voltage and current in a pure inductive circuit. (Or)
- b) Derive the mirror equation.
37. a) (i) Explain continuous X ray spectrum and derive equation for cut-off wavelength.
(ii) Calculate the cut-off wavelength and cutoff frequency of x-rays from an x-ray tube of accelerating potential $20,000 \text{ V}$. (Or)
- b) Prove laws of refraction using Huygens principle.
38. a) Derive the expression for radius of the orbit of hydrogen atom using Bohr atom model. (Or)
- b) State and prove De Morgan's First and Second theorems.
