12

Time : 3.00 Hrs

Half-Yearly Examination - 2023
PHYSICS

Marks : 70

PART - I

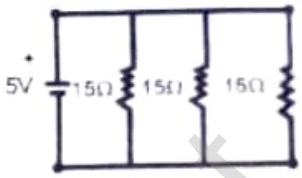
15 x 1 = 15

I. **Choose the best answer**

1. A short electric dipole has a dipole moment of 16×10^{-9} cm. The electric potential due to the dipole at a point at a distance of 0.6 m from the centre of the dipole, situated on a line making an angle of 60° with the dipole axis is

$\left(\frac{1}{4\pi\varepsilon_0} = 9\times10^9\ Nm^2/C^2\right)$ a) 50 V b) 200 V c) 400 V d) zero

2. What is the current drawn out from the battery? a) 1A b) 2A c) 3A d) 4A

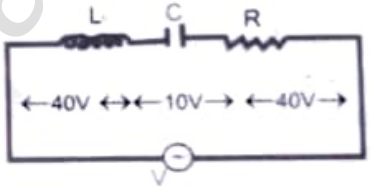


3. The magnetic field at the centre O of the following current loop is.....

a) $\frac{\mu_0 I}{4r}\otimes$ b) $\frac{\mu_0 I}{4r}\odot$ c) $\frac{\mu_0 I}{2r}\otimes$ d) $\frac{\mu_0 I}{2r}\odot$

4. An indicator of inductance L, O capacitor of capacitance C and a resistor of resistance 'R' are connected in series to an ac source of potential diffeence 'V' volts as shown in figure.
Potential difference across L, C and R is 40V, 10V and 40V respectively. The amplitude of current flowing through LCR series circuit is $10\sqrt{2}$ A . The impedance of the circuit is.....

a) $5/\sqrt{2}\Omega$ b) $4\ \Omega$ c) 5Ω d) $4\sqrt{2}\Omega$



5. In an electromagnetic wave travelling in free space the rms value of the electric field is 3V m^{-1}. The peak value of the magnetic field is..... a) 1.414×10^{-8} T b) 1.0×10^{-8} T c) 2.828×10^{-8} T d) 2.0×10^{-8} T

6. $\frac{20}{\pi^2}$ H inductor is connected to capacitor .....capacitance C. The value of C in order to import maximum power at 50 Hz is.....a) 50 μF b) 0.5 μF c) 500 μF d) 5 μF

7. A ray of light travelling in a transparent medium of refractive index n falls, on a surface separating the medium from air at an angle of incidence of 45°. The ray can undergo total internal reflection for the following n.....
a) n = 1.25 b) n = 1.33 c) n = 1.4 d) n = 1.5

8. The ratio of contributions made by the electric field and, magnetic field compond to the intensity of an electromagnetic wave is (C = speed of electromagnetic waves).....
a) c : 1 b) 1 : 1 c) 1 : c d) 1 : c^2

9. Two point while dots are 1 mm apart on a black paper. They are viewed by an eye of pupil diameter 3 mm approximately The maximum distance at which these dots can be resolved by the eye is (Take = 500 nm)
a) 1m b) 5m c) 3m d) 6m

10. An electromagnetic wave of wavelength 'λ' is incident on a photosensitive surface of negligible work function. If 'm' mass is of photoelectron emitted from the surface has de-Broglike wavelength 'λ_d' then.....

a) $\lambda d = \left(\frac{2mc}{h}\right)\lambda^2$ b) $\lambda = \left(\frac{2mc}{h}\right)\lambda^2_d$ c) $\lambda = \left(\frac{2h}{mc}\right)\lambda^2_d$ d) $\lambda = \left(\frac{2m}{hc}\right)\lambda^2_d$

11. The ratio of the wavelengths for the transition from n = 2 to n = 1 in Li^{++}, He^+ and H is.....
a) 1 : 2 : 3 b) 1 : 4 : 9 c) 3 : 2 : 1 d) 4 : 9 : 36

12. Ionised hydrogen atoms and α - particles with same momenta enters perpendicular to a constant magnetic field B. The ratio of their radii of their paths $r_H : r_\alpha$ will be a.....
a) 1 : 4 b) 2 : 1 c) 1 : 2 d) 4 : 1

13. The nucleus is approximately spherical in shape. Then the surface area of nucleus .....
a) $A^{2/3}$ b) $A^{4/3}$ c) $A^{1/3}$ d) $A^{5/3}$

14. Which one of the following represents forward bios diode?

a) 0V — R — −2V b) −4V — R — −3V c) −2V — R — +2V d) −3V — R — +5V

15. The particle which gives mass to protons and neutrons is.....
a) Higgs particle b) Einstein particle c) Nanoparticle d) Bulk particle

PART - II

Answer any six questions. Question number 24 is compulsory. **6 x 2 = 12**

16. State Gauss law.
17. Define magnetic dipole moment.
18. How will you define Q-factor?
19. Why are e.m.waves non-mechanical?
20. What is interference of light?
21. Define work function of a metal. Give its unit.
22. Calculate the number of nuclei of carbon-14 undecayed after 22,920 years if the initial number of carbon -14 atoms is 10,000. The half life of carbon-14 is 5730 years.
23. Why are NOR and NAND gates called universal gates?
24. A cell supplies a current of 0.9A through a 2Ω resistor and a current of 0.3A through a 7Ω resistor. Calculate the internal resistance of the cel.

PART - III

Answer any six questions. Question Number 33 is compulsory. **6 x 3 = 18**

25. Obtain the expression for capacitive for a parallel plate capacitor.
26. Explain the equivalent resistance of a parallel resistor network.
27. Write down the properties of electromagnetic waves.
28. What are critical angle and total internal reflection?
29. Discuss about Nicol prism.
30. List out the characteristics of photons.
31. Discuss the beta (β^+) decay process with example.
32. State and prove De Morgan's first and secon theorem.
33. Find the impedance of a series RLC circuit if the inductive reactance, capacitance reactance and resistance are 184Ω, 144Ω and 30Ω respectively. Also calculate the phase angle between voltage and current.

PART - IV

Answer all the questions. **5 x 5 = 25**

34. a) Calculate the electric field due to a dipole on its axial line.
(OR)
b) What is dispersion? Obtain the equation for dispersive power of a medium.

35. a) Derive the expression for the force on a current-carrying conductor in a magnetic field.
(OR)
b) Discuss the diffraction at single slit and obtain the condition for n^{th} minimum.

36. a) Explain the determination of unknown resistance using meter bridge.
(OR)
b) Explain the construction and working of a full wave rectifier.

37. a) Assuming that the length of the solenoid is large when compared to its diameter, find the equation for its inductance.
(OR)
b) Write down Maxwells equation in integral form.

38. a) Obtain Einstein's photoelectric equation with necessary explanation.
(OR)
b) Explain the J.J. Thomson experiment to determine the specific charge of electron