

CODE : A-P223123-A

I Semester Exam 2024-25

4 x 430

Std. : XII

Sub. : PHYSICS

Marks : 70

Date :

Roll No. _____

Time : 3 hrs.

General Instructions :-

- The question paper is divided into four sections.
 - Section A:** Q. No. 1 contains **10 multiple choice** type questions carrying **one mark** each.
Q. No. 2 contains **8 very short answer** type questions carrying **one mark** each.
 - Section B:** Q. No. 3 to Q. No. 14 are **12 short answer - I** type questions carrying **two marks** each. Attempt any eight questions.
 - Section C:** Q. No. 15 to Q. No. 26 are **12 short answer - II** type questions carrying **three marks** each. Attempt any eight questions.
 - Section D:** Q. No. 27 to Q. No. 31 are **5 long answer** type questions carrying **four marks** each. Attempt any **three** questions.
- Start each section on a new page.
- Figures to right indicate full marks.
- For each MCQ, correct answer must be written along with its alphabet :
e.g. a) / b) / c) / d)
- Evaluation of each MCQ would be done for the first attempt only.
- Use of Logarithm Tables is allowed. Use of a calculator is not allowed.

Physical constants :

- | | |
|--|---|
| 1) $\pi = 3.142$ | 2) $g = 10 \text{ m/s}^2$ |
| 3) $h = 6.63 \times 10^{-34} \text{ J.S.}$ | 4) $c = 3 \times 10^8 \text{ m/s}$ |
| 5) $e = 1.6 \times 10^{-19} \text{ C}$ | 6) $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N.m}^2$ |
| 7) $\mu_0 = 4\pi \times 10^{-7} \text{ T.m/A}$ | 8) $\sigma = 5.7 \times 10^{-8} \text{ W/m}^2.\text{K}^4$ |

Section - A

Q. 1 Select and write the correct answer for the following multiple choice type of questions :- 10

- Force of static friction is _____ $\mu_s N$.
 - less than
 - equal to
 - more than
 - less than or equal
- Kirchhoff's first law ie. $\Sigma I = 0$ at a junction deals with the conservation of _____.
 - charge
 - energy
 - momentum
 - mass
- The total energy of a particle in Simple Harmonic Motion is inversely proportional to _____.

a) square of time period	b) square of amplitude
c) mass of bob	d) time period
- Which of the following phenomenon proves that light is a transverse wave ?
 - reflection
 - interference
 - diffraction
 - polarization

- 5) In Young's double slit experiment the two coherent sources have different intensities. If the ratio of maximum intensity to the minimum intensity in the interference pattern produced is 25:1. What was the ratio of intensities of the two sources ?
 a) 5 : 1 b) 25 : 1
 c) 3 : 2 d) 9 : 4
- 6) A thin ring has mass 0.25 kg and radius 0.5m. It's M.I. about an axis passing through its centre and perpendicular to its plane is _____
 a) 0.625 kg m² b) 0.0625 kg m²
 c) 6.25 kg m² d) 62.5 kg m²
- 7) In a stationary wave the distance between a node and its adjacent antinode is _____.
 a) λ b) $\lambda/4$
 c) $\lambda/2$ d) 2λ
- 8) A conducting thick copper rod of length 1m carries a current of 15A and is located on the Earth's equator. There the magnetic flux lines of the Earth's magnetic field are horizontal with the field of 1.3×10^{-4} T south to north. The magnitude and direction of the force on the rod when it is oriented so that current flows from west to east are
 a) 14×10^{-4} N, downward b) 20×10^{-4} N, downward
 c) 14×10^{-4} N, upward d) 20×10^{-4} N, upward
- 9) According to Curie's law temperature and susceptibility is related as _____.
 a) $X \propto T$ b) $X \propto \frac{1}{T}$ c) $X \propto T^2$ d) $X \propto \frac{1}{T^2}$
- 10) An electron, a proton, an α particle and a hydrogen atom are moving with the same kinetic energy. The deBroglie wavelength will be longest for _____.
 a) electron b) proton
 c) α particle d) hydrogen atom

Q. 2 Answer the following questions.

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- 1) Calculate the radius of gyration of the disc of radius 1m and mass 2kg about transverse axis.
- 2) What is the value of force on a closed circuit in a magnetic field ?
- 3) If a charge of 50 μ C is moving with speed of 50 m/s parallel to the direction of magnetic field 5×10^{-5} T; find the mechanical force acting on charged particle.
- 4) Write the formula for beat frequency.
- 5) Define wavenormal.
- 6) Four resistors 10 Ω , 10 Ω , 10 Ω and 15 Ω form a Wheatstone's network. What shunt is required across 15 Ω resistor to balance the bridge ?
- 7) What do you understand by the term wave particle duality ?
- 8) How much is intensity of magnetic field of the Earth at the point inside a hollow iron box ?

Section - B

Attempt any Eight of the following questions.

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- ✓ Q. 3 Find the formula for maximum safe speed for a vehicle moving along a horizontal circular track.
- ✓ Q. 4 State and prove principle of conservation of angular momentum.
- Q. 5 Define second's pendulum. Derive a formula for length of second's pendulum.
- Q. 6 A particle performing linear S. H. M. has maximum velocity 25 cm/s and maximum acceleration 100 cm/s². Find period of oscillation.

- Q. 7 What are harmonics and overtones. (Two points)
- Q. 8 A 36cm long Sonometer wire vibrates with frequency of 280 Hz in fundamental mode when it is under tension of 24.5 N. Calculate linear density of the material of wire.
- Q. 9 State Brewster's law and draw neat and labelled diagram.
- Q. 10 A point is situated at 6.5 cm and 6.65 cm from two coherent sources. Find the nature of illumination at the point, if wavelength of light is $5000 \text{ \AA}$.
- Q. 11 How will you convert a moving coil galvanometer into an ammeter ?
- Q. 12 In a cyclotron, magnetic field of 3.5 wb/m^2 is used to accelerate protons. What should the time interval in which the electric field between the Dees be reversed ?
[Mass of proton = $1.64 \times 10^{-27} \text{ kg}$]
- Q. 13 Give any two points of difference between diamagnetic and ferromagnetic substances.
- Q. 14 Find the wave number of a photon having an energy of 2.072 eV.

Section - C

Attempt any Eight of the following :

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- Q. 15 Draw a neat labelled diagram of a suspended coil type of moving galvanometer.
- Q. 16 State Einstein's photoelectric equation. Hence explain any two characteristics of photoelectric effect.
- Q. 17 Obtain the expression for Bohr Magneton.
- Q. 18 The total energy of a particle of mass 200g, performing S.H.M. is 10^{-2} J . Find its maximum velocity and period if the amplitude is 7 cm.
- Q. 19 State theorem of Perpendicular axes. Hence derive the expression $I_Z = I_X + I_Y$.
- Q. 20 During a stunt a motor cyclist (considered to be a particle) is undergoing horizontal circles inside a cylindrical well of radius 6.05 m. If the necessary friction coefficient is 0.5, how much minimum speed should the stunt artist maintain ? Mass of the artist is 50 kg. If she/he increases speed by 20% how much will the force of friction be?
- Q. 21 Explain refraction of light on the basis of wave theory. Hence prove the laws of refraction.
- Q. 22 In Fraunhofer diffraction by a narrow slit, a screen is placed at a distance of 2 m from the lens to obtain the diffraction pattern, If the slit width is 0.2 mm and the first minimum is 5 mm on either side of central maximum, find the wavelength of light.
- Q. 23 Represent graphically the displacement, velocity and acceleration against time for a particle performing linear S.H.M, when it starts from mean position.
- Q. 24 A simple pendulum of length 1m has mass 10g and oscillates freely with amplitude of 5 cm. Calculate its potential energy at extreme position.
- Q. 25 Explain with neat circuit diagram how will you determine unknown resistance by using meterbridge.
- Q. 26 Two diametrically opposite points of a metal ring are connected to two terminals of the left gap of meter bridge. The resistance of 11Ω is connected in right gap. If the null point is obtained at a distance of 45 cm from the left end, find the resistance of metal ring.

Section - D

Attempt any Three of the following questions.

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- Q. 27** State the differential equation of simple harmonic motion. Hence obtain the expression for acceleration, velocity and displacement of a particle performing S.H.M.
- Q. 28** State by formula for magnetic potential energy of a dipole and hence obtain minimum and maximum magnetic potential energy. The combined resistance of a galvanometer of resistance $500\ \Omega$ and its shunt is $21\ \Omega$. Calculate the value of shunt.
- Q. 29** What is gyromagnetic ratio? Write the necessary expression.
The magnetic moment of a magnet of dimensions $5\text{ cm} \times 2.5\text{ cm} \times 1.25\text{ cm}$ is 3 Am^2 . Calculate the magnitude of intensity of magnetization.
- Q. 30** Draw a neat labelled circuit diagram of experimental arrangement for study of photoelectric effect.
A student weighing 45 kg is running with a speed of 8 km/hr on a footpath 2 m wide. Calculate de Broglie wavelength.
- Q. 31** State Kirchhoff's laws of electrical network.
What happens to a ferromagnetic substance heated above Curie temperature?
Define photoelectric work function.
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