

x1) Sel (3)



Code: A-P337123-M

I Semester Exam – 2022-23

Std.: XII

Sub: PHYSICS

Date: 21/11/2022

Roll No.: _____

4 x 840

Marks: 70

Time: 3 hrs.

General Instructions :-

The question paper is divided into four sections.

- Section A** : Q. No. 1 contains Ten multiple choice type of questions carrying one mark each.
Q.No.2 contains Eight very short type of questions carrying one mark each.
- Section B** : Q. No. 3 to Q. No. 14 contains Twelve short answer type of questions carrying Two marks each. (Attempt any eight)
- Section C** : Q.No.15 to Q.No. 26 contain Twelve short answer type, Three marks each. (Attempt any Eight)
- Section D** : Q.No. 27 to Q.No. 31 contain Five long answer type of questions carrying Four marks each. (Attempt any Three)
- Use of log table is allowed.
- Figures to right indicate full marks.
- Each MCQ's, correct answer must be written along with its alphabet.

Section - A

Q.1 Select and write the correct answer.

10

- The mathematical statement of the principle of parallel axes is, _____
 a) $I_0 = I_c + Mh^2$ b) $I_0 = I_c - Mh^2$
 c) $I_z = I_x + I_y$ d) $I_z = I_x - I_y$
- Accuracy of potentiometer can be easily increased by _____
 a) increasing resistance of wire b) decreasing resistance of wire
 c) increasing the length of wire d) decreasing the length of wire
- In Bernoulli's theorem, which of the following is conserved?
 a) Linear momentum b) Angular momentum
 c) Mass ☒ d) Energy
- The relation between relative permeability (μ_r) and magnetic susceptibility (χ_m) is _____
 a) $\mu_r = 1 - \chi_m$ b) $\mu_r = 1 + \chi_m$
 c) $\chi_m = \mu_r + 1$ d) $\chi_m = \mu_r$
- A voltmeter has a resistance 30Ω . What will be its reading, when it is connected across a cell of emf 2 V having internal resistance 10Ω ?
 a) ☒ 1.5 V b) 2.0 V
 c) 2.5 V d) 3.0 V
- A liquid rises in glass capillary tube up to a height of 2.5 cm at room temperature. If another glass capillary tube having radius half that of the earlier tube is immersed in the same liquid, the rise of liquid in it will be _____
 a) 1.25 cm b) 2.5 cm
 c) 5 cm d) 10 cm
- According to right hand thumb rule, the direction of magnetic induction if current is directed in anticlock wise direction is _____
 a) perpendicular and inwards b) same as current
 c) perpendicular and outwards d) opposite to that of current

P.T

- viii) A standing wave is produced on a string fixed at one end with the other end free. The length of the string _____
- must be an odd integral multiple of $\lambda/4$
 - must be an odd integral multiple of $\lambda/2$
 - must be an odd integral multiple of λ
 - must be an even integral multiple of λ .
- ix) When an electron is accelerated through a potential of 54 V, the wavelength associated with an electron is _____
- 0.167 nm
 - 0.187 nm
 - 0.0167 nm
 - 0.0187 nm
- x) The period of a simple pendulum is doubled when _____
- its length is doubled
 - its length is halved
 - its length is made four times
 - mass of the bob is doubled

Q.2

Answer the following.

8

- Calculate the moment of inertia of a uniform disc of mass 10 kg and radius 60 cm about an axis perpendicular to its length and passing through its centre.
- What is second's pendulum?
- Define antinode.
- State Kirchhoff's first law.
- What is mean by Hydrostatic paradox?
- For two long parallel conductors, state equation for the magnitude of the force of attraction per unit length.
- Define magnetization.
- If the displacement of a particle in SHM is given by $x = 0.1 \cos (100 t)$ m, what is the maximum speed of the particle?

Section - B

Attempt any Eight of the following.

16

- Derive the relation between surface tension and surface energy per unit area.
- Obtain the differential equation of linear simple harmonic motion.
- Derive an expression for the kinetic energy of body rotating with uniform angular speed.
- In a hydraulic lift, the input piston had surface area 30 cm² and the output piston has surface area of 1500 cm². If a force of 25 N is applied to the input piston. Calculate weight an output piston.
- State and explain principle of potentiometer.
- Draw a neat labelled diagram of the experimental arrangement of the Davisson and Germer experiment.
- The de Broglie wavelengths associated with an electron and a proton are same. What will be the ratio of their momentum?
- A solid sphere of mass 1 kg rolls on a table with linear speed 2 m/s, find its total kinetic energy.
- Calculate the value of magnetic field at a distance of 2 cm from a very long straight wire carrying a current of 5A ($\mu_0 = 4\pi \times 10^{-7}$ Wb/Am)
- A potentiometer wire has a length of 1.5 m and resistance of 10 Ω . It is connected in series with the cell of emf 4 volt and internal resistance 5 Ω . Calculate the potential drop per unit length.

- Q.13 Define harmonics and overtone.
- Q.14 With help of suitable diagram state the expression for Biot-Savart's law in vector form.

Section - C

Attempt any Eight of the following.

24

- Q.15 Derive an expression for period of a simple pendulum.
- Q.16 Show that even as well as odd harmonics are present as overtones in the case of an air column vibrating in a pipe open at both the ends.
- Q.17 What is banking of roads? Obtain an expression for the maximum safety speed of a vehicle moving along a curve horizontal road.
- Q.18 Obtain the expression for Bohr magneton.
- Q.19 Twenty seven droplets of water, each of radius 0.1 mm coalesce into a single drop. Find the change in surface energy. Surface tension of water is 0.072 N/m.
- Q.20 A moving coil galvanometer has been fitted with a rectangular coil having 50 turns and dimensions 5 cm $\times$ 3 cm. The radial magnetic field in which the coil is suspended is of 0.05 Wb/m². The torsional constant of the spring is 1.5×10^{-9} N m/degree. Obtain the current required to be passed through the galvanometer so as to produce a deflection of 30°.
- Q.21 A motorcyclist (as a particle) is undergoing vertical circles inside a sphere of death. The speed of the motorcycle varies between 6 m/s and 10 m/s. Calculate diameter of the sphere of death. What are the minimum values are possible for these two speeds?
- Q.22 A set of 8 tuning forks is arranged in a series of increasing order of frequencies. Each fork gives 4 beats per second with the next one and the frequency of last fork is twice that of the first. Calculate the frequencies of the first and the last fork.
- Q.23 Explain with neat circuit diagram how will you determine unknown resistance by using meter bridge experiment.
- Q.24 Explain how a moving coil galvanometer is converted into an ammeter. Derive the necessary formula.
- Q.25 What is photo electric effect?
Define i) Stopping potential
ii) Photoelectric work function
- Q.26 A rod of magnetic material of cross section 0.25 cm² is located in 4000 Am⁻¹ magnetising field. Magnetic flux passing through the rod is 25×10^{-6} Wb. Find out a) relative permeability b) magnetic susceptibility c) magnetisation of the rod.

Section - D

Attempt any three of the following questions.

12

- Q.27 Distinguish between diamagnetic and paramagnetic substance.
- What is the speed of a proton having deBroglie wavelength of 0.08 Å? (Planck's constant $h = 6.63 \times 10^{-34}$ Js, mass of a proton = 1.67×10^{-27} kg)
- Q.28 Represent graphically the displacement, velocity and acceleration against time for a particle performing linear S.H.M., when it starts from the mean position.

- Q.29** Draw a neat labelled diagram of conical pendulum. When two cells of emfs ϵ_1 and ϵ_2 are connected in series so as to assist each other, their balancing length on a potentiometer is found to be 2.7 m. When the cells are connected in series so as to oppose each other, the balancing length is found to be 0.3 m. Compare the emfs of the two cells.
- Q.30** Derive an expression for Cyclotron frequency. A violin string vibrates with fundamental frequency of 440 Hz. What is the frequency of second overtone.
- Q. 31** Derive an expression for terminal velocity of a spherical object falling under gravity through a viscous medium.
-