CODE : A - P730123 - M	First Semester Examination 2023 - 24	4 x 770
Std. : XII	Sub. : Physics	Marks : 70
Date : 06/11/2023	Roll no. _____	Time : 3 hrs

General Instructions :-

The question paper is divided into Four section.

1. Section - A : Q. No. 1 contains Ten multiple choice type of questions carrying One mark each.
   Q. No. 2 contains Eight very short answer type of questions carrying One mark each.
2. Section - B : Q. No. 3 to Q. No. 14 contains Twelve short answer type of questions carrying two marks each. (Attempt any Eight)
3. Section - C : Q. No. 15 to Q. No. 26 contains Twelve short answer type of questions carrying three marks each. (Attempt any Eight)
4. Section - D : Q. No. 27 to Q. No. 31 contain Five long answer type of questions carrying Four mark each. (Attempt any Three)
   - Use of Log table is allowed use of calculator is not allowed.
   - Figures to right indicate four marks.
   - For each multiple choice type of questions, it is mandatory to write correct answer along with it's alphabet. e.g (a) ..... / (b) ..... / (c) ..... / (d) ..... only the first attempt will be considered.
   - Physical constants. i) $h = 6.63 \times 10^{-34}$ JS (ii) $C = 3 \times 10^8$ m/s (iii) $\Pi = 3.142$ (iv) $g = 9.8$ m/s^2 (v) $\varepsilon = 8.85 \times 10^{-12}$ C^2 / Nm^2 (vi) $\mu = 4\Pi \times 10^{-7}$ Wb / Am

   ii) In case of MCQ, evaluation will be done for the first attempt only.
5. Begin the answer of each section on a new page.

Section A

Q.1. Select and write the correct answer. **10**

i) A conical pendulum of string length 'L' and bob of mass 'm' performs UCM along a circular path of radius 'r'.
The tension in the string is

a) $\frac{mgL}{\sqrt{L^2 - r^2}}$ b) $\frac{mgL}{\sqrt{L^2 + r^2}}$

c) $\frac{mgL}{\sqrt{2r}}$ d) $\frac{mrg\tan\theta}{L}$

ii) The average energy in one time period in simple harmonic motion is _____

a) $\frac{1}{2}mw^2A^2$ b) $\frac{1}{4}mw^2A^2$

c) mw^2A^2 d) zero

3) When the balance point is obtained in the potentiometer, a current is drawn from _____
   a) both the cell and auxiliary battery
   b) cell only
   c) auxiliary battery only
   d) neither cell nor auxiliary battery

4) The photoelectric threshold wavelength of a certain metal is 3315 A^0. Its work function is
   a) 6×10^{-19} J
   b) 7.286×10^{-19} J
   c) 9×10^{-19} J
   d) 9.945×10^{-19} J

5) Plane wavefronts of light of wavelength 6000 A^0 is incident on two slits on a screen perpendicular to the direction of light rays. If total seperation of 10 bright fringes on screen 2m away from its 2 cm, find the distance between the slits.
   a) 0.6 mm b) 0.4 mm c) 0.8 mm d) 0.2 mm

6) When transverse wave on a string is reflected from free end, the phase change produced is
   a) zero rad b) $\frac{\Pi}{2}$ *rad* c) $\frac{3\Pi}{4}$ *rad* d) Π *rad*

7) The dimensions of magnetic intensity is
   a) [LI] b) $[L^2I]$ c) $[L^{-1}I]$ d) $[L^{-2}I]$

8) The differential equation of SHM for a seconds pendulum is
   a) $\frac{d^2x}{dt^2} + x = 0$
   b) $\frac{d^2x}{dt^2} + \Pi x = 0$
   c) $\frac{d^2x}{dt^2} + 4\Pi x = 0$
   d) $\frac{d^2x}{dt^2} + \Pi^2 x = 0$

9) A bar magnet 10 cm long has cross - sectional area $2cm^2$ and magnetic dipole moment of $10Am^2$. The magnetization of its material, assumed to be uniform is
   a) 5×10^5 A/m
   b) 2×10^5 A/m
   c) 0.5 A/m
   d) 0.2 A/m

10) If the numerical aperture of a microscope is increased, then its
   a) resolving power decreases
   b) limit of resolution decreases
   c) resolving power remains constant
   d) limit of resolution increases

Q.2. Answer the following questions: 8

1) If friction is made zero for a road, can a vehicle move safely on this road ?
2) At which position, the total energy of a particle executing linear S.H.M is purely potential ?
3) What happens to the fringe width in diffraction pattern, if the diameter of wire is increased.
4) What is the value of resistance for an ideal voltmeter ?
5) A particle executes S.H.M of amplitude 3 cm. Its acceleration at extreme position is $27cm/s^2$. Calculate its angular velocity.
6) Which property of soft iron makes it useful for preparing electromagnet ?
7) For two waves which superimpose with ($\phi = 0$) zero phase difference, but have different amplitudes A_1 & A_2. What can you say about the intensity of the resultant wave.
8) For glass plate as a polarizer with refractive index 1.633, Calculate the angle of incidence at which reflected light is completely polarized.

Section B

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Attempt any Eight questions of the following.

Q.3. State and prove the law of conservation of angular momentum.

Q.4. State any two conditions for steady interference pattern.

Q.5. Explain de Broglie wavelength. Obtain an expression for de Broglie wavelength of wave associated with the material particles.

Q.6. Define i) Stopping potential ii) Photoelectric work function.

Q.7. What must be the ratio of slit width to the wavelength for a single slit to have the first diffraction minimum at 45^0 ?

Q.8. A simple pendulum performs SHM of period 4 seconds. How much time after crossing the mean position, will the displacement of bob be one third of its amplitude ?

Q.9. Define radius of gyration. Explain its physical significance.

Q.10. State and explain Amperes circuital law.

Q.11. A sonemeter wire of length 0.5 m is stretched by a weight of 5 kg. The fundamental frequency of vibration is 100 HZ. Calculate linear density of wire.

Q.12. State the formula for magnetic potential energy of a dipole and hence obtain the minimum and maximum magnetic potential energy.

Q.13. What is the speed of a proton having de Broglie wavelength of $0.08A^0$.

Q.14. A ceiling fan having moment of inertia 2 kgm^2 attains its maximum frequency of 60 rpm in 2 Π seconds . Calculate its power rating.

Section C

Attempt any Eight questions of the following. **24**

Q.15. With the help of a neat diagram, explain the reflection of light on a plane reflecting surface.

Q.16. Derive an expression for linear velocity at lowest position, midway position and topmost position for a particle revolving in a vertical circle, if it has to just complete circular motion without string - slackening at top.

Q.17. Explain the conversion of moving coil Galvanometer (MCG) into an ammeter.
Obtain necessary formula.

Q.18. State the principle of superposition of waves Distinguish between forced vibrations and free vibrations.

Q.19. The emf of a cell is balanced by a length of 120 cm of potentiometer wire.
When the cell is shunted by a resistance of 10 Ω , the balancing length is reduced by 20 cm. Find the internal resistance of the cell.

Q.20. A solid sphere of diameter 50 cm and mass 25 kg rotates about an axis through its centre. Calculate its moment of inertia. If its angular velocity changes from 2 rad /s to 1 rad /s in 5 seconds, calculate the torque applied.

Q.21. Current of equal magnitude flows through two long parallel wires having seperation of 1.35cm . If the force per unit length on each wire is 4.76×10^{-2} N, what must be I ?

Q.22. With neat labelled diagram, describe an experiment to study the charactertistics of photoelectric effect.

Q.23. Derive an expression of magnetic field at a point near infinitely long straight wire.

Q.24. Derive an expression for orbital magnetic moment of an electric revolving around the nucleus in an atom. State the formula for the Bohr magneton.

Q.25. Two tuning fork having frequencies 320 HZ and 340 HZ are sounded together to produce sound waves. The velocity of sound in air is 326.4 m/s. Find the difference in wavelength of these wave.

Q.26. In biprism experiment, light of wavelength 5200 A^0 is used to obtain an interference pattern on the screen. The fringe width changes by 1.3 mm when the screen is moved towards the biprism by 50 cm. Calculate the distance between the two virtual images of the slit.

Section D

Attempt any Three of the following questions. **12**

Q.27. State the differential equation of linear simple harmonic motion. Hence obtain the expression for acceleration, velocity and displacement of a particle performing linear SHM.

Q.28. Show that all harmonics are present in case of an air column.

Q.29. State Kirchhoff's law of electric network.

A voltmeter has a resistance of 100 Ω what will be its reading when it is connected across a cell of emf 2 V and internal resistance 20 Ω .

Q.30. What is magnetization ? Write its unit and dimensions.

The susceptibility of a paramagnetic material is χ at 27^0c. At what temperature its susceptibility be $\frac{\chi}{3}$?

Q.31. Using Ampere's law, derive an expression for magnetic induction at a point along the axis of a toroid.

For proton acceleration, a cyclotron is used in which a magnetic field of 1.4 Wb/m^2 is applied. Find the time period for reversing the electric field between the two Ds.

($m_p = 1.67 \times 10^{-27}$kg, $q_p = 1.6 \times 10^{-19}$c)