MODEL QUESTION PAPER - SET- 2 : 2021-22
PHYSICS (THEORY)

MM : 70 **Time : 3 Hrs.**

Entire Syllabus

The question paper is divided into Four sections :

(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. Internal choice is provided (Any 8)

(3) Section C: Q. No. 15 to Q. No. 26 contains Twelve short answer type of questions carrying Three marks each. Internal choice is provided (Any 8)

(4) Section D: Q. No. 27 to Q. No. 31 contains Five long answer type of questions carrying Four marks each. Internal choice is provided (Any 3)

(5) Use log – Table if necessary. Use of Calculator is not allowed.

SECTION A

Q.1 Select & Write the correct Answer **10M**

i. The body is rotating with uniform angular velocity (ω) having rotational kinetic energy (E). Its angular momentum (L) is: **1M**

a) $\frac{2E}{\omega}$ **b)** $\frac{E^2}{\omega}$ **c)** $\frac{E}{\omega^2}$ **d)** $\frac{E}{2\omega}$

ii. The energy stored in a soap bubble of diameter 6 cm and T = 0.04 N/m is nearly **1M**

a) 0.9×10^{-3} J **b)** 0.4×10^{-3} J **c)** 0.7×10^{-3} J **d)** 0.5×10^{-3} J

iii. If the total kinetic energy per unit volume of gas enclosed in a container is E, the pressure exerted by the gas is _____. **1M**

a) E **b)** $\frac{3}{2}$E **c)** $\sqrt{3}$E **d)** $\frac{2}{3}$E

iv. A gas in a closed container is heated with 10J of energy, causing the lid of the container to rise 2m with 3N of force. What is the total change in energy of the system? **1M**

a) 10 J **b)** 4 J **c)** – 10 J **d)** – 4J

v. Diffraction pattern is obtained using red light. What will happen if it is replaced by violet light?

a) Bands will disappear. **b)** Bands will become narrow.
c) Bands will get spaced apart. **d)** Bands will remain unchanged.

vi. Condenser is a device used to store **1M**

a) Large potential at low charge **b)** Low potential at low charge
c) Large charge at low potential **d)** Large charge at large potential

vii. A galvanometer can be converted into a voltmeter by connecting a **1M**

a) High resistance in parallel **b)** High resistance in series
c) low resistance in parallel **d)** low resistance in series.

viii. In which of the following processes, heat is neither absorbed nor released by a system? **1M**

a) isobaric **b)** isochoric

c) isothermal **d)** adiabatic

ix.. A current through a coil of self inductance 10 mH increases from 0 to 1 A in 0.1 s. What is the induced emf in the coil? **1M**

a) 0.1 V **b)** 1 V

c) 10V **d)** 0.01V

x. For a transistor I_C = 15 mA, I_B = 0.5 mA the value of β is

a) 1/30 **b)** 30

c) 3 **d)** 0.52

Q.2 Short Answers (1 Mark Each) **8M**

i. Define centripetal force & represent in vector form. **1M**

ii. Electrostatic energy of 3.5×10^{-4}J is stored in a capacitor at 700V. what is the charge on the capacitor? **1M**

iii. State first law of Thermodynamics. **1M**

iv. A gas enclosed in a cylinder is expanded to double its initial volume (V_i = 0.5 units) at a constant pressure of one atmosphere . How much work is done in this process? **1M**

v. Define Ampere's Law. **1M**

vi. Draw a circuit diagram of circuit used for studying input-output characteristics of a transistor. **1M**

vii. What is meant by angle of contact? **1M**

viii. Two coherent sources whose intensity ratio is 25:1 produce interference fringes. Calculate the ratio of amplitudes of light waves coming from them. **1M**

SECTION B

Attempt Any Eight Questions **16M**

Q.3 Derive the expression for moment of inertia of a ring about diameter. **2M**

Q.4 How much work is required to form a bubble of 2 cm radius from the soap solution having surface tension 0.07 N/m. **2M**

Q.5 If the density of oxygen is 1.44 kg/m^3 at a pressure of 10^5 N/m^2 , find the root mean square velocity of oxygen molecules. **2M**

Q.6 calculate the change in angular momentum of electron when it jumps from 3rd orbit to 1st orbit in hydrogen atom. $\left[\text{Take } h = 6.63\times10^{-34}\text{Js}\right]$ **2M**

Q.7 At what distance from the mean position is the speed of a particle performing S.H.M. half its maximum speed. Given path length of S.H.M. = 10 cm. **2M**

Q.8 State any four characteristics of stationary waves. **2M**

Q.9 A double-slit arrangement produces interference fringes for sodium light (λ=589 nm) that are 0.20° apart. What is the angular fringe separation if the entire arrangement is immersed in water (n = 1.33)? **2M**

Q.10 A potential drop per unit length along a wire is 5×10^{-3} V/m. If the emf of a cell balances against length 216 cm of this potentiometer wire, find the emf of the cell. **2M**

Q.11 A toroid of narrow radius of 10 cm has 1000 turns of wire. For a magnetic field of 5×10^{-2}T along its axis, how much current is required to be passed through the wire? **2M**

Q.12 Calculate the gyromagnetic ratio of electron (given e = 1.6×10^{-19}C, $m_e = 9.1 \times 10^{-31}$kg). **2M**

Q.13 The de Broglie wavelengths associated with an electron and a proton are same. What will be the ratio of **(i)** their momenta **(ii)** their kinetic energies? **2M**

Q.14 Draw and explain phasor diagram for voltage and current in a purely capacitive circuit. **2M**

SECTION C

Attempt Any Eight Questions **24M**

Q.15 Derive an expression that relates angular momentum with the angular velocity of a rigid body. **3M**

Q.16 Discuss the various conditions when liquid drop on a plane solid surface will either form droplets on the surface or spread on the surface. **3M**

Q.17 Determine the expression for the work done and heat transferred for an isothermal process. **3M**

Q.18 Explain the variation of photocurrent with the intensity of incident radiation in photoelectric effect. **3M**

Q.19 A metal disc is made to spin at 20 revolutions per second about an axis passing through its centre and normal to its plane. The disc has a radius of 30 cm and spins in a uniform magnetic field of 0.20 T, which is parallel to the axis of rotation. Calculate **3M**
i. The area swept out per second by the radius of the disc.
ii. The flux cut per second by a radius of the disc,
iii. The induced emf in the disc.

Q.20 Derive the laws of reflection of light using Huygens' principle. **3M**

Q.21 Draw a neat diagram of full wave rectifier and explain its working. **3M**

Q.22 Describe how a potentiometer is used to compare the emfs of two cells by connecting the cells individually. **3M**

Q.23 What is a toroid? Using Ampere's law, derive an expression for magnetic induction at a point along the axis of a toroid. **3M**

Q.24 State the principle of working of transformer. Explain the construction and working of a transformer. Derive an expression for e.m.f. and current in terms of turns ratio. **3M**

Q.25 Define angular S.H.M. and obtain its differential equation. **3M**

Q.26 Obtain an expression for orbital magnetic moment of an electron rotating about the nucleus in an atom. **3M**

SECTION D

Attempt Any Three Questions **12M**

Q.27 Derive an expression for the impedance of an LCR circuit connected to an AC power supply. **4m**

Q.28 Prove that all harmonics are present in the vibrations of the air column in a pipe open at both ends. **4m**

Q.29 Prove the relation between pressure of the gas and speed of its molecules. **4m**

Q.30 State the postulates of Bohr's atomic model and derive the expression for the energy of an electron in the atom. **4m**

Q.31 Derive an expression for electric potential due to an electric dipole. Discuss the same at axial and equatorial point. **4m**

Together we will make a difference