

Note: Section I is compulsory. Attempt any THREE (3) questions from Section II.

SECTION – I

2. Write short answers to any EIGHT questions.

(2 × 8 = 16)

- i. What are significant figures? What is rule when first digit dropped is less than 5 while rounding off the data?
- ii. What is absolute uncertainty? What is its value?
- iii. Why do we find it useful to have two units for the amount of substance, the kilogram and the mole?
- iv. Give the drawbacks to use the period of a pendulum as a time standard?
- v. Can a vector have a component greater than the vector's magnitude? Explain.
- vi. If $\vec{A} + \vec{B} = \vec{O}$, what can you say about the components of the two vectors?
- vii. What is position vector? Explain briefly.
- viii. Discuss and draw the velocity time graph when car moves with constant acceleration?
- ix. Explain the circumstances in which velocity $\vec{v}$ and acceleration $\vec{a}$ are
 - (i) perpendicular to each other
 - (ii) anti-parallel
- x. What will happen when a light body collides with a massive body at rest in an elastic collision?
- xi. A 70 kg man runs up a long flight of stairs in 4.0 s. The vertical height of the stairs is 10 m. Calculate his power output in watts.
- xii. Calculate the work done in kilo joules in lifting a mass of 10 kg (at a steady velocity) through a vertical height of 10 m.

3. Write short answers to any EIGHT questions.

(2 × 8 = 16)

- i. If a lift is falling freely under gravity, how weightlessness is produced. Use mathematical equations to support your answer.
- ii. How do you create a gravity free system?
- iii. What is meant by centripetal force and why it must be furnished to an object, if the object is to follow a circular path?
- iv. What is meant by moment of inertia with its physical significance? Use equations to support your answer.
- v. How Bernoulli's equation is reduced? When
 - a) height difference is negligible
 - b) velocity is constant.
- vi. What do you understand by the term viscosity? Also give its unit.
- vii. Define damping process. Use a graph to support your answer.
- viii. If a mass spring system is hung vertically and set into oscillations, why does the motion eventually stop?
- ix. Explain the relation between total energy, potential energy and kinetic energy of a body oscillating with S.H.M
- x. How Doppler Effect is used to monitor blood flow? Use diagrammatic explanation to support your answer.
- xi. Explain why sound travels faster in warm air than in cold air?
- xii. How are beats useful in tuning musical instrument?

4. Write short answers to any SIX questions.

(2 × 6 = 12)

- i. Under what conditions two or more sources of light behave as coherent sources?
- ii. What are the conditions for detectable interference?
- iii. 10000 lines per centimeter has been ruled on diffraction grating. Find its grating element.
- iv. Why would it be advantageous to use blue light with a compound microscope?
- v. Why is meant by "least distance of distinct vision"?

(Turn Over)

- vi. Find magnifying power of convex lens of 25 cm focal length acts as a magnifying glass.
- vii. Does entropy of a system increase or decrease due to friction?
- viii. Is it possible to construct a heat engine that will not expel heat into the atmosphere?
- ix. Derive Charles' law from Kinetic theory of gases

SECTION – II

- 5. (a) Does the inertia depend on the momentum of a body? Give its reason. Also state and explain the law of conservation of linear momentum. (5)
(b) Show that the three vectors $\hat{i} + \hat{j} + \hat{k}$, $2\hat{i} - 3\hat{j} + \hat{k}$ and $4\hat{i} + \hat{j} - 5\hat{k}$ are mutually perpendicular. (3)
- 6. (a) Stationary waves are also called standing waves, why? Discuss stationary waves in air column of an open organ pipe. (5)
(b) How large a force is required to accelerate an electron ($m = 9.1 \times 10^{-31} \text{ kg}$) from rest to a speed of $2 \times 10^7 \text{ ms}^{-1}$ through a distance of 5cm? (3)
- 7. (a) How does a space satellite acquire an artificial gravity? (5)
(b) A block weighing 4.0 Kg extends a spring by 0.16 m from its unstretched position. If the block is removed and 0.50 kg body is hung from same spring, now what is its period of vibration? (3)
- 8. (a) Explain four stroke petrol engine in detail. What is the efficiency of a diesel engine? (5)
(b) Water flows through a hose, whose internal diameter is 1cm at a speed of 1 ms^{-1} . What should be the diameter of the nozzle if the water is to emerge at 21 ms^{-1} ? (3)
- 9. (a) What is meant by diffraction of light? Also discuss the diffraction of light through a narrow slit. (5)
(b) An astronomical telescope having magnifying power of 5 consists of two thin lenses 24 cm apart. Find the focal lengths of the lenses. (3)