

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 $\vec{A} + \vec{B} = \vec{0}$, 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"?

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(Turn Over)

- 2-
- 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)