

Time: 2:40 Hours

SUBJECTIVE

Marks: 68

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

(SECTION – I)

G42-22

2. Write short answers to any EIGHT questions.

(2 x 8 = 16)

- i. Give the drawbacks to use period of a simple pendulum as a time standard.
- ii. What are the dimensions and units of gravitational constant G in the formula $F = G \frac{m_1 m_2}{r^2}$?
- iii. What are the three main frontiers of fundamental science?
- iv. Differentiate between precise measurement and accurate measurement.
- v. Can the velocity of an object reverse the direction when acceleration is constant?
If so, give an example.
- vi. An object is thrown vertically upward. Discuss the sign of acceleration due to gravity, relative to velocity, while the object is in air.
- vii. What is velocity-time graph? What does its slope represent?
- viii. A projectile is thrown horizontally from a height with velocity of 10 m s^{-1} and reaches the ground after 2 sec. Find the horizontal distance covered by the projectile.
- ix. Calculate the entropy change when 1.0 kg of ice at 0°C melts into water at 0°C .
Latent heat of fusion of ice is $L_f = 3.36 \times 10^5 \text{ J kg}^{-1}$.
- x. What happens to the temperature of the room, when an air conditioner is left running on a table in the middle of the room?
- xi. Give an example of a natural process that involves an increase in entropy.
- xii. 100 J of heat is supplied to a gas which increases its internal energy by 20 J.
Find the work done by the system.

3. Write short answers to any EIGHT questions.

(2 x 8 = 16)

- i. Define null vectors and equal vectors.
- ii. Explain right hand rule to find the direction of vector product.
- iii. Can a body rotate about its centre of gravity under the action of its weight?
- iv. When rocket re-enters the atmosphere, its nose cone becomes very hot.
Where does this heat energy come from?
- v. A girl drops a cup from certain height, which breaks into pieces.
What energy changes are involved?
- vi. Name different sources of geothermal energy with brief discussion.
- vii. What is meant by moment of inertia? Explain its significance.
- viii. Show that orbital angular momentum $L_o = mvr$.
- ix. What is the minimum orbital velocity for close orbiting satellite?
- x. Write down the postulates of Huygens's principle.
- xi. Can visible light produce interference fringes? Explain.
- xii. Explain whether the Young's experiment is an experiment for studying interference or diffraction effects of light.

(Turn Over)

4. Write short answers to any SIX questions.

(2 x 6 = 12)

- i. Explain, how the swing is produced in a fast moving cricket ball?
- ii. Show that in SHM the acceleration is zero when the velocity is greatest and the velocity is zero when the acceleration is greatest.
- iii. What are damping devices? Give at least one example.
- iv. If length of simple pendulum is increased four times, then what will be effect on its time period?
- v. How are beats useful in tuning musical instruments?
- vi. What features do longitudinal waves have in common with transverse waves?
- vii. What is the frequency and wavelength of 3rd mode of stationary waves in closed organ pipe?
- viii. Why would it be advantageous to use blue light with a compound microscope?
- ix. How the light signal is transmitted through the optical fibre?

(SECTION – II)

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

5. (a) What is gravitational field? Show that gravitational field is conservative field. **(5)**
(b) The magnitude of dot and cross products of two vectors are $6\sqrt{3}$ and 6 respectively. **(3)**
Find the angle between the vectors.
6. (a) State and explain law of conservation of linear momentum. **(5)**
(b) The earth rotates on its axis once a day. Suppose by some process the earth contracts so that its radius is only half as large as at present. How fast will it be rotating then? **(3)**
7. (a) What is meant by Doppler's effect? Discuss this effect for these two cases. **(5)**
i) An observer moving towards a stationary source of sound.
ii) Source of sound moving away from a stationary observer.
(b) What gauge pressure is required in the city mains for a stream from a fire hose connected to the mains to reach a vertical height of 15.0 meter? **(3)**
8. (a) What is simple pendulum? Show that its motion is SHM. Derive an expression for its time period. Also find its frequency. **(5)**
(b) A mono-chromatic light of $\lambda = 588 \text{ nm}$ is allowed to fall on a half silvered glass plate G_1 in Michelson interferometer. If mirror M is moving through 0.233 mm. How many fringes will be observed to shift? **(3)**
9. (a) State and explain carnot engine and carnot theorem in detail and how would you determine which fact makes carnot engine a superior one? **(5)**
(b) A telescope is made of an objective of focal length 20 cm and an eye piece of 5.0 cm, both convex lenses. Find the angular magnification. **(3)**