SUBJECT: **PHYSICS**

Total Pages: 3

SET – 1/3

Time: 3 Hours

Max. Marks: 70

General Instructions:

(i) *All Questions are Compulsory.*

(ii) *Marks for each question are indicated against it.*

(iii) *Question no. 1 to 8 are very short answer carrying 1 Mark each. Answer all in one word or one sentence.*

(iv) *Question no. 9 to 18 are short answer of 2 Marks each. Answer these in about 30 words.*

(v) *Question no. 19 to 27 are short answer of 3 Marks each. Answer these in about 40 words.*

(vi) *Question no. 28 to 30 are long answer of 5 Marks each. Answer these in about 70 words.*

(vii) *Use of calculator is not permitted. However, you may ask for log tables, if required.*

****

1. A car moves through a circular road with a constant speed. Is the car an inertial frame of reference or a non-inertial frame of reference? Why? [1M.]

2. A body thrown vertically up with an initial velocity returns to the same point after few second. Draw velocity-time graph for the motion of the body. [1M.]

3. The temperature of two bodies measured by two thermometer are $t_1 = 25^0 \pm 0.5\,^0C$ and $t_2 = 20^0 \pm 0.2\,^0C$. Calculate the temperature difference and the error there in. [1M.]

4. A satellite revolves round a planet in a circular orbit of radius r. If the gravitational force on the satellite by the planet is F newton, what is the work done by the planet on the satellite when the satellite covers half of orbit? [1M.]

5. If the ice on the polar caps of earth melts, how will it affect the duration of the day? Why? [1M.]

6. Two gases helium and hydrogen are in thermal equilibrium. Then what is the ratio of kinetic energies of helium and hydrogen molecules? [1M.]

7. What is the maximum value of gravitational potential and where? [1M.]

8. Why moon has no atmosphere? [1M.]

9. Displacement of a particle executing simple harmonic motion is represented by

   $x = 0.24 \cos(200t - 1.5)$ where x is in metre and t in second. Then, find

   (a) amplitude   (b) angular frequency

   (c) period and   (d) initial phase of the simple harmonic motion. [2M.]

10. State the first law of thermodynamics.

    A gas enclosed in a container with non-conducting walls is expanded by a volume ΔV. Apply first law of thermodynamics for this process and represent it mathematically.

    [2M.]

11. What are the main parts of a heat engine? Draw a labelled schematic diagram of heat engine. [2M.]

12. Define mean free path. How does it depend on (i) diameter of gas molecules and (ii) number of molecules per unit volume? [2M.]

13. Two rods A and B are of unequal lengths. Rod A is twice longer than B. Their thermal conductivities are K_1 and K_2 and radii r_1 and r_2 respectively. Find the ratio K_1 by K_2, if both rods conduct the same amount of heat when their ends are kept at the same temperatures T_1 and T_2. [2M.]

14. Velocity of a particle at an instant of time t is $v = at + bt^2 + c$ where a, b and c are constants. Find the dimensions of a and b. [2M.]

15. Derive the expression $v^2 = u^2 + 2as$ from velocity – time graph, where the symbols have usual meanings? [2M.]

16. A cyclist comes to a skidding stop in 5m. During this process, the force on the cycle due to the road is 300N and is opposite to the motion of the cycle.
    (a) How much work does the road do on the cycle?
    (b) How much work does the cycle do on the road? Why? [2M.]

17. Find the torque of a force $8i + 2j – 2k$ newton about the origin. The force act on a particle whose position vector is $i + j – k$ metre. [2M.]

18. Define the term impulse. Obtain the relation between impulse and momentum. [2M.]

OR

Derive an expression for the maximum velocity of a car on a level curved road.

19. Find the magnitude and direction of the resultant of two vectors A and B in terms of their magnitudes and angle θ between them. [3M.]

20. Derive an expression for the variation of acceleration due to gravity with depth from the surface of earth. Then find its value at the centre of earth. [3M.]

21. (a) Define coefficient of static friction.
    (b) Determine the maximum acceleration of the train in which a box lying on its floor will remain stationary, given that the coefficient of static friction between the box and the trains floor is 0.15. [3M.]

22. State and prove the law of conservation of momentum. Mention one example where we make use of the law. [3M.]

23. (a) Distinguish between elastic and inelastic collisions.
    (b) Does the total energy conserved in either of the collisions?
    (c) Two bodies having masses m_1 and m_2 travelling with velocities v_1 and v_2 collide each other. After collision, they stick together and travel with a common velocity. What type of collision is this? [3M.]

OR

Two bodies of masses m_1 and m_2 moving with velocities u_1 and u_2 undergo elastic collision in one dimension. Derive expressions for their final velocities in terms of m_1, m_2, u_1 and u_2.

24. (a) State the perpendicular axes theorem of moment of inertia.
    (b) A grind stone has moment of inertia 6 kgm^2 about its axis. A constant torque is applied and the grind stone is found to acquire a speed of 150 rotations per minute in 10 sec. after starting from rest. Calculate the torque. [3M.]

25. State Pascal's law. Explain how the law is applicable in hydraulic lifts. [3M.]

26. A string of mass 2.5 kg is under a tension of 200N. The length of the stretched string is 20m. If a transverse jerk is struck at one end of the string, how long does the disturbance take to reach the other end? [3M.]

27. Define degrees of freedom.

Give the number of degrees of freedom of a diatomic molecule. Then, find the ratio of specific heat capacities. [3M.]

28. (a) What is Doppler effect in sound?

Derive an expression for the apparent frequency of sound heard by a listener if both the listener and source are in motion.

(b) A pipe 30 cm long, is open at both ends. Which harmonic mode of the pipe resonates at 1.1 KH_z source? Take the speed of sound = 330 m/s. [5M.]

OR

Define simple harmonic motion.

Derive expressions for potential energy, kinetic energy and total energy of a particle executing simple harmonic motion. Represent the energies graphically.

29. (a) Define stress and strain. Draw a stress strain graph of a wire and explain elastic limit and yield point.

(b) The excess pressure inside a soap bubble is twice that of another soap bubble. What is the ratio of the volumes of the first and second bubbles? [5M.]

OR

(a) Name the different forms of energy possessed by a liquid.

(b) State and proved Bernoulli's theorem. Mention any two applications of the theorem.

30. (a) What is a projectile? Derive expression for the horizontal range of a projectile. Discuss the condition for maximum range.

(b) The position of a particles is given by $\bar{y} = 3t\,\hat{i} + 2t^2\,\hat{j} + 5\hat{k}$. Calculate the magnitude of the velocity of the particle at t = 1 sec. [5M.]

OR

Define uniform circular motion. Derive an expression for acceleration of a particle in uniform circular motion. Explain why this acceleration is called centripetal acceleration.

<><><><><>