Roll Number			

SET   C

General Instructions:
1. All questions are compulsory. There are 27 questions in all.

2. This question paper has five sections: Section A, Section B, Section C and Section D.

3. Section A contains five questions of one mark each, Section B contains seven questions of two marks each, Section C contains twelve questions of three marks each, Section D contains three questions of five marks each.

4. There is no overall choice. However, internal choices have been provided in two questions of one mark, two questions of two marks, four questions of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.

5. You may use the following values of physical constants wherever necessary.
$g = 10 m/s^2$, $Radius \ of \ earth = 6400 km$

SECTION A

1   Why are shockers used in cars, scooters and motor cycles?   1

OR

What happens to coefficient of friction, when weight of body is doubled?

2   If the pressure of a gas at constant temperature is increased four times, how the velocity of sound   1
in the gas will be affected?

3   Arrange the four fundamental forces in nature in the ascending order of their strength.   1
OR
Give any two characteristics of gravitational force.

4   Why do the clouds appear white in colour?   1

5   Why wheels are made circular in automobiles?   1

SECTION B

6   Check whether the equation $FS = \frac{1}{2}mv^2 - \frac{1}{2}mu^2$ is dimensionally correct, where 'm' is the mass   2
of the body, 'v' its final velocity, 'u' its initial velocity, 'F' is the force applied and 'S' is the
distance moved.

OR

Give any two differences between accuracy and precision.

7   (i) Write the relation between the refractive index and critical angle for a given pair of optical media.   2
      (ii) State the conditions for total internal reflection to occur.

8   State and prove law of conservation of angular momentum.   2

OR

     (i) How a swimmer jumping from a height is able to increase the number of loops made in the air?
     (ii) Why are spokes fitted in a wheel?

9   (i) A ray of monochromatic light passes through medium (1) to medium (2). If the angle of incidence in medium (1) is θ and the corresponding angle of refraction in medium (2) is $\theta/2$, which of the two media is optically denser? Give reason.   2
     (ii) Explain why light is dispersed while passing through a prism.

10   (i) What is the direction of velocity vector of a particle in uniform circular motion?   2
     (ii) If both speed of a body and radius of its circular path are doubled, what will happen to centripetal acceleration?

11   Represent graphically the variation of extension with load in an elastic body. On the graph mark: 2
(a) Hooke's law region   and (b) Elastic limit

12   Two parallel rail tracks run north-south. Train A moves north with a speed of 54 km h^{-1}, and train B moves south with a speed of 90 km h^{-1}. What is the   2
(a) velocity of B with respect to A?
(b) velocity of ground with respect to B?

SECTION C

13   (i) Draw a schematic labelled ray diagram of a reflecting type telescope (cassegrain).   3
     (ii) Write any two important advantages of reflecting type telescope over refracting telescope.

OR

     (i) Draw a ray diagram to show the formation of image by a concave mirror when an object is placed between its focus and the pole.
     (ii) Using the above ray diagram derive the mirror formula.

14   Give three differences between reversible process and irreversible process.   3

15   (i) Define Doppler effect.   3
     (ii) On what factors does the energy of a harmonic oscillator depend?
     (iii) What is the distance between (a) adjacent nodes (ii) a node and an adjacent antinode?

16   Find the potential energy of a system of four particles placed at the vertices of a square of side l. Also obtain the potential at the centre of the square.   3

OR

(i) Does the escape speed of a body from the earth depend on the mass of the body?

(ii) A body weighs 63 N on the surface of the earth. What is the gravitational force on it due to the earth at a height equal to half the radius of the earth?

17   State and prove Kepler's third law of planetary motion.   3

18   (i)   State and prove work energy theorem.   3

    (ii)   What will be the change in potential energy if a proton and an electron are brought together?

19   (i) Stainless steel cooking pans are preferred with extra copper bottom. Why?   3

    (ii) State Wein's displacement law for black body radiation.

    (iii)The Coolant used in a nuclear plant should have high specific heat. Why?

OR

(i) Why birds often swell their feathers in winter?

(ii) State Stefan Boltzmann law.

(iii)Why is a small gap left between the iron rails of railway tracks?

20   A projectile is fired at an angle θ with the horizontal. Obtain expression for the maximum height attained, the time of its flight and the horizontal range.   3

21   (i) Draw position-time graph of two objects moving along a straight line when their relative velocity is non-zero.   3

    (ii) Can a body have a constant speed but variable velocity? Give example.

    (iii)What is the acceleration of a body when its velocity-time graph is parallel to time axis?

22   (i) Define degree of freedom.   3

    (ii) Using law of equipartition of energy obtain the ratio of specific heats for a monoatomic gas molecule.

23   (i) A person is sitting in the compartment of a train moving with uniform velocity on smooth track. How will the velocity of centre of mass of compartment change if person begins to run in compartment?   3

    (ii) Derive an expression for rotational kinetic energy of a rigid body.

24   (i) State any two differences between elastic and inelastic collision.   3

    (ii) In a ballistics demonstration a police officer fires a bullet of mass 50.0 g with speed 200 $m \, s^{-1}$ on soft plywood of thickness 2.00 cm. The bullet emerges with only 10% of its initial kinetic energy. What is the emergent speed of the bullet?

OR

(i) State any two differences between conservative and non-conservative forces.

(ii) To simulate car accidents, auto manufacturers study the collisions of moving cars with mounted springs of different spring constants. Consider a typical simulation with a car of mass 1000 kg moving with a speed 18.0 km/h on a smooth road and colliding with a horizontally mounted spring of spring constant 6.25×10^3 N m^{-1}. What is the maximum compression of the spring?

25   i) State and prove Bernoulli's theorem.   5

(ii) Oil is spread on water to calm down rough sea. Give reason.

(iii) To keep a piece of paper horizontal, you should blow over, not under it. Give reason.

OR

(i) Define terminal velocity and derive an expression for the terminal velocity of a sphere falling through a highly viscous fluid in a jar.

(ii) When we try to close a water tap with our fingers, fast jets of water gush through the openings between our fingers. Give reason.

(iii)Explain why the blood pressure in humans is greater at the feet than at the brain.

26   (i) Show that the oscillations of a simple pendulum are simple harmonic and derive expression for   5
frequency of oscillations of simple pendulum.

(ii) Why soldiers are asked not to march over old bridges?

(iii) Draw a graph showing the variation of energy with respect to time for a harmonic oscillator executing damped oscillations.

OR

(i) Discuss about the harmonics formed in an closed organ pipe and show that the harmonics are in the ratio 1:3:5:……..

(ii) Give two differences between stationary waves and progressive waves.

(iii) A simple pendulum is inside a space-craft. What should be its time period of vibration?

27   (i) State and prove the law of conservation of linear momentum.   5

(ii) A bullet of mass 0.04kg moving with a speed of 90m/s enters a heavy wooden block and is stopped after a distance of 60cm. What is the average resistive force exerted by the block on the bullet?

OR

(i) Derive expression for optimum speed and maximum permissible speed of a car on a banked circular track.

(ii) A cyclist speeding at 18km/h on a level road takes a sharp circular turn of radius 3m without reducing the speed. The coefficient of static friction between the tyres and the road is 0.1. Will the cyclist slip while taking the turn? Justify.

End of the Question Paper