

2018

CBCS

1st Semester

PHYSICS

PAPER—C2T

(Honours)

Full Marks : 40

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Mechanics

Group—A

Answer any five questions : 5×2

1. Distinguish between 'true' and 'fictitious' forces. 2
2. A machine gun fires 50 gm bullets at speed of 100 m/s. The gunner holding the machine gun in his hands can exert an average force of 180 newton against the gun. Determine the maximum number of bullets he can fire per minute. 2

3. Calculate the work done by a force $F = kx^2$ acting on a particle at an angle 60° with x -axis to displace it from x_1 to x_2 along the x -axis. 2
4. The co-ordinate of a moving particle at any time 't' is given by $x = ct^2$ and $y = bt^2$. Find the speed of the particle. 2
5. Determine the Poissons's ratio and bulk modulus of a material, for which young's modulus is $1.2 \times 10^5 \text{ N/mm}^2$ and modulus of rigidity is $4.8 \times 10^4 \text{ N/mm}^2$.
6. Calculate the limiting velocity required by an earth's satellite for orbiting round the earth. $R = 6.4 \times 10^6 \text{ m}$;
 $g = 9.8 \text{ m/s}^2$ 2
7. What is resonance? What is sharpness of resonance? 2
8. An electron whose rest mass is $9.11 \times 10^{-31} \text{ kg}$ is accelerated by potential difference of 50 KV. Calculate the mass of the electron. 2

Group—B

Answer any *four* questions :

4×5

9. (a) What is meant by stable and unstable equilibrium ?

(b) The potential energy of a particle is given by

$$V(x) = x^4 - 4x^3 - 8x^2 + 48x. \text{ Find the points of stable}$$

and unstable equilibrium. 2+3

10. Find the moment of inertia of a uniform rectangular lamina about a diagonal. Also find M.I. for square lamina using the previous result. 4+1

11. Establish the relation among modulus of rigidity, Young modulus and bulk modulus. 5

12. Show how by introducing the idea of reduced mass, a two-body problem under central force can be reduced to a one body problem. 5

13. Show that the resultant of two S.H.M. of the same period but different amplitudes and phases in perpendicular direction is an elliptic motion. For what conditions will the path of the resultant motion be a circle and a straight line ? 3+2

14. Establish relativistic addition of velocities. 5

Group—C

Answer any *one* questions : 1×10

15. (a) Find the speed of a 0.1 Mev electron according to classical and relativistic mechanics? 3
- (b) A 200 kg projectile is fired due east with an initial elevation of 30° and initial speed 500 m/s. If the latitude of the place is 60° N, find the magnitude of the total initial coriolis force. 3
- (c) A solid sphere rolls down over two different inclined planes of the same height but different inclinations. Will it reach the bottom with the same velocity in each case? Will it take same time? 4
16. (a) Deduce an expression for the couple required to twist a uniform cylinder (wire). What is 'torsional rigidity'. 5+1
- (b) Calculate the velocity with which a body must be thrown vertically upward from the surface of the earth, so that it may reach a height $10R$, where R is the radius of the earth. 4

$$R = 6.4 \times 10^6 \text{ m}, \quad M = 6 \times 10^{24} \text{ Kg}$$

$$G = 6.7 \times 10^{-11} \text{ N - m}^2 / \text{kg}^2$$
