Date: 05-04-2019   Dept. No.   Max. : 100 Marks

Time: 09:00-12:00

SECTION – A

Answer ALL questions   **(10 X 2 = 20)**

1. State the principles of conservation of linear momentum.
2. State Newton's second law of motion.
3. Find the time taken by the particle to reach the maximum height in a projectile.
4. Define angle of Projection.
5. If T is the time of flight of the S.H.M., f its acceleration and v, velocity at any position, show that the expression $f^2T^2 + 4\pi^2v^2$ is a constant.
6. Define epoch.
7. Write down the differential equations of the central orbit of p-r co-ordinates.
8. Define apse.
9. Define moment of inertia.
10. What is the moment of inertia of circular ring of radius a about a tangent line.

SECTION – B

Answer any FIVE questions   **(5x 8=40)**

11. Show that when masses P and Q are connected by a string over the edge of a table, the tension is the same whether P hangs and Q is on the table or Q hangs and P is on the table.

12. A body, sliding down a smooth inclined plane, is observed to cover equal distances, each equal to a, in consecutive intervals of time t_1, t_2. Show that the inclination of plane to the horizon is $\sin^{-1}\left[\dfrac{2a(t_1 - t_2)}{gt_1t_2(t_1 + t_2)}\right]$.

13. State and prove perpendicular axes theorem.

14. A particle executing a S.H.M. in a straight line has velocities 8, 7, 4 at three distant one foot from each other. Find the period.

15. A particle moves in a simple harmonic motion in a straight line. In the first second, after starting from rest, it travels a distance a and in the next second, it travels a distance b in the same direction. Prove that the amplitude of the motion is $\dfrac{2a^2}{3a-b}$.

16. The velocities of a particle along and perpendicular to radius vector are $\}r$ and $\sim_{,,}$; find the path and show that the accelerations along and perpendicular to radius vector are $\}^2r - \dfrac{\sim^2_{,,}}{r}$ and $\sim_{,,}\left(\} + \dfrac{\sim}{r}\right)$.

17. Obtain the differential equation of the central orbit.

18. Show that the Moment of inertia of a rectangular lamina.

SECTION – C

Answer any TWO questions   **(2 X 20 = 40)**

19. (i) Two particles of masses m_1 and m_2 $(m_1 > m_2)$ are connected by means of a light inextensible string passing over a light, smooth fixed pulley. Discuss the motion.

    (ii) A string passes over a fixed smooth pulley and to one end, there is attached a mass m_1 and to the other a smooth light pulley over which passes another string with masses m_2 and m_3 at the ends. If the system is released from rest. Show that m_1 will not move if $\frac{4}{m_1} = \frac{1}{m_2} + \frac{1}{m_3}$.

                                                                          (10+10)

20. Show that the path of a projectile is a Parabola.   **(20)**

21. (i) Show that the resultant motion of two S.H.M of the same period in the same straight line.

    (ii) If the law of acceleration is $5 \sim u^3 + 8 \sim c^2 u^5$ and the particle is projected from an apse at a distance c with a velocity $\frac{3\sqrt{\sim}}{c}$. Prove that the equation of orbit is $r = c\cos\frac{2_{\prime\prime}}{3}$.   **(10+10)**

22. (i) State and Prove Parallel axes theorem.

    (ii) Find the moment of inertia of solid sphere about a tangent line.   **(10+10)**

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