LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc.DEGREE EXAMINATION –**MATHEMATICS**

FIFTH &SIXTH SEMESTER – **APRIL 2018**

MT 6604 / MT 5500 – MECHANICS - II

Date: 21-04-2018   Dept. No.   Max. : 100 Marks
Time: 01:00-04:00

PART –A

ANSWER ALL THE QUESTIONS: **(10 X 2 = 20)**

1. Define centre of gravity.

2. Write down the formula for centre of gravity of a rigid body.

3. Define the work done by the tension in an elastic string.

4. Define catenary.

5. Define simple pendulum.

6. Define simple Harmonic motion.

7. Write down the p – r equation of hyperbola.

8. Derive the pedal equation of a central orbit.

9. Write down the formula for M.I of (i) a thin uniform rod (ii) a rectangular lamina.

10. State D'Alembert's principle.

PART - B

ANSWER ANY FIVE QUESTIONS: **(5 X 8 = 40)**

11. Find the centre gravity of a uniform hollow hemisphere of radius r.

12. Derive the equation of the common catenary in the form $= C \cosh \frac{x}{c}$.

13. The maximum speed in a simple harmonic motion is V and the amplitude is a. Show that when the speed is v, the acceleration is $\frac{V}{a}\sqrt{V^2 - v^2}$.

14. A particle describe a curve with uniform speed v. If the acceleration at any point be $\frac{v^2 c}{s^2 + c^2}$, find the intrinsic equation of curve.

15. A point P describes with a constant angular velocity about O the equiangular spiral $r = ae^{\theta}$, O being the pole of the spiral. Obtain the radial and transverse acceleration of P.

16. Derive Pedal equation (p - r) equation of a central orbit.

17. Find the moment of inertia of rectangular lamina.

18. A uniform circular disc of radius a and mass M is rotating with an angular velocity ω about a fixed axis at right angles to the plane at a distance b from the centre. Find the kinetic energy.

PART – C

ANSWER ANY TWO QUESTIONS: **(2 X 20 = 40)**

19. a) A homogeneous solid is formed of a hemisphere of radius r soldered to a right circular cylinder of the same radius. If h be the height of the cylinder , Show that the centre of gravity of the solid from the common base is $\frac{3}{4}\frac{2h^2-r^2}{3h+2r}$

    b) Find the centre of gravity of the area in the first quadrant bounded by the coordinate axes and the curve $x^{2/3} + y^{2/3} = a^{2/3}$.   **(10+10)**

20. a) A string of length $l,$ hangs between two points, not in the same vertical line and the tangents at the end points are inclined at the angles α and β with the horizontal. Show that the height of one extremity above the other is $\frac{l\ sin\frac{\alpha+\beta}{2}}{cos\frac{\alpha-\beta}{2}}$ the two extremities being on the same side of the vertex of the catenary.

    b) Derive the principle of virtual work for a system of coplanar forces acting on a rigid body.   **(10+10)**

21. a) Derive the intrinsic equation of catenary.   **(10+10)**

    b) Drive the velocity and acceleration of a particle moving on a curve.

22. a) A particle describes the following orbit under a central force, the pole being the centre. Find the law of forces. (i) $r = ae^{\theta cot\alpha}$ (ii) $\frac{l}{r} = 1 + ecos\theta$

    b) State and prove theorem of parallel axes.   **(10+10)**

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