LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034
B.Sc., DEGREE EXAMINATION – MATHEMATICS
SIXTH SEMESTER – APRIL 2013
MT 6604 / MT 5500 – MECHANICE –II

DATE : 27/04/2013   Dept. No.   Max. : 100 Marks

TIME : 1.00 – 4.00

PART - A

Answer ALL the questions: (10 x 2 = 20 marks)

1. Define Centre of gravity.
2. Where does the C.G of a uniform circular cone lie?
3. Write any two applications of the principle of virtual work.
4. Define span and sag of a catenary.
5. What is amplitude e and frequency of a particle executing simple harmonic motion.
6. Define Simple Pendulum.
7. What are the radial and transverse components of a velocity.
8. What is the p-r equation of Ellipse.
9. What is the moment of inertia of a circular disc about a tangent line.
10. Write down the expression for angular momentum and kinetic energy of a rigid body rotating about a fixed axis.

PART - B

Answer Any FIVE questions: (5 x 8 = 40 marks)

11. Find the centre of gravity of a solid hemisphere.
12. Find the centre of gravity of a sector of a circle of radius a subtending an angle 2α at the centre. Deduce the centre of gravity of the quadrant of the circle.
13. A solid hemisphere is supported by a string fixed to a point A on its rim and to a point O on a smooth vertical wall with which a curved surface of the sphere is in contact at P. If θ and θ are the inclinations of the string and the plane base of the hemisphere to the vertical, prove that $\tan \varphi = \frac{3}{8} + \tan \theta$.
14. Derive the equation of the common catenaryin the form y = C cosh x/c.
15. A string 10 cms long can just support a mass of 20 gms. A mass of 3 gms is attached at one end and the other end is kept fixed. If the mass revolves uniformly in a horizontal circle, find the greatest number of revolutions it can make per second.
16. A Second pendulum is carried down with a lift at a uniform acceleration of 20 cm/sec^2. How many seconds an hour will it lose?
17. Derive the differential equation of the central orbit in polar co-ordinates.
18. Find the moment of inertia of the right solid cone of height *h* and semi-vertical angle α about its axis.

PART - C

Answer Any TWO questions: (2 x 20 = 40)

19. (a) A square hole is punched out of a circular lamina of a radius 'a' having a radius as its diagonal. Show that the center of gravity of the remaining is at a distance $\dfrac{a}{4\pi - a}$ from the center of the circle.

(b) Four rods, each of length a and weight W are smoothly joined together to form a rhombus $ABCD$, which is kept in shape by a light rod BD. The angle BAD is 60° and the rhombus is suspended in a vertical plane from A. Find the thrust in BD.

(10+10)

20. (a) A uniform chain of length $2l$ is to be suspended from two points A and B in the same horizontal line so that either terminal tension is 'n' times that at the lowest point. Show that the span AB is $\dfrac{2l}{\sqrt{n^2}} \log (n + \sqrt{n^2 - 1})$.

(b) If a particle moving with S.H.M has velocity u, v, w, when its distances from an arbitrary point in the straight line are a, b, c respectively, prove that its period T is given by the equation $\dfrac{4\pi^2}{T^2} (b - c)(c - a)(a - b) = \begin{vmatrix} u^2 & v^2 & w^2 \\ a & b & c \\ 1 & 1 & 1 \end{vmatrix}$. (10+10)

21. (a) A particle P describes the orbit $r^n = a^n cosn\theta$ under a central force, the pole being the centre. Find the law of force.

(b) Derive the expression for the Kinetic energy of a rigid body moving in 2- dimensions.

(10+10)

22. (a) Find the moment of inertia of a parabolic plate cut off by an ordinate at a distance h from the vertex, about the tangent at the vertex.

(b) Find the moment of inertia of a hollow sphere about a diameter, its internal and external radii being b and a.

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