SUBJECT CODE : 11MT/ME/SM63

B. Sc. DEGREE EXAMINATION, APRIL 2014
BRANCH I – MATHEMATICS
SIXTH SEMESTER

COURSE   : **MAJOR ELECTIVE**
PAPER   : **SPECIAL TOPICS IN MECHANICS**
TIME   : **3 HOURS**   **MAX. MARKS : 100**

SECTION-A
ANSWER ALL QUESTIONS: **10 X 2 = 20**

1. Write the centre of gravity of a thin triangular lamina.

2. Write the centre of gravity of a circular area.

3. Write the Cartesian equation of the common Catenary.

4. What is an impulsive force?

5. State Newton's Experimental law.

6. State perpendicular axis theorem.

7. Write he M.I. of a thin uniform rod of length $2a$ and mass M about a line through the mid-point and perpendicular to it.

8. Write the expression for kinetic energy of a rotating rigid body about an axis.

9. What is the length of the simple equivalent pendulum.

10. Show that the tension at any point of a Catenary varies as the ordinate of point.

SECTION-B
ANSWER ANY FIVE QUESTIONS: **5 X 8 = 40**

11. A piece of uniform wire is bent into the shape of an isosceles triangle whose sides are respectively a, a, b. Show that the distance of the centre of gravity from the base of the triangle is given by $a \left(a^2 - \frac{b^2}{4} \right)^{1/2} / (2a + b)$.

12. Show that a tightly stretched common Catenary of parameter c, approximate to a parabola of latus rectum $2c$.

13. There are two equal perfectly elastic balls. One is at rest and is struck obliquely by the other. Show that after impact their directions of motion are at right angles.

14. Find the M.I. of a circular ring of radius a about (i) a diameter   (ii) a line through centre and perpendicular to the plane.

15. Prove that centres of suspension and oscillation are reversible.

16. Obtain the M.I of an elliptical lamina about its major and minor axes and perpendicular to the lamina.

17. A ball overtakes another ball of m times its mass which is moving with $\frac{1}{n}^{th}$ of its velocity n the same direction. If the impact reduces the first ball to rest, find the coefficient of restitution.

SECTION-C
ANSWER ANY TWO QUESTIONS: **2 X20 = 40**

18. a) Find the centre of gravity of a solid hemisphere.

    b) 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 must be $\frac{2l}{\sqrt{n^2-1}}\log(n + \sqrt{n^2 - 1})$.

19. a) Discuss the impact of an elastic sphere with a smooth fixed plane.

    b) Define compound pendulum. Derive the equation of oscillatory motion.

20. a) A shot of mass m kgms is discharged from a gun of mass M kgms which to free to recoil and the relative velocity is v. Find the velocity of each and the K.E. generated.

    b) Find the M.I of right solid cone of height h and semivertical angle α about its axis.

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