File No.

B.Sc. II Code B-22B Mechanics

Q.1. Find the centre of gravity of the astroid $x^{2/3}+y^{2/3}=a^{2/3}$ lying in the first quadrant.

Q.2. Find the centre of gravity of the parabola $y^2=4ax$ extending from the vertex to an extremity of the latus rectum.

Q.3. Find the centre of gravity of the arc of the catenary $y = c\cosh(x/c)$ from the vertex to the point (x,y).

Q.4 Find the centre of gravity of the region bounded by the parabola $x^2=4ay$, x-axis and the ordinate $x=b$.

Q.5. Define centre of gravity. Find the C.G. of a loop of the curve $r=a\cos 2\theta$.

Q.6 Find the C.G. of a plane lamina of uniform density in the form of a quadrant of an ellipse.

Q.7 Find the C.G of the area cut off from the parabola $y^2=4ax$ by the straight line $y=mx$.

Q.8 Define common catenary and find relations between

(i) x and s (ii) y and s

(iii) s and ψ

Q.9. A uniform chain of length l is suspended from two points A, B in the same horizontal line. If the tension at A is twice that at the lowest point show that the span AB is

$$\frac{l}{\sqrt{3}}\log(2+\sqrt{3}).$$

Q.10 Define the axis, vertex and directrix of a catenary.

Q.11 Show that for a common Catenary $x = c\log\left(\frac{\rho+s}{c}\right)$

Q.12 If the ends of a uniform inextensible string of length l hanging freely under gravity slide on a fixed rough horizontal rod whose coefficient of friction is μ. Show that at most they can rest at a distance

$$4l\log\left[\frac{1+\sqrt{(1+\mu^2)}}{\mu}\right]$$

Q.13 A uniform chain of length $2l$ is suspended by its ends which are on the same horizontal level. The distance apart $2a$ of the ends is such that the lowest point of the chain is at a distance a vertically below the ends. Prove that if c be the distance of the lowest point from the directrix of the Catenary, then

$$\frac{2a^2}{l^2-a^2}=\log\left(\frac{l+a}{l-a}\right) \text{ and } \tanh\frac{a}{c}=\frac{2al}{l^2+a^2}.$$

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