

2019

Time : 3 hours

Full Marks : 80

Candidates are required to give their answers in their own words as far as practicable.

1. Answer all questions of the following :

2×10 = 20

- (a) Define Coplanar forces.
- (b) Write the general condition of equilibrium of system of forces upon a rigid body.
- (c) Define virtual work.
- (d) The intrinsic equation of the catenary is :

(i) $y = C \sinh \left(\frac{x}{c} \right)$

(ii) $y = C \tan \psi$

(iii) $s = C \tan \psi$

(iv) $y = C \cosh \left(\frac{x}{c} \right)$

- (g) Write the formula of Radial Velocity and Transverse Velocity of a moving particle in polar coordinate.
- (h) Define Hooke's law for elastic strings.
- (i) Define central orbit.
- (j) State Newton's Law of Gravitation.

- 2. (a) State and prove the general condition of equilibrium of Coplanar forces acting on a rigid body. 10
- (b) A system of Coplanar forces has the total moments p, 2p and 3p about the points (0, 0), (0, 1) and (2, 4) respectively. Find the magnitude and the equation of the line of action of the resultant. 10

- 3. (a) State and prove principle of virtual work done by a system of Coplanar forces acting on a particle. 10
- (b) A square framework formed of four uniform rods of equal weight W joined together is hung up by one corner. A weight W is suspended from each of three corners and the shape of the square is preserved by a light rod along the horizontal diagonal. Find the thrust in the light rod. 10

- 4. (a) Derive Cartesian equation of common catenary. 10
- (b) A uniform chain of length ℓ is suspended from two points A and B in the same horizontal. If the tension of A is twice at the lowest point. Show that the span AB is $\frac{\ell}{\sqrt{3}} \log (2 + \sqrt{3})$. 10

5. (a) Find the equation of central axis of any given system of forces. 10

(b) To find the resultant wrench of two given Wrenches. 10

6. Discuss S. H. M. Find the period of oscillation. Prove that time period is free from amplitude. 20

7. (a) Find the expression for Radial and Transverse acceleration. 10

(b) The velocity component of a particle along and perpendicular to the radius vector from a fixed origin are λr^2 and μv^2 . Find the equation of path. Also, find the radial and transverse acceleration. 10

8. (a) To find the differential equation of a central orbit. 10

(b) Find the law of force towards the pole under which the curve $r^n \cos n\theta = a^n$ is described. 10

