

TH-4 ENGINEERING MECHANICS

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define elasticity.
 - b. Define force, write down its SI units.
 - c. What do you mean by kinematics.
 - d. Define coplanar and collinear forces.
 - e. Define couple.
 - f. State perpendicular axis theorem.
 - g. What is self locking machine.
 - h. Define centroid.
 - i. Define Coefficient of Restitution.
 - j. What is De -Alembert's principle.

2. Answer **Any six** Questions. 6 x 5
 - a. State and prove Lami's theorem.
 - b. Find the angle between two equal forces of magnitude p , when their resultant is (i) p and (ii) $p/2$.
 - c. Derive velocity ratio of a compound gear train.
 - d. Derive the relation between mechanical advantage, velocity ratio and efficiency of a machine.
 - e. A body of weight 50N is pulled along a rough horizontal plane by a force of 18N acting an angle of 14° with horizontal. Find the coefficient of friction.
 - f. Find the position of centroid of I-section having following dimensions:
Bottom flange = 300mm x 50mm
Top flange = 150mm x 50mm
Web = 300mm x 50mm
 - g. A ball of mass 2 kg moving with a velocity of 2 m/s hits directly on a ball of mass 4 kg at rest. The first ball, after impinging, comes to rest. Find the velocity of the second ball after the impact and the coefficient of restitution.

3. Find the moment of inertia of a T-section having flange and web both $120 \text{ mm} \times 30 \text{ mm}$ about X-X axis passing through the centre of gravity of the section. 10

- 4 A uniform ladder 'AB' 3m long weighs 200N. It is placed against a wall making an angle of 60° with the floor. The coefficient of friction between the wall and the ladder is 0.25 and that between the floor and ladder is 0.35. The ladder in addition to its own weight, support a man of 1000N at its top at B. Calculate the horizontal force 'P' to be applied to the ladder at the floor level to prevent slipping. 10
- 5 A simple screw jack has a thread of pitch 12 mm. Find the load that can be lifted by an effort of 20 N applied at the end of handle 500 mm long. Take efficiency of the machine as 50%. 10
- 6 Prove that the moment of inertia of a rectangular section having width 'b' and depth 'd' about x-x axis is $bd^3/12$. 10
- 7 The forces 20N, 30N, 40N, 50N & 60N are acting at one of the angular points of a regular hexagon towards the other five angular points taken in order. Find the magnitude and direction of resultant force. 10