



(Following Paper ID and Roll No. to be filled in your Answer Book)

**PAPER ID : 180220**

Roll No.

|  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|
|  |  |  |  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|--|--|

## B. Tech.

### (SEM. II) THEORY EXAMINATION, 2014-15 ENGINEERING MECHANICS

Time : 3 Hours]

[Total Marks : 100

Note : The question paper is divided in three sections. Attempt each section. Assume missing data suitably if necessary. The use of calculator is permitted.

#### SECTION - A

- 1 Attempt each short answer type questions : **10×2=20**
- (a) State the Triangle law of forces?
  - (b) What do you understand by free body diagram?
  - (c) Two forces of 100N and 150N are acting simultaneously at a point. What is the resultant of these two forces, if the angle between them is 45°?
  - (d) What is simply supported beam?
  - (e) Where does the centre of gravity of a triangle lies?
  - (f) What do you mean by "Inertia" of a body?
  - (g) For what purposes a truss is used?
  - (h) What is nominal diameter of a rivet?

- (i) What do you understand by elastic constant?
- (j) Define the young's modulus of elasticity?

### SECTION - B

- 2 Attempt any three parts of the following : **10×3=30**
- (a) What is the law of motion? Two forces act at an angle of  $120^\circ$ . The bigger force is of 40N and the resultant is perpendicular to the smaller one. Find the smaller force.
  - (b) Determine the minimum value of weight W required to cause motion of a block which rests on a horizontal plane. The block weighs 300N and the coefficient of friction between the block and plane is 0.6. Angle of wrap over the pulley is  $90^\circ$  and the coefficient of friction between the pulley and rope is 0.3.
  - (c) What is framed structure? List its application. How will you find the forces in a members of truss joint by graphical method ? Illustrate with an example.
  - (d) How will you find the mass movement of Inertia of
    - (i) Circular ring and (ii) Cylinder
  - (e) State clearly the" Hook's law". Derive a relation between stress and strain of an elastic body.

### SECTION-C

- 3 Attempt any five parts of the following : **10×5=50**
- (a) A mild steel rod of 20 mm diameter and 300mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm.

The ends of the rod and tube are brazed together and the composite bar is subjected to an axial pull of 40 kN. If  $E$  for steel and copper is 200 GPa and 100 GPa respectively. Find the stresses developed in the rod and the tube. Also find the extension of steel rod.

**OR**

What do you mean by principle of superposition. A copper rod circular in cross section, uniformly tapers from 40 mm to 20 mm in length of 1m. Find the elongation of rod when it is subjected to a tensile load of 50 KN. Take  $E$  as 100 GPa.

- (b) State and prove the "Parallel Axes Theorem".

**OR**

Determine the centroid of the area of a triangle with respect to its base.

- (c) Express the relationship between bending moment, shear force and loading.

**OR**

A beam carrying uniformly distributed load rests on two supports "b" m apart with an equal overhang of "a" m at each end. Determine the ratio  $b/a$  for the maximum bending moment to be as small as possible. Use this result to determine the most economical length for a railway sleeper if the rail centers are 1.6 m part and also for the meter-gauge rails.

- (d) Discuss the Coulomb law's of friction? A force of 250N pulls a body of weighs 500N up an inclined plain, the force being applied parallel to the plane. If the inclination of the plane to the horizontal is  $15^\circ$  Find the coefficient of friction.

**OR**

What is cone of friction? State its significance. Also distinguish between viscous friction and non- viscous friction.

- (e) Derive an expression for the shear stress at any point in the cross section of a beam.

**OR**

Three forces acting on a rigid body, are represented in magnitude and direction and line of action by three sides of triangle taken in order. Prove that the forces are equivalent to a couple whose moment is equal to twice the area of the triangle.

---