

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-I & II EXAMINATION – WINTER 2015

Subject Code: 110010**Date:05/01/2016****Subject Name: Mechanics of Solids****Time: 10:30am to 01:00pm****Total Marks: 70****Instructions:**

1. Attempt any five questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Fill in the blanks with appropriate answer from the given choices: **08**
- 1) Mass is a _____ quantity.
 a) Vector b) Scalar c) Tensor
 - 2) Two equal and opposite parallel forces, whose lines of action are not same, form a _____.
 a) Shear Force b) Couple c) Principal Stress
 - 3) Law of Parallelogram of forces is applicable to _____ forces.
 a) Two Parallel b) Two concurrent c) Three Parallel
 - 4) In 'Method of Joints' for truss, forces acting at a joint are _____.
 a) Concurrent b) Parallel c) Non-Concurrent
 - 5) As per Hooke's law, Within elastic limit, Stress is _____ proportional to Strain.
 a) Directly b) Inversely c) Not
 - 6) Lateral Strain and Linear Strain are of _____ nature.
 a) Same b) Opposite
 - 7) A Hinge support offers _____ support reactions.
 a) One b) Three c) Two
 - 8) When a block is on the verge of sliding down the inclined plane, Friction is _____.
 a) Minimum b) Maximum c) Zero
- (b)** Answer ANY THREE: **06**
- 1) Write Characteristics of a Force.
 - 2) Conditions for Perfect Truss, Deficient Truss and Redundant Truss explaining the notations used.
 - 3) State Lami's Theorem
 - 4) Define Angle of Repose.
- Q.2 (a)** Find the Resultant force of a force system shown in FIG.1. Also sketch the Resultant force. **07**
- (b)** Find the Magnitude, Direction and Location with respect to 'A' of the Resultant force for a Non-Concurrent force system shown in FIG.2. **07**

- Q.3** (a) Determine the Member forces in all members of a Truss shown in FIG.3. Use any Method. **07**
- (b) A 6m long uniform ladder of weight 1000N is resting on a horizontal surface and leaning against a smooth vertical wall. It makes 60° inclination with horizontal. It is on the verge of sliding when a man of weight 500N climbs upto 2m along the ladder from the foot of the ladder. Calculate co-efficient of friction between ladder and Floor. **07**
- Q.4** (a) For the lamina (plane body) shown in FIG.4., locate centroid. **07**
- (b) For the lamina (plane body) shown in FIG.4., calculate Moment of Inertia about base AB. **07**
- Q.5** (a) A bar of Varying section (Stepped bar) is subjected to concentrated axial loads as shown in FIG.5. Take $E = 2 \times 10^5 \text{ N/mm}^2$, Calculate:
 1) Load 'P' required for equilibrium.
 2) Stress in each segment
 3) Deformation of each segment and Total deformation of the bar. **07**
- (b) A cube of 150mm x 150mm x 150mm is subjected to an axial Tensile forces of 1000kN, 800kN and 600kN along X-dir, Y-dir and Z-dir respectively. Taking Poisson's ratio $\nu = 0.25$ and Modulus of Elasticity, $E = 2 \times 10^5 \text{ N/mm}^2$, Determine:
 1) Change in each dimension
 2) Change in Volume
 3) Stress in each direction **07**
- Q.6** (a) For the beam shown in FIG.6., Find Support Reactions. **05**
- (b) For the beam shown in FIG.6., Draw Shear Force and Bending Moment Diagrams with values at important points. **09**
- Q.7** (a) A simply supported beam has T-cross section as shown in FIG.7. It is subjected to Bending Moment of 50kN-m. Find Bending Stress at extreme fibers and draw bending stress distribution across the section. **07**
- (b) A certain point in a strained material is subjected to following stresses: **05**
 a) Major stress, $\sigma_x = 100\text{MPa}$ (Tensile),
 b) Minor stress, $\sigma_y = 60\text{MPa}$ (Tensile)
 c) Shear stress, $\tau = 40\text{MPa}$
 Determine Principal Stresses and Location of Principal Planes
- (c) Define Principal Stress and Principal Plane. **02**

Figures

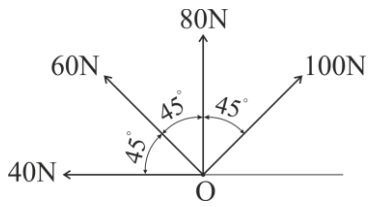


FIG.1

FIG.2

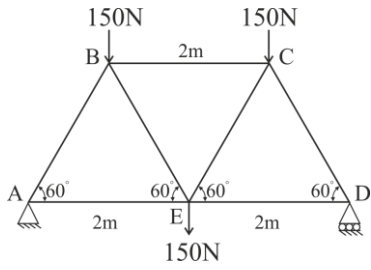
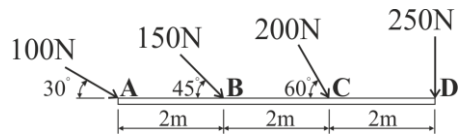


FIG.3

FIG.4

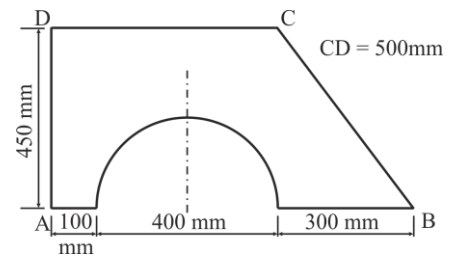


FIG.5

FIG.6

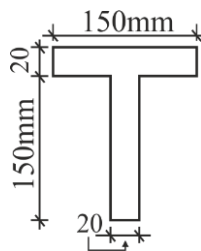
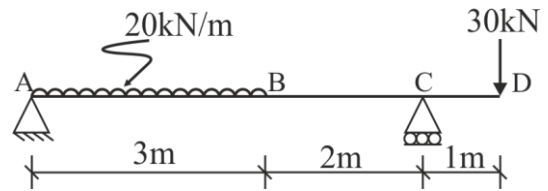
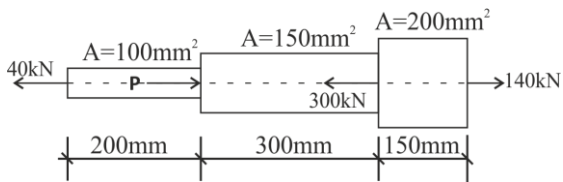


FIG.7
