Seat No.: _____ Enrolment No._____

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 $E = 2 \times 10^5$ N/mm^2, Calculate: **07**

1) Load 'P' required for equilibrium.
2) Stress in each segment
3) Deformation of each segment and Total deformation of the bar.

(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 v = 0.25 and Modulus of Elasticity, $E = 2 \times 10^5$ N/mm^2, Determine: **07**

1) Change in each dimension
2) Change in Volume
3) Stress in each direction

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, σ_x = 100MPa (Tensile),
b) Minor stress, σ_y = 60MPa (Tensile)
c) Shear stress, τ = 40MPa

Determine Principal Stresses and Location of Principal Planes

(c) Define Principal Stress and Principal Plane. **02**

Figures

FIG.1

FIG.2

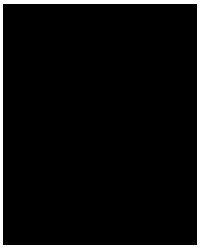
FIG.3

FIG.4

FIG.5

FIG.6

FIG.7



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