Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEMESTER– 1st / 2nd (SPFU) EXAMINATION – WINTER 2016

Subject Code: ENG004 **Date: 28/01/2017**

Subject Name: Mechanics of Solids

Time:02:30 PM TO 5:00 PM **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) Give the most appropriate answer: **07**

(1) Mass is a _____ quantity.
   a. Vector
   b. Scalar
   c. Tensor
   d. All the above

(2) 1 GPa = _____ N/mm^2
   a. 1
   b. 103
   c. 109
   d. 106

(3) Point of contraflexure is where _____
   a. Shear force is zero
   b. Shear force changes sign
   c. Bending moment is zero
   d. Bending moment changes sign

(4) As per Hook's law, within elastic limit, stress is _____ proportional to strain.
   a. Directly
   b. Inversely
   c. Not
   d. None of the above

(5) A hinge support offers _____ support reactions.
   a. One
   b. Two
   c. Up to two
   d. Three

(6) Modulus of rigidity is the ratio of _____
   a. Axial stress to axial strain
   b. Axial strain to axial stress
   c. Shear stress to shear strain
   d. Shear strain to shear stress

(7) Unit of velocity is _____
   a. m/sec
   b. m
   c. m/sec^2
   d. m^2

	(b)	Define the following terms: (1) Rigid Body (2) Moment (3) Centroid (4) Young's modulus (5) Poisson's ratio (6) Angle of repose (7) Principle of superposition	**07**
Q.2	**(a)**	Find the resultant force of a force system as shown in figure-1.	**07**
	(b)	Find the magnitude, direction and location with respect to O of the resultant force for a non-concurrent force system as shown in the figure-2.	**07**
Q.3	**(a)**	Determine the reactions at support for the beam shown in figure-3.	**07**
	(b)	Draw Shear Force and Bending Moment diagram for the beam shown in figure-4.	**07**
Q.4	**(a)**	Using first principle, obtain moment of inertia of triangular lamina about centroidal axis parallel to base.	**07**
	(b)	Find CG of a plane area shown in figure-5.	**07**
Q.5	**(a)**	A ladder AB is 4.5m long and 450N weight rests on a rough horizontal floor at end B and vertical wall at A making 60° with horizontal. The co-efficient of static friction is 0.4 for all contact surfaces. A man of 800N weight climbs on the ladder. Determine the minimum distance travelled on the ladder, when it is on the verge of slipping.	**07**
	(b)	In a simple lifting machine, to lift a load of 120N through a distance of 20cm, an effort of 20N is to be applied for a distance of 1.5m. Find (I)Mechanical Advantage (II)Velocity Ratio (III)Mechanical efficiency of the machines	**07**
Q.6	**(a)**	A short concrete column 450mmX450mm in section is axially loaded to 500kN. The column is strengthened by four; 16mm dia. Steel bars each one at corner. Calculate stresses in concrete and steel. Take Ec=14GPa & Es=210GPa.	**07**
	(b)	A rod of length 1m and diameter 20mm is subjected to tensile load of 30kN. The increase in length of rod is 0.3mm and decrease in diameter is 0.0018mm. Calculate the Poisson's ratio & modulus of elasticity.	**07**
Q.7	**(a)**	(I) State and prove law of Parallelogram of forces. (II) State and explain Laws of static friction.	**07**
	(b)	Explain: (I) Type of beam with sketches (II) Type of loading on beam (III) Type of supports & corresponding reactions.	**07**

Figure-1

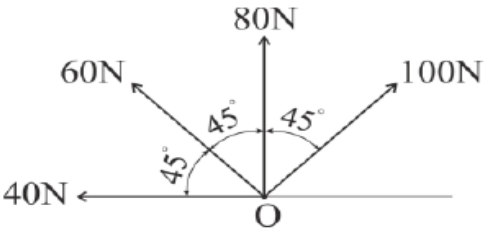


Figure-2

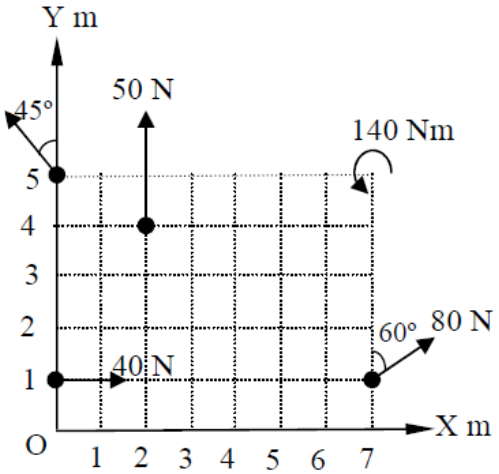


Figure-3

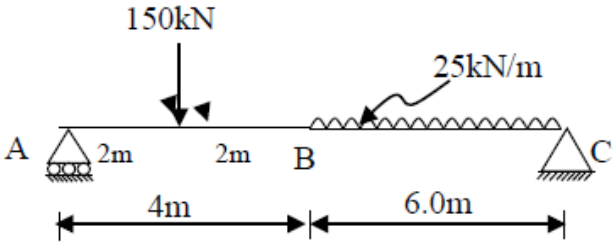


Figure-4

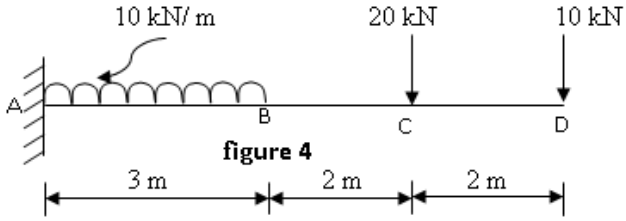
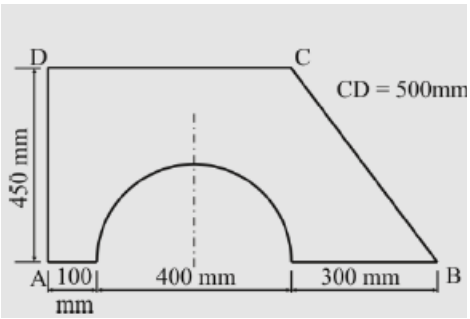


Figure-5



****