Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (New) EXAMINATION – WINTER 2015

Subject Code:2130003 Date:05/01/2016

Subject Name: Mechanics of Solids

Time: 2:30pm to 5:00pm Total Marks: 70

Instructions:

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

			Marks
Q.1		**Short Questions (each question carry one Mark)**	**14**
	a	Define Pappu's Guldinus theorem- I	
	b	Define Principle of Superposition	
	c	Define law of Transmissibility	
	d	Define Couple	
	e	Enlist types of supports.	
	f	Sketch qualitative shear stress distribution diagrams of 'I' section of the beams.	
	g	Give mathematical expression of Lami's theorem, Fill in the blanks	
	h	Lateral strains are _____ longitudinal strains. (sometimes less than, always less than, never less than)	
	i	The shape of shear force diagram for cantilever beam subjected to couple at free end is _____ [horizontal straight line, zero, parabola, incline straight line].	
	j	Moment is a _____ vector, whereas Couple is a _____ vector. (free, null, fixed)	
	k	At the point of contraflexure _____ changes its sign. (shear force, bending moment, axial force)	
	l	The Relation between Shear force and Bending moment is _____.	
	m	The relation between, dynamic coefficient of friction (μd) is_____ static coefficient of friction (μs). (less then/ greater then/Equal to)	
	n	Relation between Modulus of Elasticity and Bulk Modulus is _____.	
Q.2	**(a)**	Write assumption made in the theory of pure bending.	**03**
	(b)	State and Prove with usual notation 'The law of Parallelogram'.	**04**
	(c)	The forces are acting on a rigid body as shown in **Figure 1**. Find the resultant of the given force system, in terms of magnitude and direction. Find the location of Resultant with respect to point A.	**07**
		OR	
	(c)	Determine centroid of the section shown in **Figure 2.**	**07**
Q.3	**(a)**	At a point in a strained material, the state of stress is as shown in **figure 3.** Determine (i) principal stresses	**03**
	(b)	For problem above in Q.3 (a), **figure 3** calculate (i) location of principal planes and (ii) maximum shear stress and its location.	**04**

	(c)	Draw shear force diagram and bending moment diagram for beam shown in **figure 4.**	**07**

OR

Q.3	**(a)**	A solid steel shaft has to transmit 350 kW at 900 r.p.m. Find the diameter of the shaft if the shear stress is to be limited to 125 N/mm^2. Calculate the diameter of the shaft.	**03**
	(b)	A solid steel shaft has to transmit 350 kW at 900 r.p.m. Find the diameter of the shaft if the shear stress is to be limited to 125 N/mm^2. Calculate the diameter of the shaft if hollow shaft is provided of internal diameter equals 0.75 times external diameter	**04**
	(c)	A simply supported beam 10 m long carries three point loads at 50 kN, 60 kN and 80 kN at 3m, 5m and 8m from left support. Draw S.F. and B.M. diagram for the beam.	**07**
Q.4	**(a)**	Define friction and State laws of Dry friction.	**03**
	(b)	The T-section is manufactured by connecting two equal rectangular blocks having size 200 mm x 30 mm. Determine moment of inertia of the section about its horizontal axis.	**04**
	(c)	Find the magnitude of the Horizontal force 'P' applied to the lower block to cause impending motion as shown in **figure 5.** Take $\mu = 0.3$ at all contact surfaces. Weight of block 'A' is 300 N and weight of block 'B' is 1200 N.	**07**

OR

Q.4	**(a)**	Determine reaction at supports for the Beam as shown in **Figure 6**.	**03**
	(b)	Determine deformation in each part of the bar ABCD shown in **Figure 7**. Take $E = 2 \times 10^5$ N/mm^2.	**04**
	(c)	A uniform ladder AB weighing 230 N and 4m long, is supported by vertical wall at top end B and by horizontal floor at bottom end A. A man weighing 550 N stood at the top of the ladder. Determine minimum angle θ of ladder AB with floor for the stability of ladder. Take co efficient of friction between ladder and wall as 1/3 and between ladder and floor as 1/4.	**07**
Q.5	**(a)**	Derive formula for determine volumetric strain of circular bar of diameter 'd', length 'L', modulus of elasticity 'E' subjected to axial tensile force 'P' and Poisson's ratio 'μ'.	**03**
	(b)	The Rectangular block of size 300mm (b) x 450mm (d) is subjected to a uniform bending moment 120 kNm. Calculate the bending stresses at extreme fiber of the blocks. Also, find out total tensile and compressive forces due to bending stresses. Draw bending stress distribution diagram also.	**04**
	(c)	A rectangular block of size 350mm (l) x 50mm (b) x 150mm (h) is subjected to forces shown in **figure 8**. $E = 2 \times 10^5$ N/mm^2 and Poisson's ratio is 0.28, calculate the Change in volume of block.	**07**

OR

Q.5	**(a)**	State the condition of equilibrium for Co-planner force system.	**03**
	(b)	The Rectangular block of size 300mm (b) x 450mm (d) is subjected to a shear force 80 kN. Calculate the Shear stresses at neutral axis and Junction of the blocks. Draw Shear stress distribution diagram also.	**04**
	(c)	A system of connected flexible cables shown in **figure 9** is supporting two vertical forces 300 N and 400 N at points B and D. determine the forces in various segments of the cable.	**07**

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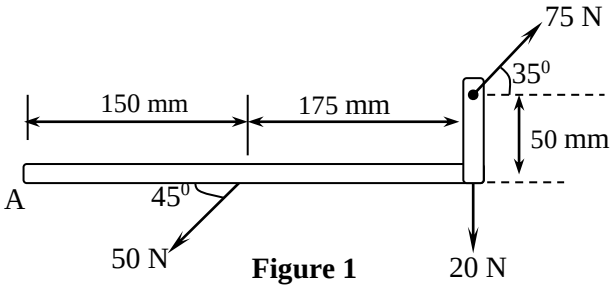

Figure 1

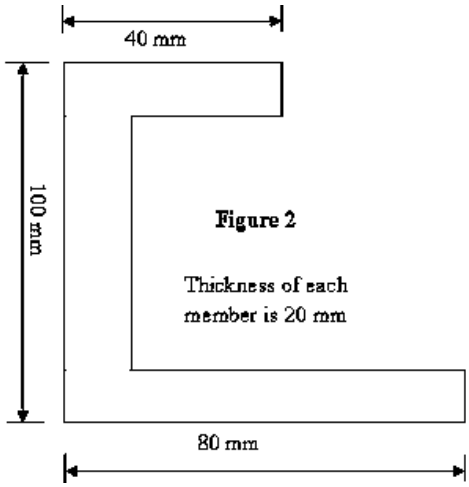

Figure 2

Thickness of each member is 20 mm

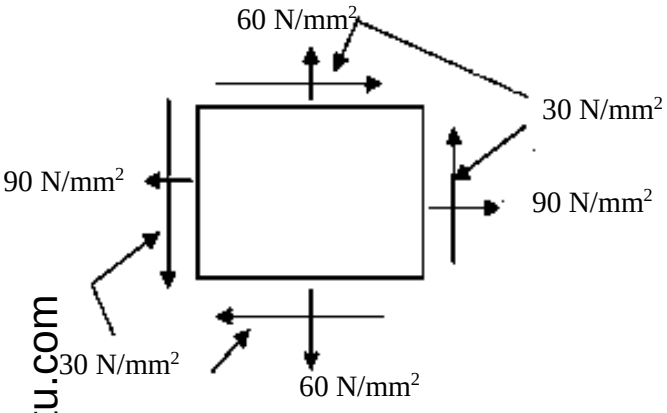

Figure 3

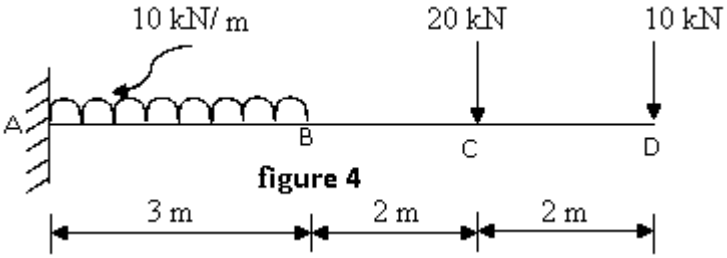

figure 4

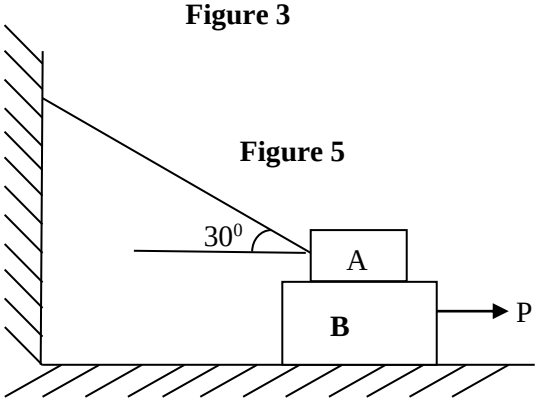

Figure 5

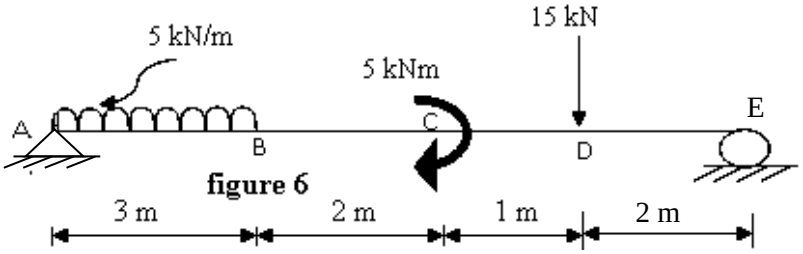

figure 6

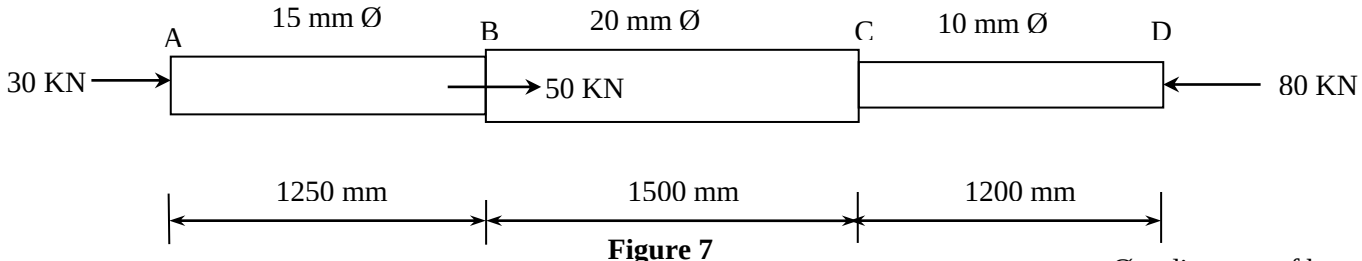

Figure 7

Ø = diameter of bar

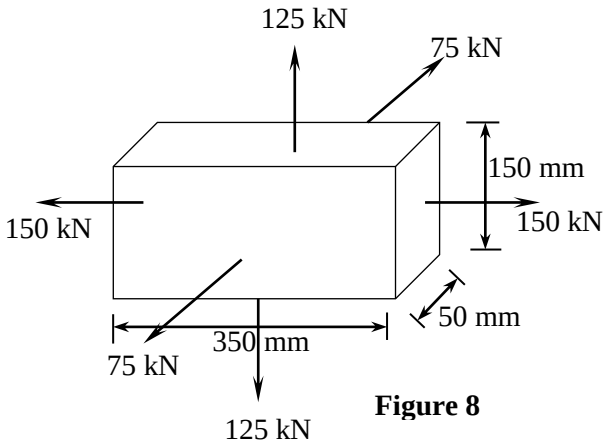

Figure 8

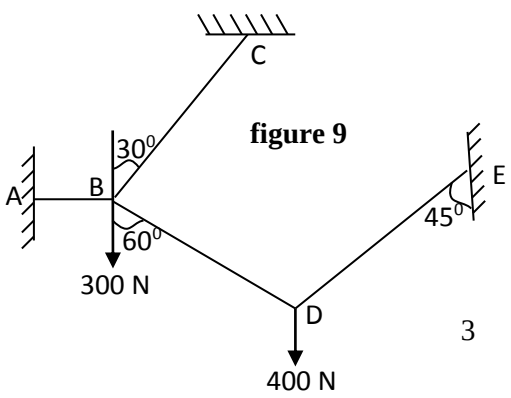

figure 9