

**GUJARAT TECHNOLOGICAL UNIVERSITY**

BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

**Subject Code: 2130608****Date: 30/11/2019****Subject Name: Strength of Materials****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

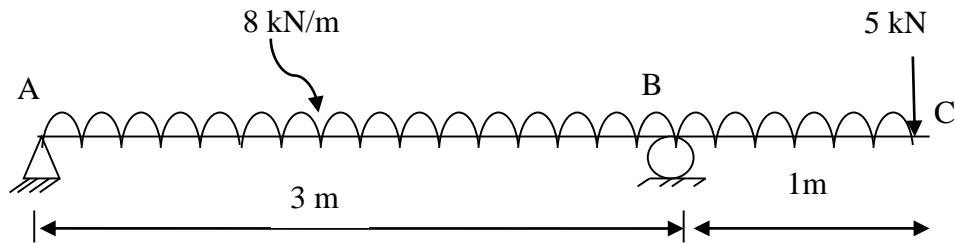
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

		MARKS
<b>Q.1</b>	(a) Define: (1) Toughness (2) Hardness (3) Fatigue strength	<b>03</b>
	(b) Enlist various type of loads and type of supports.	<b>04</b>
	(c) Calculate and Draw Shear force and Bending moment diagram of cantilever beam of 4 m span. A load of 10 kN acting at free end and 20 kN is acting at 2m from free end, also UDL 10 kN/m is acting on 2 m from fixed end.	<b>07</b>
<b>Q.2</b>	(a) Explain assumption made in theory of pure bending.	<b>03</b>
	(b) Derive relation between the rate of loading , shear force and bending moment in a beam.	<b>04</b>
	(c) Draw Shear force and Bending moment diagram for the beam shown in fig 1.	<b>07</b>
<b>OR</b>		
<b>Q.3</b>	(c) Find support reaction for the beam shown in fig. 2.	<b>07</b>
	(a) Explain the principal planes, principal stresses and natural axis.	<b>03</b>
	(b) Explain MOHR'S circle of stress?	<b>04</b>
	(c) A steel bar 1600 mm long is acted upon by forces as shown in fig. 3. Find the elongation of the bar. Take $E = 2 \times 10^5$ N/mm <sup>2</sup> .	<b>07</b>
<b>OR</b>		
<b>Q.3</b>	(a) What is Point of Contra flexure? What is its significance?	<b>03</b>
	(b) Derive the Torsion equation with usual notations.	<b>04</b>
	(c) At a certain point in a strained material direct stress of 60 N/mm <sup>2</sup> tensile is acting. Find normal stress, tangential stress and resultant stress on a plane inclined at 30° to the plane of stress. Also verify the same by graphical method.	<b>07</b>
<b>Q.4</b>	(a) State the Laws of Friction.	<b>03</b>
	(b) Prove with usual notation the maximum shear stress for a rectangular section is 1.5 times the average shear stress.	<b>04</b>
	(c) A hollow steel shaft, 3 m of length must transmit a torque of 25 kN.m. The total angle of twist in this length is not to exceed 2.5 ° and the allowable shearing stress in the material is 90 Mpa. Calculate the inside diameter of the shaft and thickness of the metal. $G = 85$ GN/m <sup>2</sup> .	<b>07</b>
<b>OR</b>		
<b>Q.4</b>	(a) Write the assumption for Theory of torsion	<b>03</b>
	(b) Draw representative shear stress distribution diagrams for Hollow rectangle, b) I section, c) Hollow circle	<b>04</b>
	(c) Derive the torsion formula. $\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{l}$	<b>07</b>

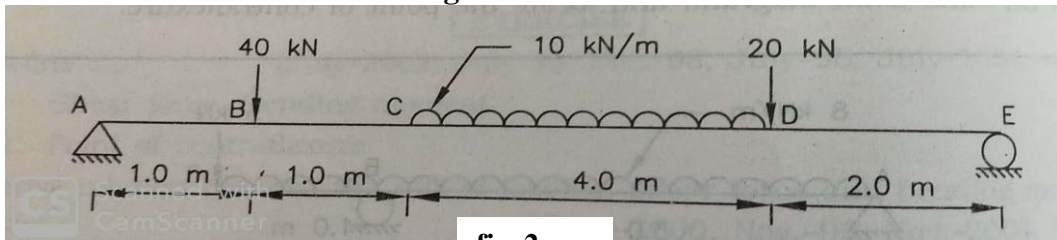
- Q.5 (a) Define section modulus and its importance in bending. 03  
 (b) Define :- i) Brittleness ii) Malleability iii) working stress 04  
 iv) Ductility  
 (c) A ladder AB is 4.5m long and 450N weight rests on a rough horizontal floor at end B and vertical wall at A making 60° with horizontal. The coefficient 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

**OR**

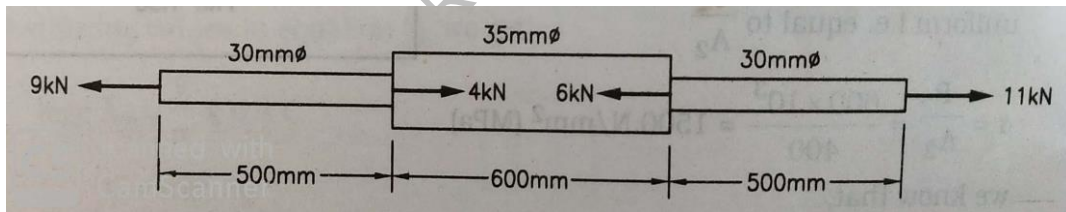
- Q.5 (a) Explain Classification of Materials 03  
 (b) State assumption made in the theory of pure bending. 04  
 (c) A T- section has dimensions shown in fig.4. The section is subjected to shear force of 180 kN. Calculate (i) shear stress at junction of flange & web. (ii) Shear stress at neutral axis. Sketch the shear stress distribution diagram for the section. 07



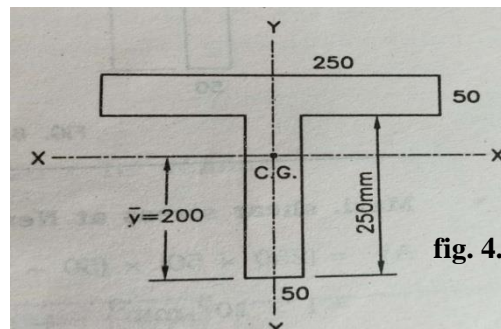
**fig. 1.**



**fig. 2.**



**fig. 3.**



**fig. 4.**

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