*Seat No.: _____* *Enrolment No._____*

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC Sem-I June-July Examination 2011**

**Subject code: X11901 Subject Name: STRENGTH OF MATERIALS**

**Date: 06/07/11 Total Marks: 70 Time: 10:30am to 1:00pm**

## Instructions:

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

**Q.1** **(a)** (i)Explain with sketch the terms in brief **06**

I. Point of contra flexure
II. Elastic limit and Proportionality limit
III. Izod impact test specimen
IV. Hardness test indentor

**(b)** Discuss the type of failures observed in cast iron, timber and mild steel subjected to the compression test. **03**

**(c)** Find the minimum diameter of steel wire if the permissible stress is limited to $90x10^6$ N/m$^2$ and the 2 m wire is required to lift a load of 10 kN Also determine the elongation of steel wire when stressed to it's permissible limit. (Take E= 200 Gpa. ) **05**

**Q.2** **(a)** A load of 100 N falls through a height of 2 cm on to a collar rigidly attached to the lower end of a vertical bar 1.5 m long and of 1.5 cm$^2$ cross-sectional area. The upper end of the vertical bar is fixed. Take E= $2x10^5$ N/mm$^2$. **07**

Determine :

(I) Maximum instantaneous stress induced in the vertical bar,
(II) Maximum instantaneous elongation, and
(III) Strain energy stored in the vertical rod.

**(b)** Explain: Concept of strain energy, resilience, proof resilience, shear resilience, gradual loading, sudden and impact loadings **07**

**OR**

**(b)** Two plates of 20mm thickness are to be connected by a single riveted lap joint with rivets of 18mm nominal diameter. Find the necessary pitch of the rivets . Take shear stress as 100N/mm$^2$, bearing stress as 300N/mm$^2$ and tearing strength as 120N/mm$^2$ **07**

**Q.3** **(a)** A hollow shaft of external diameter 120 mm transmits 300 kW power at 200 r.p.m. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 60 N/mm$^2$. **07**

**(b)** Derive an expression for the shear stress produced in a circular shaft which is subject to torsion. What are the assumptions made in the derivation? **07**

**OR**

**Q.3** **(a)** The principal stresses at a point in a bar are 200 N/mm$^2$ (tensile) and 100 N/mm$^2$ (compression). Determine the resultant stress in magnitude and direction on a plane inclined at 60$^o$ to the axis of the major principal stress. Also determine the maximum intensity of shear stress in the material at the point. **07**

**(b)** Two solid shafts AB and BC of aluminum and steel respectively are rigidly fastened together at B and attached to two rigid supports at A and C. Shaft AB is 7.5 cm in diameter and 2m in length. Shaft BC is 5.5 cm in diameter and 1m in length. A torque of 20 kN.cm is applied at the junction B. Compute the maximum shearing stresses in each material. What is the angle of twist at the junction? Take the modulus of rigidity of the materials as 0.3 x 10$^5$ N/mm$^2$ for aluminum and 0.9 x 10$^5$ N/mm$^2$ for steel. **07**

**Q.4** **(a)** Compare and contrast the riveted joints and welded joints .Illustrate with neat sketches different types of riveted or welded joints. **07**

**(b)** Find out the fixing moments, support reactions and maximum deflection for a fixed beam AB carrying an eccentric point load at C. Compare the values with that of simply supported beam. **07**

**OR**

**Q.4** **(a)** A solid circular shaft of 120mm is subjected to twisting moment of 8 kNm and a bending moment of 5kNm. Determine principal stresses in the section and specify the position of the plane on which they act. **07**

**(b)** A simply supported steel beam 6 m long is circular in cross-section and is of 15 cm diameter. What point load should be placed at the mid span to restrict the deflection to1.035 cm Take E=200 Gpa. What will be the slope at the ends? **07**

**Q.5** **(a)** Find the deflection at the centre of the span AB for a simply supported beam of uniform flexural rigidity EI by Moment area method, if the span L of the beam carries two symmetrically placed loads P at one-third of the span from each end A and B. **07**

**(b)** A simply supported beam of span 4m and circular section having diameter 200mm is loaded by udl of 8 kNm up to 2m (half span), find the maximum deflection of the beam by Macaulay's method take E=2* 10$^4$N/mm$^2$ **07**

**OR**

**Q.5** **(a)** Explain Distribution factor. Draw bending moment diagram for the continuous beam using moment distribution method. **07**

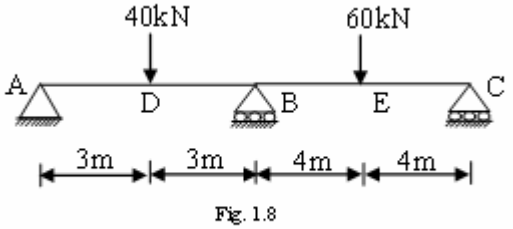


Fig. 1.8

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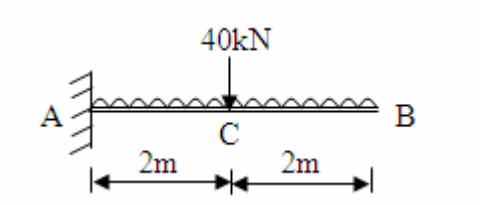
**(b)** State the relation between load ,shear force and bending moment .For the cantilever beam shown, draw shear force and bending moment diagrams and show important points with value. **07**

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