Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - Ist Semester–Examination – May/June- 2012

Subject code: X11901

Subject Name: Strength of Materials

Date:31/05/2012 **Time: 10:30 am – 01:00 pm**

Total Marks: 70

Instructions:

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

Q.1 **(a)** Explain following terms in brief. **07**
(1) Ductility (2) Brittleness (3) Toughness (4) Resilience
(5) Hardness (6) Malleability (7) Creep

(b) Define Simple Stress and Linear Strain. Also explain basic characteristic stress-strain curve for ductile material. **07**

Q.2 **(a)** Explain relation between the rate of loading, shear force and bending moment at a section of beam. **07**

(b) A simply supported beam 8 m long carries three point loads at 100 kN, 150 kN and 200 kN at 2m, 5m and 7m from left roller support. The self-weight of the beam is 25 kN/m. The right end support is hinged. Draw S.F. and B.M. diagram for the beam. **07**

OR

(b) A simply supported beam of length 8 m rests on supports 6 m apart, the right hand end is overhanging by 2 m. The beam carries a uniformly distributed load of 1200 N/m over the entire length. Draw S.F. and B.M. diagrams and find the point of contraflexure, if any. **07**

Q.3 **(a)** What do you mean by "Strain Energy" and Proof Resilience"? Also, derive an expression for strain energy stored in a body when the load is applied suddenly. **07**

(b) A column fixed at bottom is of uniform strength carries an axial compressive load of 600 kN. The length of column is 20 m and having weight per unit volume as 0.00008 N/mm^3. If area of the column at the top is 400 mm^2, find area of column at the base. **07**

OR

Q.3 **(a)** For torsion of a circular shaft, derive the equation $T/I_P = \tau/R = C\theta/L$ with usual notations. **07**

(b) A solid circular steel shaft (G = 80 GPa), 4 m long transmit 300 kW of power at 450 r.p.m. If the allowable shearing stress is limited to 70 MPa and allowable angle of twist is 0.045 radian, determine the minimum permissible diameter of the shaft. **07**

Q.4 **(a)** A torque of 10 kNm is transmitted a shaft of 80 mm diameter through keys and couplings. If the length of the key is 150 mm, breadth 20 mm, find maximum stresses developed in keys and shaft. **07**

(b) A short metallic column of 500 mm^2 cross sectional area carries an axial compressive load of 100 kN for a plane inclined at 60˚ with the direction of load, calculate : Normal, Tangential, Resultant, Maximum shear stresses and obliquity of the resultant stress. **07**

OR

Q.4 **(a)** A cantilever beam of 4 m length, contain 40 kN and 30 kN load at 3 m and 4 m respectively form fixed end. Calculate rotation and deflection at free end using strain energy method. Take $E = 2 \times 10^5$ N/mm^2, $I = 5 \times 10^8$ mm^4. **07**

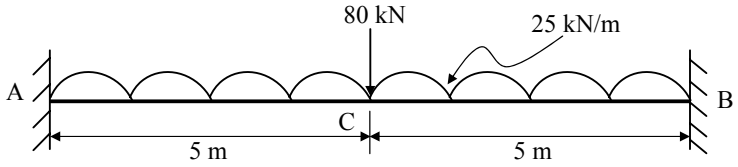
Q.4 **(b)** A simply supported beam of 8 m length loaded with point load of 48 kN at the center of left 4 m span, and with 10 kN/m uniformly distributed load on remaining 4 m span. Using Macaulay's method, find slope at each end and maximum deflection. Take $E = 200$ kN/mm^2, $I = 6.5 \times 10^8$ mm^4. **07**

Q.5 **(a)** Define "Eccentricity" and explain different types of failure of a riveted joint with sketch. **07**

(b) Design a butt weld to connect a 12 mm thick bracket plate to the flange of a column. The bracket is to transmit a load of 100 kN at an eccentricity of 150 mm and the steel conforms to IS: 226-1975. **07**

OR

Q.5 **(a)** Analyse a fixed beam as shown in fig. below, using area moment method. Also draw S.F.D. and B.M.D. **07**



(b) A horizontal beam ABCD is carried a hinged supports and is continuous over three equal spans of 4 m each. The beam has equal moment of inertia and the modulus of elasticity E is 200 kN/mm^2. If a load of 30 kN/m is uniformly distributed over each of the two spans AB and BC, draw B.M.D. **07**

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