Enrolment No.\_\_\_\_\_

Date:01/06/2017

**Total Marks: 70** 

# **GUJARAT TECHNOLOGICAL UNIVERSITY**

PDDC- SEMESTER-I - EXAMINATION – SUMMER 2017

Subject Code: X11901

Subject Name: STRENGTH OF MATERIALS

Time: 02:30 PM to 05:00 PM

## Instructions:

- 1. Attempt any five questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) Define and explain basic characteristic of stress and strain and draw stress-strain 07 curve for ductile material (Mild steel) for Tension Test.
  - (b) Define Strain energy and Proof Resilience and Derive an expression for strain 07 energy stored in a body when the member is subjected to Torsional Moment.
- Q.2 (a) For torsion of a circular shaft, Prove with usual notations  $\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{R}$ . Give 07

suitable assumptions made in the above theory also.

(b) Determine the reaction at support for the continuous beam ABC as shown in figure 1. Using Moment distribution method.

### OR

- (b) A solid steel shaft has to transmit 150 kW at 750 r.p.m. Find the diameter of the shaft if the shear stress is to be limited to 120 N/mm<sup>2</sup>. Estimate the possible % saving in the material of the shaft if hollow shaft of internal diameter equals 0.80 times external diameter is replaced against solid shaft.
- **Q.3** (a) Define the following terms in brief

(1) Brittle (2) Strength (3) Toughness

(b) In a tension test on Metal specimen with initial diameter of 12 mm and length 04 of 240 mm, following readings were recorded:

i) Diameter after failure = 10.3 mm

ii) Length after failure = 262 mm

iii) Failure load = 54 kN

Compute % contraction, % elongation, True stress at failure & engineering stress at failure.

(c) Calculate the strain energy in a bar 3m long and 40mm diameter, when it is subjected to a tensile load of 100KN. What will then a modulus of resilience of the material of the bar?

### OR

- Q.3 (a) Derive the expression for the slope and deflection of cantilever beam subjected 07 to point load at free end.
  - (b) Determine deflection at point mid point for the Simply supported overhanging 07 beam as shown in figure 2, using double integration method. Take EI = 20000 kNm<sup>2</sup>.
- Q.4 (a) Derive the expression for the fixed end moment for the beam subjected to 07 uniformly distributed load subjected to over the entire span.
  - (b) Analyse the fixed beam shown in figure 3. Draw shear force and bending 07 moment diagram.

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- Q.4 (a) Define Shear force & bending moment and derive the relation between rate of 07 loading, shear force and bending moment.
  - (b) A Simply supported beam of 8 m length, contain 20 kN, 40 kN and 30 kN load 07 at the interval of 2 m each from left end. Draw S.F. and B.M. diagram for the beam.
- Q.5 (a) What are principal planes and principal stresses?
  - (b) For the element shown in the figure 4, find the normal stress, tangential stress 10 and resultant stress. Also, find principal stresses and principal planes. Use any method.

#### OR

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

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(b) Two plates 12 mm thick are joined by single riveted lap joint. The diameter of the rivets is 20 mm and pitch of 50 mm. Determine strength and efficiency of the riveted joint. Consider permissible tensile stress of plate material = 120 MPa, permissible shearing stress of rivet material = 75 MPa & permissible crushing stress of rivet material = 150 MPa.



Figure 1







Figure 3

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