

Roll No. 

Total No. of Pages : 02

Total No. of Questions : 09

B. Tech.(AE) (Sem.-3rd) (2011 Batch)

**MECHANICS OF MATERIALS**

Subject Code : BTAE-301

Paper ID : [A1112]

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.

**SECTION-A**

1. Write briefly :
  - a. Explain the difference between stress and strength.
  - b. Name four ductile materials.
  - c. What is the difference between Yield Strength and Ultimate Strength?
  - d. Define S.F. and B.M.
  - e. What is the expected nature of S.F. and B.M. at point of contraflexure?
  - f. What are the assumptions of Simple Bending Theory?
  - g. What is the difference between section modulus and moment of inertia?
  - h. What are assumptions of Rankine-Gordon formula?
  - i. What is meant by Modulus of Rupture?
  - j. What is meant by Hoop Stress?

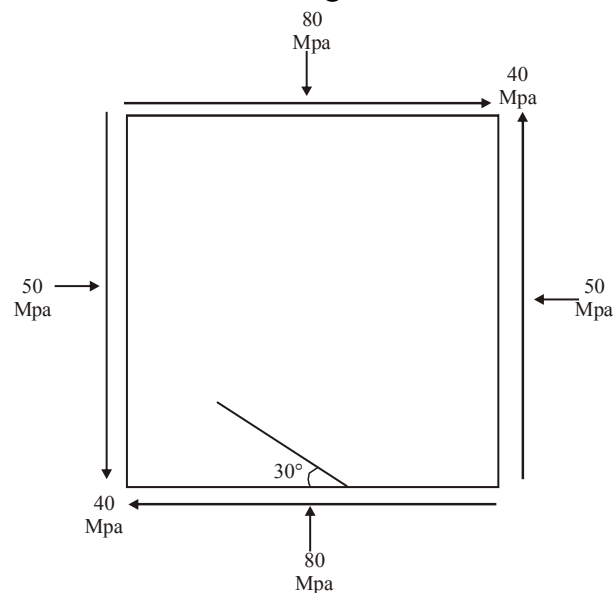
**SECTION-B**

2. Derive the formula for stress, strain and deflection in a bar of varying cross-section and uniform strength.
3. Explain the method of construction of B.M. and S.F. diagrams by use of cantilever moments.
4. Show the application of bending formula to a composite beam made up of two different materials.

5. Explain the concept of complimentary shearing stresses in shafts under pure tension.
6. Apply following theories of failure to thin cylinders :  
Principle stress theory, Principle strain theory, maximum shear stress theory, strain energy theory and distortion energy theory.

### SECTION-C

7. Following figure shows the stress condition at a point. Find the normal, shear and resultant stresses and the direction of resultant stress for the plane inclined at  $30^\circ$  as shown in figure.



8. A hollow steel shaft 8 cm outside diameter is coupled to a solid phosphor bronze shaft of 8 cm diameter. Neglecting the effect of coupling, find the suitable internal diameter of the steel shaft, if a torque is to be applied to the compound shaft to develop a maximum shear stress of 40 MPa in the bronze shaft and a maximum shear stress of 72 MPa in the steel shaft. Angle of twist in the steel shaft is not to exceed  $1^\circ$ . Length of steel shaft is 1 m and of bronze shaft is 1.2 m. Also find the total angle of twist for whole of the shaft. Take  $G_{\text{steel}} = 80 \text{ GPa}$  and  $G_{\text{bronze}} = 40 \text{ GPa}$ .
9. Find the critical load for a standard rolled steel angle  $50 \times 50 \times 6$  (ISA 5050) column 2m long having area of angle as  $5.68 \text{ cm}^2$ , minimum radius of gyration as 0.96 cm,  $E = 210 \text{ GPa}$  and proportional limit stress in simple compression = 210 MPa for following conditions :
  - (i) the column has rounded ends
  - (ii) both ends are fixed
  - (iii) one end is fixed and the other hinged
  - (iv) one end is fixed and the other is free