

[03-2112]

II/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

MECHANICS OF SOLIDS – I

(Common with Dual Degree Program in Mechanical Engineering)

(Effective from the admitted batch of 2006–2007)

Time : Three hours

Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. Answer the following: (7 × 2 = 14)
  - (a) What is differential thermal expansion? Give an example for a system which undergoes this expansion.
  - (b) Draw the Mohr's circle diagram for shaft of circular section carrying twisting moment.

- (c) What is pure bending? Give an example.
  - (d) What is pure state of shear? Give an example of a member in the state of pure shear.
  - (e) Determine the maximum deflection of cantilever with an end point load by moment area method.
  - (f) Write the relations that represent generalized Hooke's law.
  - (g) Define the terms
    - (i) deformation and
    - (ii) distortion.
2. (a) Prove that the state of simple shear produces pure tensile and compressive stresses across planes inclined at  $45^\circ$  to those of pure shear. (7)
- (b) Derive the equation for determining the change in volume of a cylindrical shell under internal pressure,  $p$ . (7)

3. (a) An I - section beam of flanges  $200 \text{ mm} \times 20 \text{ mm}$  and web  $300 \text{ mm} \times 10 \text{ mm}$  is acted on by a shearing force of  $150 \text{ kN}$ . Determine

(i) maximum and minimum shearing stresses in the web

(ii) maximum shear stress in the flange and

(iii) the shear stress at a layer  $60 \text{ mm}$  below the top of the section.

Show the above stresses in the stress distribution diagram. (8)

(b) The rectangular stress components at a point P in a structural part are,  $\sigma_{xx} = 4 \text{ MPa}$ ,  $\sigma_{yy} = 1 \text{ MPa}$  and  $\tau_{xy} = 3 \text{ MPa}$ . Determine graphically using Mohr's circle diagram the principal stresses, principal planes and principal shears. (6)