



Printed Pages : 4

TME-303

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 4071

Roll No.

B. Tech.

(SEM. III) EXAMINATION, 2008-09

STRENGTH OF MATERIAL

Time : 3 Hours]

[Total Marks : 100

Note : Answer all questions. Assume suitable value for missing data.

- 1 Answer part (a) and any **two** parts from remaining parts :
- (a) What is significance of strain compatibility equations? Write down these compatibility equations. 5
- (b) At a point in a body the normal and shear stresses on two mutually perpendicular planes are given as $\sigma_x = -100 \text{ MN/m}^2$, $\sigma_y = 40 \text{ MN/m}^2$, $\tau_{xy} = 50 \text{ MN/m}^2$ using Mohr's circle determine principal stresses and their planes. 7.5
- (c) The three principal stresses at a point in a body subjected to a system of loading are 2.5σ (tensile), 1.2σ (tensile) and 0.8σ (compressive). If yield stress for the material is 280 MN/m^2 , using factor of safety = 2, Poisson's ratio = 0.3, determine the maximum value of σ so that failure may not occur according to principal stress theory and shear stress theory. 7.5



(d) At a point P in a body the stresses are 7.5

$$\sigma_X = 10000 \text{ N/cm}^2, \quad \sigma_Y = -5000 \text{ N/cm}^2,$$

$$\sigma_Z = -5000 \text{ N/cm}^2, \quad \tau_{XY} = \tau_{YZ} = \tau_{XZ} =$$

10000 N/cm^2 Determine normal stress on a plane that is equally inclined to all three axes.

(e) State and explain Castiglino theorem with an example. 7.5

2 Answer any two parts

(a) A simple supported beam has a flexural rigidity of 24 MN/m^2 and is loaded as shown in Fig. 1. Determine the deflections at mid-span. 10

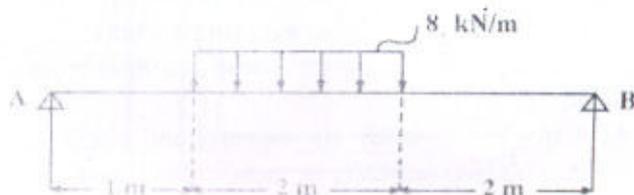


Fig. 1.

(b) A beam of length L and flexural rigidity EI is fixed at both ends at the same level and carries a u.d.l. of intensity per unit length over whole span. Obtain expressions for maximum deflection of the beam. 10

(c) A solid shaft is subjected to a bending moment of 2.3 kNm and a twisting moment of 3.45 kNm . Find the diameter of the shaft if the allowable tensile and shear stresses for shaft material are limited to 70.3 MN/m^2 and 42.18 MN/m^2 respectively. 10



- 3 Answer any **two** parts :
- (a) A cantilever type laminated spring (quarter elliptic) 10
has a span of 0.5 meter. If each leaf be 8 mm
thick and 72 mm wide, find the number of leaves
so that the spring deflects 60 mm under an end
load of 3 kN. Determine maximum bending stress
at this load. Also determine the height from which
this load may be allowed to fall so that maximum
bending stress induced is 700 N/mm^2 .
Take $E = 2 \times 10^5 \text{ N/mm}^2$
- (b) Explain middle third rule for rectangular sections. 10
- (c) Derive an expression to obtain buckling load for 10
the column which is neither too short nor too
long.
- 4 Attempt any **two** parts :
- (a) Derive an expression to determine stresses in 10
thick-walled cylinder subjected to internal
pressure only.
- (b) For a tube having $E = 2 \times 10^5 \text{ N/mm}^2$ and 10
 $\mu = 0.3$ the hoop stress at the inner face is
twice the internal pressure. Find the thickness
of the wall if internal radius is 60 mm.
- (c) A spherical tank, has a diameter of 20 meter and 10
wall thickness 15 mm. If the permissible stress
in the material is 120 MPa, determine the
maximum pressure at which a gas can be stored
in the tank. Determine the increase in diameter
and volume of the tank, due to gas pressure.
Take : $E = 200 \text{ GPa}$ and Poisson's ratio
 $(\mu) = 0.3$.



- 5 Answer any two parts
- (a) For curve bar of circular cross-section, 10
derive an expression to determine the distance of centroid from the neutral axis.
- (b) A channel section has flanges $b \times t_1$ and web $h \times t_2$. Determine the position of its shear centre. (Fig. 2) 10

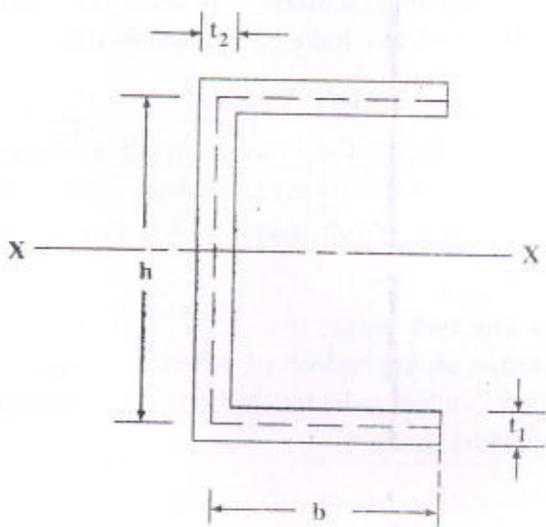


Fig. 2

- (c) If principal moments of inertia of section 10
are I_{UU} and I_{VV} then prove that moment of inertia about an axis X-X inclined to an angle θ to U-V axis will be

$$I_{XX} = I_{UU} \cos^2 \theta + I_{VV} \sin^2 \theta$$

