B.Tech. Third Semester (Chemical Engineering) (CGS)

10985 : Strength of Materials : 3 CH 03 / 3 PP 03 / 3 CT 03

P. Pages : 3 | AW - 2996

Time : Three Hours | Max. Marks : 80

* 0 0 7 2 *

Notes : 1. Due credit will be given to neatness and adequate dimensions.
2. Assume suitable data wherever necessary.
3. Illustrate your answer necessary with the help of neat sketches.

SECTION – A

1. a) Derive relation between Bulk modulus and Young's modulus. **5**

b) A rectangular block 400 mm × 250 mm × 100 mm is subjected to axial loads as follows : **9**

i) 500 kN tensile in the direction of its length.
ii) 750 kN tensile on 400 mm × 100 mm faces.
iii) 1000 kN compressive on 400 mm × 250 mm faces.

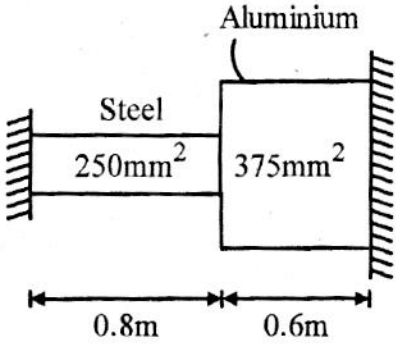
Assume $\mu = 0.25$ and $E = 2 \times 10^5$ N / mm^2

Find volumetric strain and change in volume.

OR

2. a) Explain the behaviors of ductile material under tensile load. **5**

b) A compound bar consisting of steel and aluminum as shown in fig. 1 is connected two grips at the ends at temperature of 60°C find the stresses in two rods when temperature falls to 20°C. **9**



$E_s = 2 \times 10^5$ N / mm^2

$\alpha_s = 1.17 \times 10^{-5}$ / °C

$E_A = 0.7 \times 10^5$ N / mm^2

$\alpha_A = 2.34 \times 10^{-5}$ / °C

Fig. 1

3. a) Derive relation between load intensity shear force and bending moment. **5**

b) Draw SFD and BMD for the beam loaded as shown in fig. 2. **8**

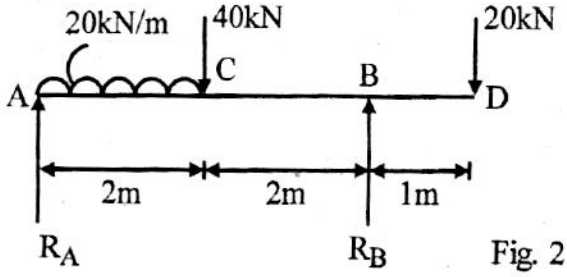


Fig. 2

OR

4. a) Define moment of resistance and section modulus. What are the assumptions in theory of simple bending? 6

b) A cantilever beam is loaded with Udl of 20 kN/m intensity over it's span of 4m. Calculate maximum bending stress. Provided cross section of beam being $300\,mm \times 450\,mm$. 7

5. a) State the assumption made in theory of pure torsion. 5

b) A solid circular shaft transmit 75 kW power at 200 RPM. Calculate minimum diameter required if shear stress limited to $50\,N/mm^2$ and twist in shaft is not to exceed 1° in 2 m length and modulus of rigidity is $1\times10^5\,N/mm^2$. 8

OR

6. a) Draw the shape of shear stress distribution across the depth of beams of the following cross sections. 6
   1) Circular Section
   2) T – Section
   3) I – Section

b) A rectangular beam is simply supported at both ends of 6m span and carries a Udl of 4 kN/m over the entire span. If the maximum shear stress is $10\,N/mm^2$ and $b = 1.5d$. Find the values of b and d. 7
b = width of beam
d = depth of beam.

SECTION – B

7. a) Show that in thin cylindrical shell subjected to internal fluid pressure the circumferential stress is twice the longitudinal stress. 5

b) A thin cylinder is made of steel of 120 cm diameter, 1.5 cm thick and 6 m long is subjected to internal fluid pressure of $2.5\,N/mm^2$. If $E = 2\times10^5\,N/mm^2$ and Poisson's ratio = 0.3. Calculate : 9
   i) change in diameter
   ii) change in length
   iii) change in volume

OR

8. a) State the assumption made in Euler's column theory. 5

b) A 1.5 m long column has a circular cross section of 50 mm diameter one of the ends of column is fixed and other end is free. Taking factor of safety as 3. 9
Calculate the safe load using :
   i) Rankine's formula
   $6c = 560\,N/mm^2$ and $\alpha = 1/1600$
   ii) Euler's formula
   $E = 1.2\times10^5\,N/mm^2$

9. a) Derive an expression for strain energy stored in a body when the load is applied gradually. 5

b) A bar 20 mm in diameter and 1 m long is freely suspended and is provided with a collar at lower end. A weight of 1000 N falls through a height of 250 mm on the collar. Calculate the maximum instantaneous stress, elongation and strain energy stored in a bar. 8
Take $E = 2\times10^5\ N/mm^2$

OR

10. a) Explain principal stresses and principal planes. 4

b) At a certain point in a strained material the stresses on two planes at right angles to each other are $70\ N/mm^2$ tensile and $35\ N/mm^2$ compressive with shear stress $17.5\ N/mm^2$. 9
Determine :
i) Principal Stresses
ii) Principal Planes
iii) Maximum shear stress

11. a) Prove the relation 5

$$M = EI\frac{d^2y}{dx^2}$$

M – Bending moment
I - Moment of inertia
E – Modulus of Elasticity

b) A simply supported beam of span 7m is loaded with a point load of 5 kN at a distance 2m from left support. Determine deflection under point load and slope at right support. 8
Take $E = 2\times10^5\ N/mm^2$; $I = 4.6\times10^6\ mm^4$

OR

12. A simply supported of 6 m is loaded as shown in fig. 3. Determine : 13
i) deflection under each load.
ii) maximum deflection.
iii) slope at pt. B.

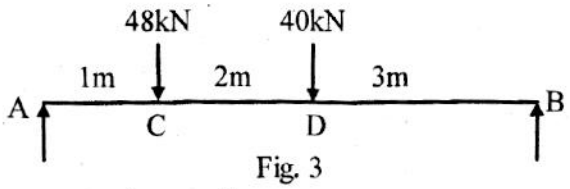


Fig. 3

$E = 2\times10^5\ N/mm^2$

$I = 85\times10^6\ mm^4$

****