AU – 2550

Third Semester B. Tech. (Chemical Engineering) Examination

STRENGTH OF MATERIALS

Paper – 3 CH 03 / 3 PP 03 / 3 CT 03

(USC – 10985)

P. Pages : 4

Time : Three Hours] [Max. Marks : 80

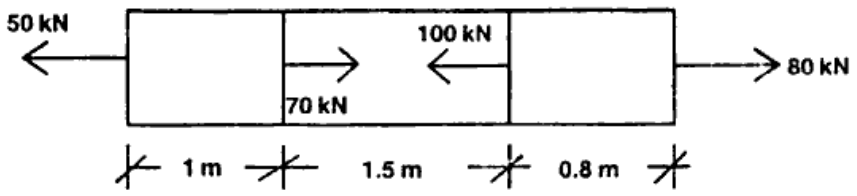
Note : (1) Separate answer book must be used for each section in the subject Geology. Engineering material of Civil branch and separate answer book must be used for Section A and B in pharmacy and Cosmetic Tech.
(2) Due credit will be given to neatness and adequate dimensions.
(3) Assume suitable data wherever necessary.
(4) Use pen of Blue / Black ink / refill only for writing the answer book.

SECTION A

1. (a) What is bulk modulus ?
Derive an expression for Young's modulus in terms of bulk modulus and Poisson's Ratio. 6

(b) A bar of uniform cross sectional area 600 mm^2 carries forces as shown in fig. no. 1. Calcualte total elongation of bar and stresses in each section. Take $E = 2 \times 10^5 N/mm^2$.

Fig. no. 1



8

OR

2. (a) Distinguish between stress and strain. Draw and explain stress – strain curve for a mild steel bar. 6

(b) A steel rod 120 mm in diameter and 1 m in length is held horizontally between two rigid supports. Calculate the force exerted by the rod on the

rigid supports. If the temperature is increased by 35^0C.
Take $E_S = 2 \times 10^5$ N/mm^2 and $\alpha_S = 12 \times 10^{-6}/^0$C.
Take $E_I = 175$ GN/mm^2 and $E_C = 75$ GN/m^2. 8

3. (a) Derive relationship between load intensity, shear force and bending moment. 4

(b) Draw SFD and BMD for the beam loaded as shown in fig. no. 2.

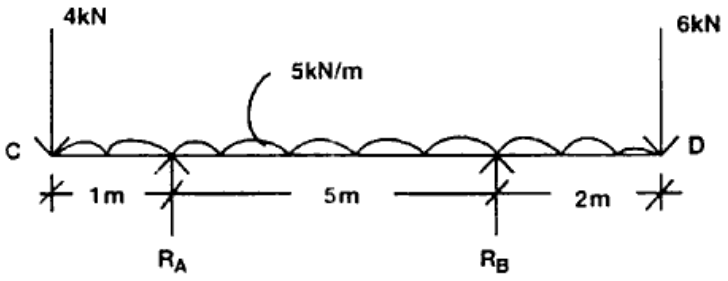


Fig. no. 2 9

OR

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

(b) A steel tube 3 m long having external and internal diameter of 80 mm and 50 mm respectively is supported at each end and carries a load of 'W' at a distance of 1.5 m from one end. Calculate the value of 'W' if the maximum bending stress is not exceed 120 N/mm^2. 7

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

(b) A solid circular shaft transmits 75 kW power at 200 RPM. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1^0 in 2 meters length of the shaft and shear stress is limited to 50 N/mm^2.
Take $C = 1 \times 10^5$ N/mm^2. 8

OR

6. (a) Draw the shape of shear stress distribution across the depth of the beams of the following cross sections :—

(1) Circular section (2) T – Section. 6

(b) A beam of rectangular section is simply supported over a span of 5 m and carries a Udl of 3 KN/m over the entire span. If the maximum shear stress is $7\,N/mm^2$ and $b = \frac{2}{3}d$. Find the values of b and d.
b = Width of beam and d = depth of beam. 7

SECTION B

7. (a) Derive the expression for circumferential and longitudinal stresses in a thin cylinder closed at both ends and subjected to internal fluid pressure. 5

(b) A thin cylinder whose ends are closed by means of rigid plates is made of steel plates 3 mm thick. The length and diameter of the cylinder 50 cm and 25 cm respectively. If it is subjected to an internal pressure of $3\,N/mm^2$, determine change in diameter, length and volume.
Take $E = 2 \times 10^5\,N/mm^2$ and Poisson's ratio = 0.25. 8

OR

8. (a) Define slenderness ratio. State the limitations of Euler's formula. 5

(b) A solid round bar 60 mm in diameter and 2.5 m long is used as a column one end of column is fixed and other end is hinged. Taking factor of safety as 3. Calculate safe load using

(1) Euler's Formula $E = 2.1 \times 10^5\,N/mm^2$

(2) Rankine's Formula

$f_c = 560\,N/mm^2$ and $\alpha = \frac{1}{1600}$ 8

9. (a) Prove that maximum stress induced in a body due to suddenly applied load is twice the stress induced when the same load is applied gradually. 5

(b) A weight of 1.2 kN is dropped on a collar attached at the lower end of a vertical bar 4 m long and 30 mm dia. Calculate the height of drop if maximum instantaneous stress is not to exceed $120\,N/mm^2$. Also calculate elongation. Take $E = 2.05 \times 10^5\,N/mm^2$. 8

OR

10. (a) Define the following terms :—

(1) Resilience

(2) Strain energy

(3) Principal stress

(4) Principal planes. 5

(b) At a certain point in a strained material the stress on two planes at right angles to each other are 20 N/mm^2 and 10 N/mm^2 both are tensile with shear stress 10 N/mm^2.
Calculate :—

(1) Principal stresses (2) Principal planes (3) Maximum shear stress. 8

11. (a) Prove the relation

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

M – Bending moment
E – Young's Modulus
I – Moment of inertia 6

(b) Find out the values of deflection and slope for cantilever beam having point load at free end. 8

OR

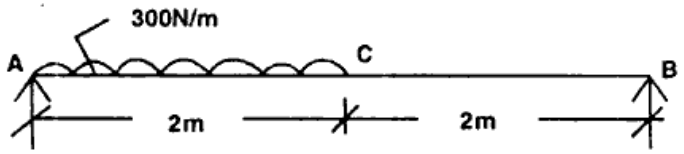
12. Determine :—

(1) The value of deflection at mid span

(2) Maximum deflection

(3) Slope at pt. A and B

For the beam loaded as shown in fig. If $E=1\times10^5$ N/mm^2 and $I=4.6\times10^6$ mm^4.



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