B.E. Third Semester (Mechanical / Production Engineering) (CGS)

10904 : Mechanics of Materials / Strength of Materials : 3 ME 02 / 3 PE 02

P. Pages : 3 | **AU - 2503**

Time : Three Hours | Max. Marks : 80

Notes :
1. All question carry equal marks.
2. Answer **three** question from Section A and **three** question from Section B.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and chemical equations should be given wherever necessary.
6. Retain the construction lines.
7. Illustrate your answer necessary with the help of neat sketches.
8. Use of slide rule logarithmic tables, Steam table, Moller's Chart, Drawing instrument, Thermodynamic table for moist air, Psychrometric Chart and Refrigeration charts is permitted.
9. Use of D.A. Laws "Pocket Book for Mechanical Engineers" is permitted.
10. Discuss the reaction, mechanism wherever necessary.
11. Assume suitable data.
12. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) Draw and explain stress-strain diagram of mild steel subjected to tensile force. **5**

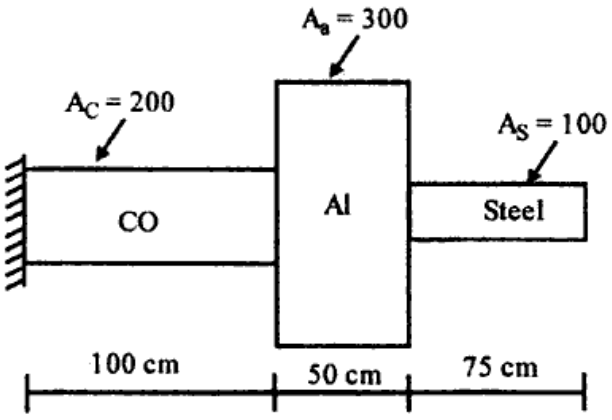
b) A composite bar ABCD is loaded as shown in fig. If the bar contracts by 1.00 mm. What are the stresses induced in different materials. **8**

Given C/S area AC = 200 mm^2, Aa = 300 mm^2, AS = 100 mm^2.

Take $E_C = 10^{11} N/m^2$

$E_a = 0.7 \times 10^{11} N/m^2$

$E_S = 2.1 \times 10^{11} N/m^2$



OR

2. a) A steel block of cube 50 cm side is subjected to a force of 6 kN (T) 8 kN (C) and 4 kN (T) along x, y, z directions. Determine change in volume of the block. E as 200 kN/mm^2 & m as 10/3. **7**

b) Prove that $E = 3k\left[1-\frac{2}{m}\right]$ where k = Back modulus, E = Young's modulus, $\frac{1}{m}$ = Poissons ratio. **6**

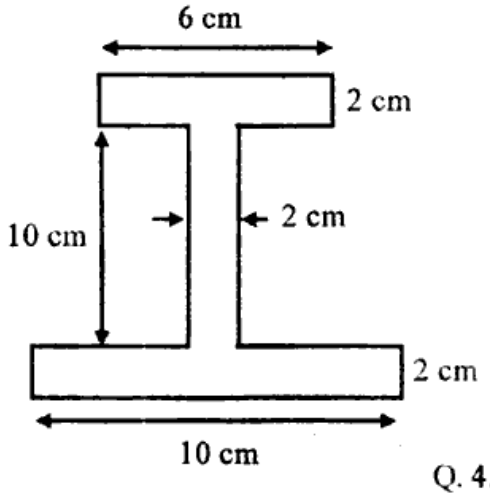
3. a) Define S.F. and B.M. & also S.F.D. & B.M.D. **3**

b) A simply supported beam 6m long is carrying a V.D.L. of 2 t/m over a length of 03 m from the right end. Draw S.F. & B.M.Dia also find maxi B.M. on the section. **10**

OR

4. a) What are the assumptions made in the theory of simple bending. **3**

b) A beam of I section is subjected to a B.M. of 500 kg-m at its neutral axis. Find maxi stress induced in the beam. **10**



Q. 4. b

5. a) Define polar modulus & Torsional Rigidity. **3**

b) Determine the dia. of a solid circular shaft which will transmit 112.5 kw at 200 r.p.m. The maxi shear stress is limited to 55 N/mm^2. Also determine the length of the shaft if the twist must not exceed 1.5° over the entire length take modulus of rigidity = 8×10^4 N/mm^2 **10**

OR

6. a) A closed coiled helical spring of 10 cm mean dia. is made up of 1 cm dia rod and has 20 turns. The spring carries an axial load of 200 N. Det. The shearing stress $C = 8.4\times10^4$ N/mm^2 Det. The deflection when carrying this load. Also calculate the stiffness of spring. **10**

b) Show that for a Rectangular section of beam, maxi shear stress is 1.5 times the Avg. shear stress. **3**

SECTION - B

7. a) Define thin cylinders name the stresses set up in a thin cylinder subjected to internal fluid pressure. **3**

b) A cylindrical thin drum 80 cm in dia. & 3m long has a stress thickness 1 cm. If the drum is subjected to an int. pressure of 2.5 N/mm^2 determine 10
1) Change dia. length, volume
$E = 2\times10^5\ N/mm^2$ Poissions Ratio = 0.25.

OR

8. a) Derive an expression for circumferential stress & longitudinal stress for the thin shell subjected to an int. pressure. 3

b) A boiler is subjected to an int steam pressure of 2 N/mm^2. The thickness of boiler plate is 2.0 cm & permissible tensile stress is 120 N/mm^2. Find out maxi dia. when efficiency of longitudinal joints is 90% & that of circumferential joint is 40%. 10

9. a) Prove that the maxi stress induced in a body due to suddenly applied load is twise the stress induced when the same load is applied gradually. 3

b) An unknown weight falls through a height of 20 mm on a collar rigidly attached to a lower end of a vertical bar 5m long and 800 mm^2 in section. If the maxi extension of the rod is to be 0.5 mm, what is the corresponding stress & magnitude of the unknown weight 10
Take $E = 2\times10^5\ N/mm^2$.

OR

10. a) Define : 3
i) Principal planes ii) Principal stresses

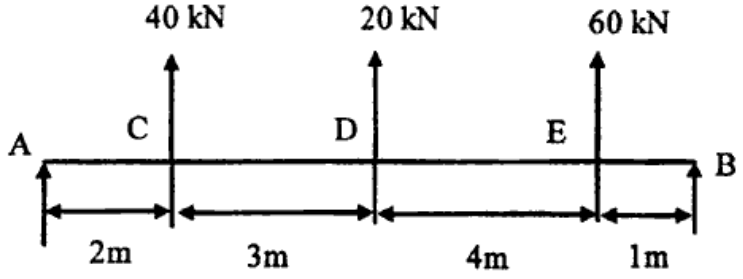
b) At a certain point in a strained material the stress on two planes, at right angles to each other are 20 N/mm^2 & 10 N/mm^2 both tensile, they are accompanied by a shear stresses of magnitude 10 N/mm^2 find principal planes & evaluate the principle stresses. 10

11. a) Prove that $Y_C = \frac{WL^3}{48EI}$ W = Point load L = Length of beam. 7

b) A simply supported beam of 8m span is subjected to a point load of 200 kN at 5m from the left support find slope at C & deflection at C Take E = 200 GPa, $I = 60\times10^6\ mm^4$ (Use Macaulay's method) 7

OR

12. Find the slope & deflection at C, D, E for the beam shown in fig. E = 200 GPa, $I = 450\times10^6\ mm^4$. 14



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