15. (a) A thin cylindrical shell, 2.5 m long has 700 mm internal diameter and 8 mm thickness. If the shell is subjected to an internal pressure of 1 MPa, find

(i) The hoop and longitudinal stresses developed

(ii) Maximum shear stress induced and

(iii) The changes in diameter length and volume. Take modulus of elasticity of the wall material as 200 GPa and Poisson's ratio as 0.3.

Or

(b) A thick cylinder with external diameter 320 mm and internal diameter 160 mm is subjected to an internal pressure of 8 N/mm^2. Draw the variation of radial and hoop stresses in the cylinder wall. Also determine the maximum shear stress in the cylinder wall.

PART C — (1 × 15 = 15 marks)

16. (a) The intensity of resultant stress on a plane AB (Fig.Q.16(a)) at appoint in a materials under stress is 8 N/mm^2 and it is inclined at 30° to the normal to that plane. The normal component of stress on another plane BC at right angles to plane AB is 6 N/mm^2. Determine the following: (15)

(i) The resultant stress on the plane BC

(ii) The principal stresses and their directions

(iii) The maximum shear stresses.

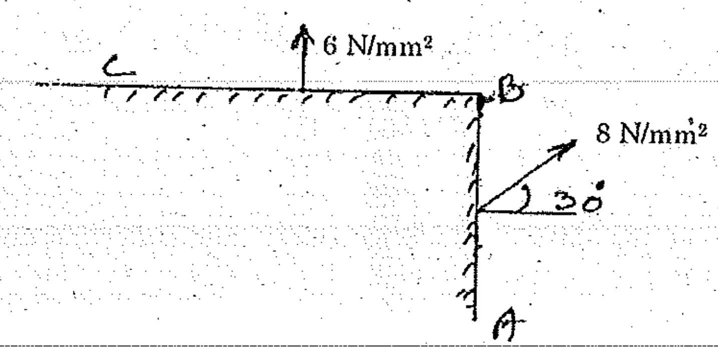

Fig. Q.16(a)

Or

(b) A water tank vertical wall is stiffened by vertical beam, and the height of the tank is 8 m. The beams are spaced at 1.5 m centre to centre. If the water reaches the top of the tank, calculate the maximum bending moment on a vertical beam. Sketch the shear force and bending moment diagrams. Unit weight of water, $\gamma = 9.8\ kN/m^3$. Take $p = \gamma h$ (15)

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Reg. No. : [| | | | | | | | | | |]

Question Paper Code : 52757

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third/Fourth Semester

Mechanical Engineering

CE 6306 — STRENGTH OF MATERIALS

(Common to Mechatronics Engineering, Industrial Engineering and Management, Agriculture Engineering, Industrial Engineering, Manufacturing Engineering, Mechanical Engineering (Sandwich), Materials Science and Engineering and also Common to Fourth Semester Automobile Engineering, Mechanical and Automation Engineering and Production Engineering)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write a relation for change in length of a bar hanging freely under its own weight.

2. What does the radius of Mohr's circle refer to?

3. Draw the shear force diagram and bending moment diagram for the cantilever beam carries uniformly varying load of zero intensity at the free end and w kN/m at the fixed end.

4. List out the assumptions used to derive the simple bending equation.

5. What is called twisting moment?

6. Give any two functions of spring.

7. What are the advantages of Macaulay's method over other methods for the calculation of slope and deflection?

8. In a cantilever beam, the measured deflection at free end was 8 mm when a concentrated load of 12 kN was applied at its mid-span. What will be the deflection at mid-span when the same beam carries a concentrated load of 7 kN at the free end?

9. State the expression for maximum shear stress in a cylindrical shell.

10. Define – hoop stress and longitudinal stress.

PART B — (5 × 13 = 65 marks)

11. (a) A reinforced short concrete column 250 mm × 250 mm in section is reinforced with 8 steel bars. The total area of steel bars is 2500 mm^2. The column carries a load of 390 kN. If the modulus of elasticity for steel is 15 times that of concrete, find the stresses in concrete and steel.

Or

(b) The stresses at a point in a bar are 200 N/mm^2 (tensile) and 100 N/mm^2 (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major stress. Also determine the maximum intensity of shear stress in the material at the point.

12. (a) Draw the shear force and B.M diagrams for a simply supported beam of length 8 m and carrying a uniformly distributed load of 10 kN/m for a distance of 4m as shown in fig 12 (a).

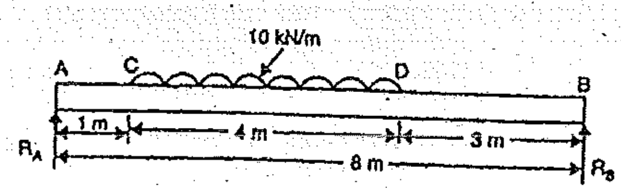

Fig. 12 (a)

Or

(b) A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. Take $E = 2 \times 10^5 N/mm^2$.

13. (a) (i) A solid shaft has to transmit the Power 105 kW at 2000 r.p.m. The maximum torque transmitted in each revaluation exceeds the mean by 36%. Find the suitable diameter of the shaft, if the shear stress is not to exceed 75 N/mm^2 and maximum angle of twist is 1.5° in a length of 3.30 m and $G = 0.80 \times 10^5 N/mm^2$. (8)

(ii) A laminated spring carries a central load of 5200 N and it is made of 'n' number of plates, 80 mm wide. 7 mm thick and length 500 mm. Find the numbers of plates, if the maximum deflection is 10 mm Let $E = 2.0 \times 10^5 N/mm^2$. (5)

Or

(b) (i) A stepped solid circular shaft is built in at its ends and subject to an externally applied torque T at the shoulder as shown in fig. Q.13(b)(i). Determine the angle of rotation θ of the shoulder section when T is applied. (7)

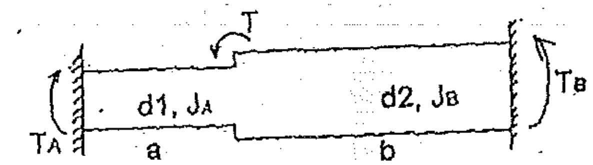

Fig. Q.13(b)(i)

(ii) A closed coiled helical spring is to be made out of 5 mm diameter wire 2 m long so that it deflects by 20 mm under an axial load of 50 N. Determine the mean diameter of the coil. Take $C = 8.1 \times 10^4 N/mm^2$. (6)

14. (a) Determine the deflection at its mid point and maximum deflection for the beam given in fig.Q.14(a). Use Macaulay's method.

$E = 2 \times 10^5 N/mm^2$, $I = 4.3 \times 10^8 mm^4$.

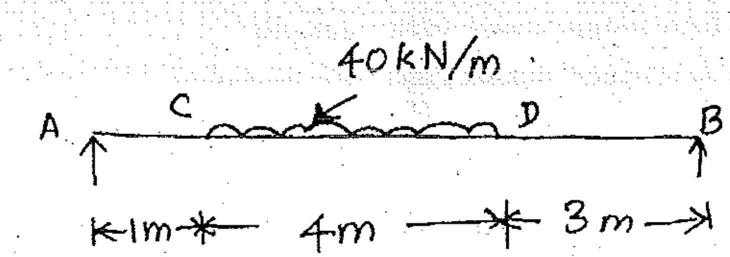

Fig.Q.14(a)

Or

(b) Determine the slope at the two supports and deflection under the loads. Use conjugate beam method. $E = 200 GN/m^2$, I for right half is $2 \times 10^8 mm^4$, I for left half is $1 \times 10^8 mm^4$ the beam is given in fig.Q.14(b)

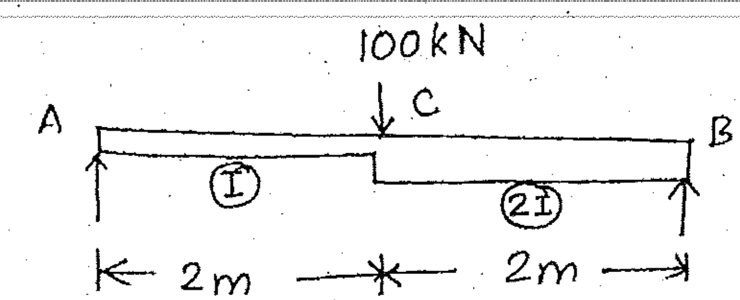

Fig.Q.14(b)