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Question Paper Code : 71551

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Third 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)

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Derive 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 shear force diagram for a simply supported beam of length 4 m carrying a central point load of 4 kN.
4. Prove that the shear stress distribution over a rectangular section due to shear force is parabolic.
5. Draw shear stress distribution of a circular section due to torque.
6. What is meant by spring constant?
7. Write down the equation for the maximum deflection of a cantilever beam carrying a central point load 'W'.
8. Draw conjugate beam for a double side over hanging beam.
9. How does a thin cylinder fail due to internal fluid pressure?
10. State Lamé's equations.

PART B — (5 × 13 = 65 marks)

11. (a) The bar shown in fig.Q.11(a) is subjected to a tensile load of 160 kN. If the stress in middle portion is limited to 150 N/mm^2 , determine the diameter of the middle portion. Find also the length of the middle portion if the total elongation of the bar is to be 0.2 mm. Young's modulus is $2.1 \times 10^5 \text{ N/mm}^2$.

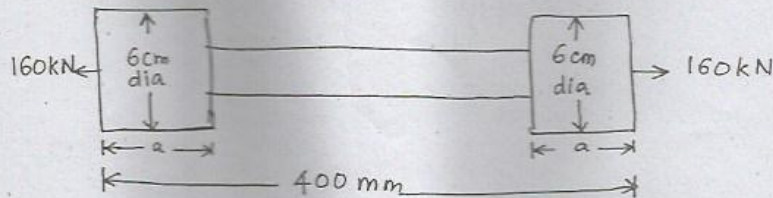


fig.Q.11(a)

Or

- (b) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.1 mm and change in diameter is 0.004 mm. Calculate :
- Young's modulus
 - Poisson's ratio and
 - Bulk modulus.
12. (a) Draw shear force diagram and bending moment diagram for the beam given in fig.Q.12(a)

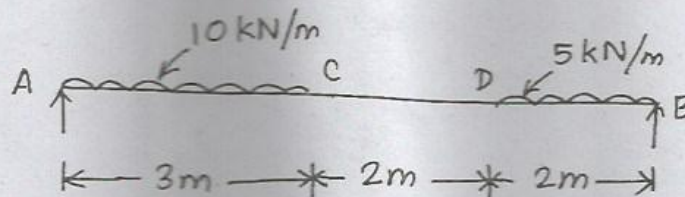


fig.Q.12(a)

Or

- (b) A beam of square section is used as a beam with one diagonal horizontal. The beam is subjected to a shear force F , at a section. Find the maximum shear in the cross section of the beam and draw shear stress distribution diagram for the section.

13. (a) A hollow shaft, having an inside diameter 60% of its outer diameter, is to replace a solid shaft transmitting in the same power at the same speed. Calculate percentage saving in material, if the material to be is also the same.

Or

- (b) Derive a relation for deflection of a closely coiled helical spring subjected to an axial compressive load 'W'.
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.
 $E = 2 \times 10^5 \text{ N/mm}^2$, $I = 4.3 \times 10^8 \text{ mm}^4$.

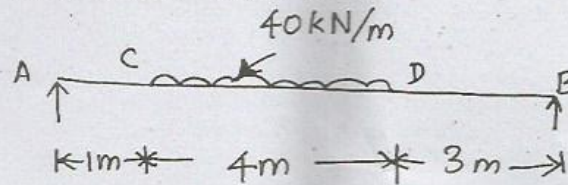


fig.Q.14(a)

Or

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

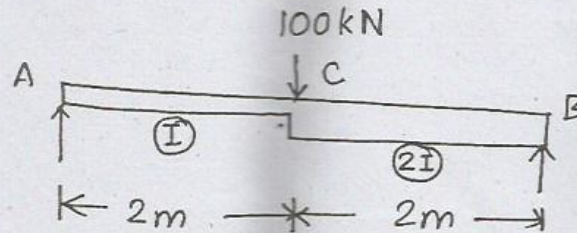


fig.Q.14(b)

15. (a) Derive a relation for change in volume of a thin cylinder subjected to internal fluid pressure.

Or

- (b) Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm^2 . Also sketch the radial pressure distribution and hoop stress distribution across the section.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Draw stress strain curve for mild steel and explain the salient points on it. (7)
- (ii) Derive a relation for change in length of a circular bar with uniformly varying diameter, subjected to an axial tensile load 'W'.(8)

Or

- (b) A water main of 500 mm internal diameter and 20 mm thick is full. The water main is of cast iron and is supported at two points 10 m apart. Find the maximum stress in the metal. The cast iron and water weigh 72000 N/m^3 and 10000 N/m^3 respectively.