

M 2023

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Third Semester

Civil Engineering

CE 1201 — MECHANICS OF SOLIDS

(Regulations – 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

Assume any additional data required and indicate it clearly.

PART A — (10 × 2 = 20 marks)

1. Find the Young's modulus of a rod of diameter 80 mm and of length 3 m which is subjected to a tensile load of 60 kN and the extension of the rod is equal to 0.4 mm.
2. Draw the Mohr's circle for the state of pure shear stress and mark the principal stresses.
3. What are the assumptions made in analysis of determining the stress?
4. Define tension coefficient of a member and write its units.
5. How will you locate (a) the point of contraflexure and (b) the section of maximum bending moment of a loaded beam?
6. Calculate the sectional Modulus of a circular section of diameter 250 mm.
7. A cantilever beam of 3 m carries a "UDL" of 24 kN/m over the entire span. Compute the deflection at the free end. Assume $EI = 2 \times 10^4$ kN-m.
8. A beam of rectangular section of 150 mm width and 300 mm depth is subjected to a shear force of 4 kN at a critical section. Calculate the maximum shear stress.
9. Define the terms polar modulus and write its units.
10. The deflection of a closed coiled helical spring under a load of 500 N is 25 mm. Calculate the stiffness of the spring.

13. (a) Draw the shear force and bending moment diagrams for the loaded beam shown in Fig. (3) and calculate the maximum bending moment and locate the point of contraflexure.



Fig. (3)

Or

- (b) A water line of 1.2 m internal diameter and 12 mm thickness is running full. If the bending stress is not to exceed 56 N/mm^2 . Find the greatest span on which the pipe may be freely supported. Assume the unit weight of material of the pipe and water as 76.8 kN/m^3 and 10 kN/m^3 respectively.
14. (a) A beam of span 8 m and of uniform flexural rigidity $EI = 40 \times 10^3 \text{ kN/m}^2$ is simply supported at its ends. It carries a uniformly distributed load of 15 kN/m over the entire span. It is also subjected to a clockwise moment of 160 kN-m at a distance of 3 m from the left support. Calculate the slope and deflection at the point of application of the moment.

Or

- (b) For the loaded beam shown in Fig. (4) determine (i) the slope at the left support (ii) the slope and deflection under 100 kN load. Assume $EI = 2 \times 10^4 \text{ kN-m}^2$. Use moment area method.

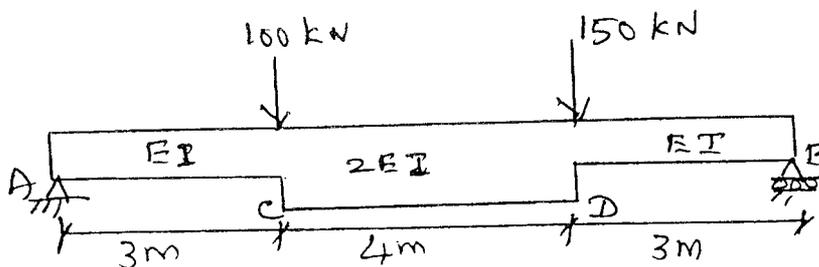


Fig. (4)

15. (a) A steel shaft is to transmit 300 kW at 100 r.p.m. If the shear stress is not to exceed 80 N/mm^2 , find the diameter of the shaft. What percent saving in weight would be obtained if this shaft were replaced by a hollow one whose internal diameter equals 0.6 of the external diameter, the length, material and maximum shear stress being the same?

Or

- (b) A helical spring, in which the mean diameter of the coils is 8 times the wire diameter, is to be designed to absorb 200 N-m of energy with an extension of 100 mm. The maximum shear stress is not to exceed 125 N/mm². Determine the mean diameter of the helix, diameter of the wire and the number of turns. Also, find the load with which an extension of 40 mm could be produced in the spring. Assume the modulus of rigidity of the spring's material as 84 kN/mm².
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