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**C 3156**

B.E./B.Tech DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Third Semester

Chemical Engineering

CH 1203 — MECHANICS OF SOLIDS

(Common to Textile Technology)

(Regulation 2004)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Hooke's law.
2. Define Poisson's ratio.
3. Give the relationship between load intensity, shear force and bending moment.
4. Define point of contraflexure.
5. Differentiate torsional rigidity and flexural rigidity.
6. Define spring constant.
7. Give any two uses of leaf springs.
8. List out the advantages of area-moment method.
9. Draw the shear stress distribution in a T shaped cross-section.
10. What are flitched beams?

11. (a) A steel flat, 500mm long and of 50mm × 75 mm uniform section is acted upon by the following forces uniformly distributed over the respective cross-section; 30 kN in the direction of length (compressive); 200 kN in the direction of width (tensile); 200 kN in the direction of thickness (tensile). Determine the change in volume of the flat. Take  $E = 2 \times 10^5 \text{ N/mm}^2$ ;  $\nu = 0.3$ .

Or

- (b) A steel tube of 70mm outer diameter and 10mm thick is thick into a copper tube of inner diameter 70mm and 10mm thick. They are connected by using 20mm diameter pins at the ends, If the length of compound bar is 750mm find the stresses produced in the tubes and pins when temperature is raised by 25°C. Take  $\alpha_s = 12 \times 10^{-6} / ^\circ\text{C}$ ,  $\alpha_c = 17.5 \times 10^{-6} / ^\circ\text{C}$ ,  $E_s = 2 \times 10^5 \text{ N/mm}^2$ ,  $E_c = 1.2 \times 10^5 \text{ N/mm}^2$ .
12. (a) Draw the shear force and bending moment diagram for the overhanging beam shown in figure 1, Locate the point of contraflexure if any.

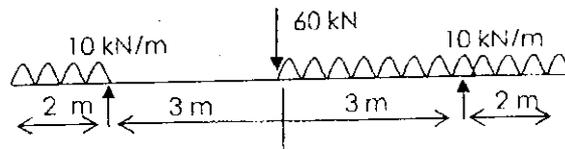


Fig. 1

Or

- (b) A 6m long cantilever carries loads of 3 kN and 5 kN at 3m and 5m respectively from the fixed end and a uniformly distributed load of 15 kN/m over its entire length. Draw the shear force and bending moment diagrams.
13. (a) A beam AB of 8m span is simply supported at the ends. It carries a point load of 25 kN at a distance of 1.5 m from the end A and a uniformly distributed load of 7kN/m for a length of 3m from the end B. If  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $I = 12 \times 10^{-6} \text{ m}^4$ , determine,
- Deflection at the mid-span
  - Maximum deflection and
  - Slope at the end A.

Or

- (b) A simply supported beam of 4m span carries a udl of 20 kN/m on the whole span and in addition carries a point load of 40 kN at the centre of span. Calculate the slope at the ends and maximum deflection of the beam. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $I = 5000 \text{ cm}^4$ .

14. (a) Derive the expression for critical load of a long prismatic cantilever column.

Or

- (b) A solid alloy shaft 50mm diameter is to be coupled in series with a hollow steel shaft of the same external diameter. If the angle of twist of per unit length of the hollow shaft is to be 80 percent of that of the solid shaft, find the internal diameter of the solid shaft. Also find the speed at which the shafts should be driven to transmit 30kw if allowable shearing stresses in steel and alloy are 80 MN/m<sup>2</sup> and 60 MN/m<sup>2</sup> respectively. Take  $C_{steel} = 2.25 C_{alloy}$ .

15. (a) An I-section beam has flanges 120 mm wide and 10mm thick and web 150mm high and 10mm thick. If this section is subjected to a bending moment of 15 kNm and a shearing force of 15 kN, find the maximum tensile and shear stresses induced in it.

Or

- (b) A laminated spring 750mm long is made up of plates each 60 mm wide and 8mm thick. If the bending stress in the plates is limited to 100 MN/m<sup>2</sup>, how many plates would be required to enable the spring to carry a central point load of 3 kN? If  $E = 2 \times 10^5 \text{ N/mm}^2$ , what is the deflection under the given load of 3 kN.