2002 SCHEME

USN | | | | | | | | | | |

CV33

Third Semester B.E. Degree Examination, June 2012
Strength of Materials

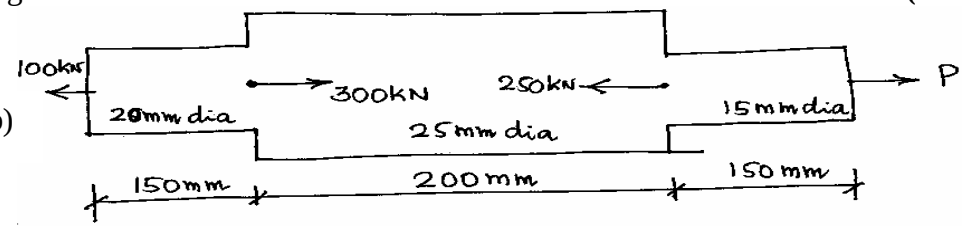
Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions.***
2. Assume any missing data suitably.

1 a. Derive an expression for the elongation of vertically supported bar due to its self weight. **(04 Marks)**

b. Determine the stresses in various segments of the circular bar shown in Fig.Q.1(b). Compute also the elongation of the bar. Given E = 195 GPa. **(08 Marks)**

Fig.Q.1(b)



c. A tensile load of 40 kN is acting on a rod of diameter 40mm and of length 4m. A bore of diameter 20mm is made centrally on the rod. To what length the rod should be bored so that total extension will increase by 30% under same tensile load. Take E = 200 GPa. **(08 Marks)**

2 a. Show that volumetric strain is sum of strains in the three mutually perpendicular directions. **(04 Marks)**

b. A steel bar of 250mm long and 50mm × 50mm cross-section is subjected to 120kN tensile load along the axis and 80 kN compressive load on the sides. Determine the total volume change. $E = 2 \times 10^5$ N/mm^2 $\mu = 0.3$ **(08 Marks)**

c. The bar shown in Fig.Q.2(c) is composed of three segments. The bar is held between rigid supports. Find stresses developed in each segment when temperature of the system is raised by 55°C. **(08 Marks)**

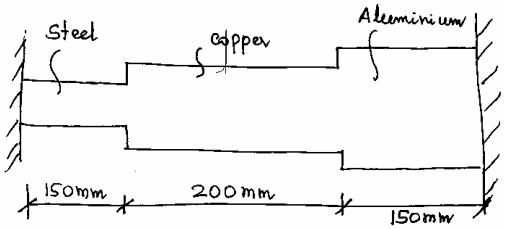


Fig.Q.2(c)

Material	Area, mm^2	E	α, /°C
Steel	200	200 GPa	12×10^{-6}
Copper	400	100 GPa	17.5×10^{-6}
Aluminium	600	70 GPa	22×10^{-6}

3 a. For the beam shown in Fig.Q.3(a), draw SFD and BMD. **(04 Marks)**

b. Draw the SFD and BMD for simply supported beam of span 6m carrying two point loads of 12 kN each at one third span from either supports and also carries a udl of 10 kN/m throughout. Also calculate the value of maximum bending moment. **(08 Marks)**

c. For the beam shown in Fig.Q.3(c), draw SFD and BMD. Determine the position and location of maximum positive and negative bending moment. Locate point of contraflexure. **(08 Marks)**

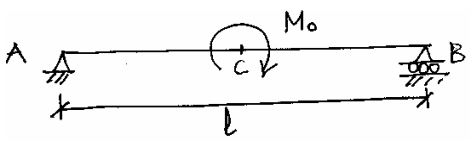


Fig.Q.3(a)

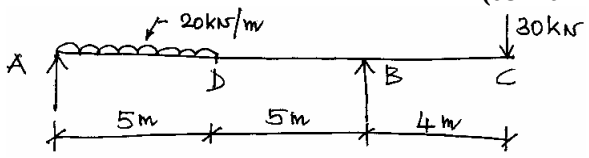


Fig.Q.3(c)

4 a. What are the assumptions made in theory of pure torsion? **(04 Marks)**

b. A hollow circular shaft transmits power of 300 kW at 100 rpm. The shear stress is limited to 70 MPa and the external diameter is twice internal diameter. Calculate the external and internal diameters of shaft, assuming that maximum torque is 1.5 times the average torque. **(08 Marks)**

c. Determine the ratio of buckling strength of two columns of circular section, one hollow and other solid. Both columns are made up of same material, length, cross sectional area and end conditions. The internal diameter of hollow column is half of its external diameter. **(08 Marks)**

5 a. Differentiate between thin and thick cylinders. Explain hoop stress and longitudinal stress in connection with their cylinder. **(04 Marks)**

b. A thin cylindrical shell of one metre diameter and 3m long has a metal thickness of 1cm. If it is subjected to an internal pressure of 3 N/mm^2, determine the change in length, diameter and volume. Take E = 210 GPa, $\mu = 0.3$. **(08 Marks)**

c. A thick cylinder of 250mm internal diameter and 350mm outer diameter contains fluid at a pressure of 12 N/mm^2. Determine the hoop stress and radial stress in the section and draw a neat sketch showing stress distribution across wall thickness. **(08 Marks)**

6 a. A beam of I-section shown in Fig.Q.6(a), is simply supported over a span of 4m. Determine the load that the beam can carry per metre length, if allowable stress in the beam is 30.82 N/mm^2. **(10 Marks)**

b. The section shown in Fig.Q.6(b) is subjected to a shear force of 50 kN. Draw the variation of shear stress across the depth and find the total shear resisted by web. **(10 Marks)**

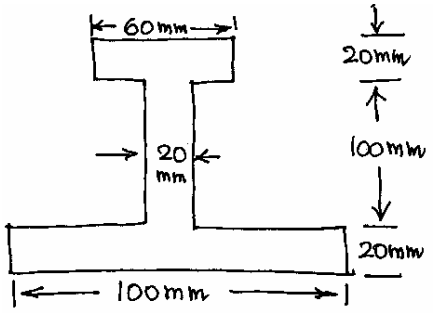


Fig.Q.6(a)

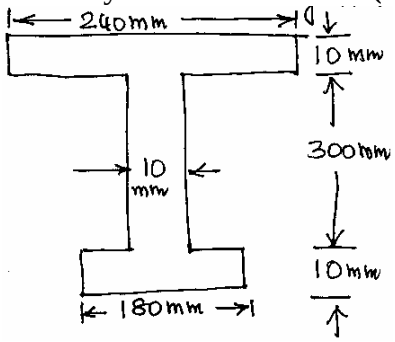


Fig.Q.6(b)

7 a. Find deflection at free end of a cantilever beam shown in Fig.Q.7(a).
Given E = 2×10^5 N/mm^2 I = 40×10^6 mm^4. **(10 Marks)**

b. A beam of length 10m carries loads as shown in Fig.Q.7(b). Determine the deflection under loads. Given E = 200 GPa I = $10^9 mm^4$. **(10 Marks)**

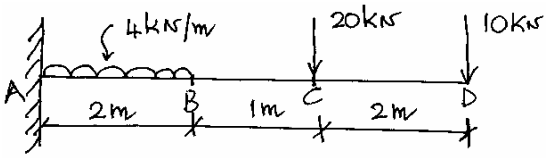


Fig.Q.7(a)

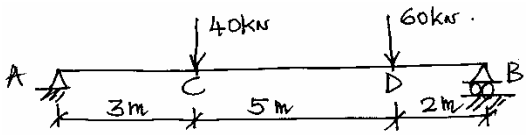


Fig.Q.7(b)

8 a. What are principal stresses and principal planes? **(04 Marks)**

b. What is Mohr's circle? Explain construction and uses of Mohr's circle. **(08 Marks)**

c. At a point in stressed body, there is tensile stress of 200 N/mm^2 in x-direction, compressive stress of 100 N/mm^2 in y-direction and a shear stress of 150 N/mm^2 clockwise on the plane of 200 N/mm^2. Determine : i) principal stresses and their planes ; ii) Maximum shear stress. **(08 Marks)**

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