CBCS Scheme

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15ME34/MA34

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

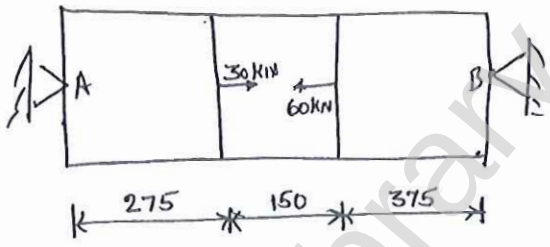
Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. Explain with a neat sketch, stress – strain diagram of mild steel indicating its salient points. **(06 Marks)**

b. A bar of 800mm length is attached rigidly at 'A' and 'B' as shown in fig. Q1(b). Determine the reactions at the two ends, if the bar is 25mm diameter. Find the stresses and change in length in each portion. Take E = 200GPa. **(10 Marks)**

Fig.Q1(b)



OR

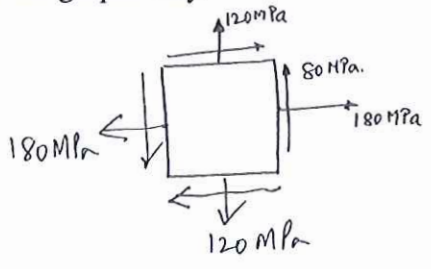
2 a. A bar of brass 25mm diameter is enclosed in a steel tube of 50mm external diameter and 25mm internal diameter. The bar and the tube are rigidly fastened at the ends and are 1.5m long. Find the stresses in the two materials when the temperature raises from 30^0C to 100^0C. Take $E_{steel} = 200kN/mm^2$ $E_{brass} = 100kN/mm^2$ **(08 Marks)**
$\alpha_{steel} = 11.6 \times 10^{-6}/^0C$ $\alpha_{brass} = 18.7 \times 10^{-6}/^0C$.

b. A circular rod of 100mm diameter and 500mm long is subjected to a tensile load of 1000kN. Determine the modulus of rigidity, Bulk modulus and change in volume if Poisson's ratio is 0.3. Take E = 200GPa. **(08 Marks)**

Module-2

3 The state of stress in a two dimensional stressed body is shown in fig.Q3. Determine the principal plane, principal stresses and maximum shear stresses. Sketch the results. Construct the Mohr's circle and verify the answer graphically. **(16 Marks)**

Fig.Q3



OR

4 a. A thin cylinder 3m long is having 1m internal diameter and 15mm thickness. Calculate the maximum intensity of shear stress induced and also the changes in the dimensions of the cylinder if it is subjected to an internal pressure of $1.5N/mm^2$. **(08 Marks)**

b. A thick cylindrical vessel is 250mm internal diameter and has 50mm thick wall. It is subjected to an internal pressure of 10MPa due to the movement of the fluid. Find the maximum hoop stress developed in the cylinder. Also calculate the radial and hoop stresses at a point 20mm from the inner surface. Sketch the stresses. **(08 Marks)**

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Module-3

5 Draw the shear force and bending moment diagrams for the beam shown in fig. Q5. **(16 Marks)**

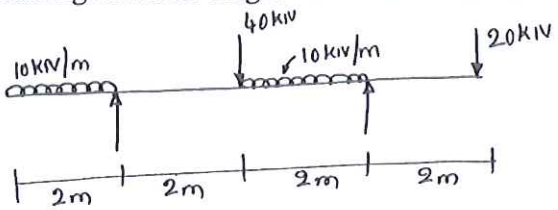

Fig.Q5

OR

6 a. A cantilever of square section 200mm × 200mm, 2 m long just fails in flexure when a load of 12kN is placed at its free end. A beam of the same material and having a rectangular cross section 150mm wide and 300mm deep is simply supported over a span of 3m. Calculate the minimum control point load required to break the beam. **(08 Marks)**

b. Using Double Integration method, determine the slope and deflection for a cantilever beam subjected to concentrated load at free end. **(08 Marks)**

Module-4

7 a. Explain Slenderness ratio. **(04 Marks)**

b. A shaft is required to transmit 245kN power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40MPa and the twist 1^0 per meter length. Determine the diameter required if :

i) the shaft is solid

ii) the shaft is hollow with external diameter twice the internal diameter.

Take modules of rigidity. $80kN/mm^2$. **(12 Marks)**

OR

8 a. Determine the buckling load for T – section shown below in fig.Q8(a). The column is 3m long and is hinged at both ends. Take E = 200GPa. **(10 Marks)**

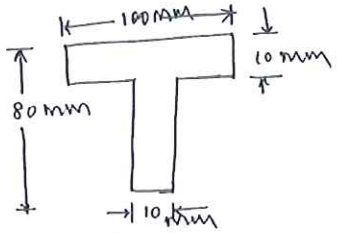

Fig.Q8(a)

b. State the assumptions made in Pure torsion theory. **(06 Marks)**

Module-5

9 A bolt is subjected to an axial pull of 12kN together with a transverse shear of 6kN. Determine the diameter of the bolt by using : **(16 Marks)**

i) Maximum principal stress theory ii) Maximum shear stress theory.

Take Elastic limit in tension = $300\ N/mm^2$; Factor of safety = 3 ; Poisson's ratio = 0.3.

OR

10 Write a note on the following :

a. Castigliano's I theorem. **(04 Marks)**

b. Modulus of resilience. **(04 Marks)**

c. Strain energy due to bending and torsion. **(08 Marks)**

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