CBCS SCHEME

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

15MN34

Third Semester B.E. Degree Examination, June/July 2018
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain Stress – Strain relationship for mild steel showing salient points on diagram. **(08 Marks)**

b. A specimen of steel 25mm in diameter with a gauge length of 200mm is tested to destruction. It has an extension of 0.16mm under a load of 80kN and the load at elastic limit is 160kN. The maximum load is 180kN. The total extension at fracture is 56mm and diameter at the neck is 18mm. Find i) The stress at elastic limit ii) Young's modulus iii) Percentage elongation iv) Percentage reduction in area v) Ultimate tensile stress. **(08 Marks)**

OR

2 a. Derive an expression for total extension of the tapered bar of circular cross section [diameter D and d], when it is subjected to an axial tensile load 'P'. **(08 Marks)**

b. Determine the magnitude of the load P necessary to produce zero net change in the length of the straight bar shown in fig. Q2(b). A = 400mm^2. **(08 Marks)**

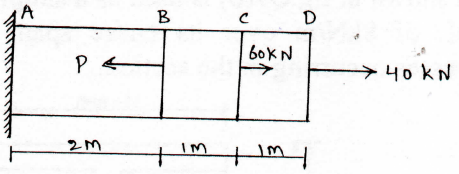


Fig.Q2(b)

Module-2

3 a. Derive the relationship between Modulus of elasticity and Bulk modulus. **(08 Marks)**

b. The state of stress shown in fig.Q3(b), determine the principle stress, Principal planes, Maximum shear stress and their Planes. **(08 Marks)**

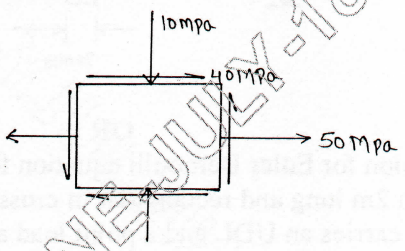


Fig.Q3(b)

OR

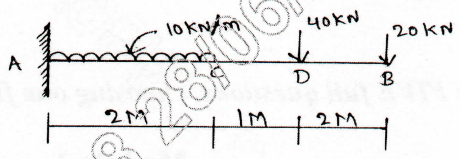
4 a. Differentiate between Thin and Thick cylinder. Also derive an expression for circumferential stress of a thin cylinder. **(08 Marks)**

b. A cylindrical shell is 3m long and 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 shell, if it is subjected to an internal fluid pressure of 1.5N/mm^2. Take E = 2×10^5 N/mm^2 and $\mu = 0.3$. **(08 Marks)**

Module-3

5 Draw Shear force and Bending moment diagram for the cantilever beam shown in fig.Q5. **(16 Marks)**

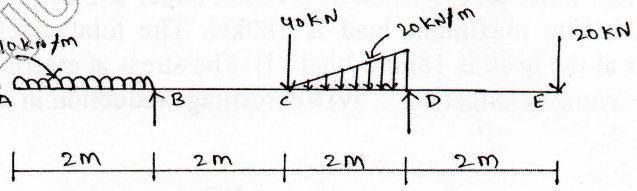
Fig.Q5



OR

6 Draw Shear force and Bending moment diagram for overhanging beam shown in fig. Q6. **(16 Marks)**

Fig.Q6

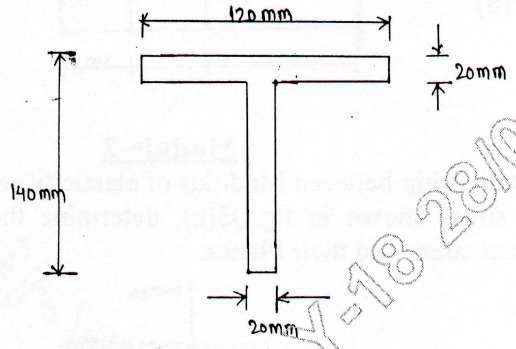


Module-4

7 a. List the assumptions made in theory of simply bending and derive the relationship between moment and radius of curvature. **(08 Marks)**

b. The T – section shown in fig.Q7(b) is used as a simply supported beam over a span of 4M. It carries an UDL of 8kN/m over its entire span. Calculate the maximum tensile and compressive stresses occurring in the section. **(08 Marks)**

Fig.Q7(b)

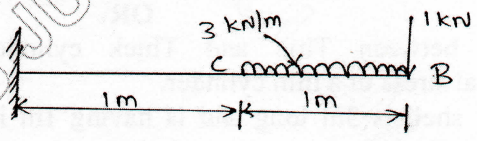


OR

8 a. Derive an expression for Euler Bernoulli equation for deflection. **(08 Marks)**

b. A cantilever beam 2m long and rectangular in cross – section of 100mm × 200mm wide and deep respectively carries an UDL and a point load as shown in fig. Q8(b). Find deflection in the beam at its free end. Take $E = 1 \times 10^5 N/mm^2$. **(08 Marks)**

Fig.Q8(b)



Module-5

9 a. List the assumption made in theory of pure torsion. Also derive the torsion equation with usual notations. **(08 Marks)**

b. A solid circular shaft has to transmit a power of 1000 kW at 120 rpm. The maximum torque 1.25 times of its mean and the shear stress of the material must not exceed 80N/mm^2. What percentage of saving in material would be obtained if the shaft is replaced by a hallow one whose internal diameter is 0.6 times its external diameter, the length , material and maximum shear stress being same? **(08 Marks)**

OR

10 a. Design the section of a circular cast iron column that can safely carry a load of 1000kN. The length of the column is 6m. Rankine's constant is $\frac{1}{16000}$, FOS = 3. One end of the column is fixed and other end is free. Critical stress is 560 MPa. **(08 Marks)**

b. Derive an expression for Euler's crippling load for a column when both of its ends are hinged (or) pinned. Also list the assumptions made in Euler's column theory. **(08 Marks)**

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