Code: 9A01301 **R09**

B.Tech II Year I Semester (R09) Supplementary Examinations June 2017

MECHANCIS OF SOLIDS

(Common to AE, ME & MCT)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

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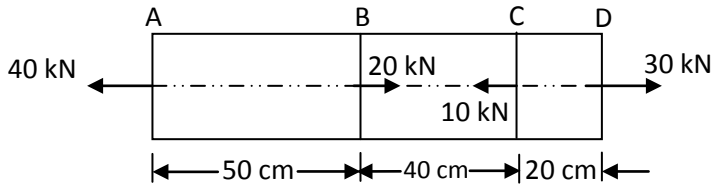
1 (a) Draw the stress-strain diagram for mild steel, brittle material and ductile material and indicate the salient features.

(b) A steel bar 25 mm diameter is loaded as shown in figure below. Determine the stresses in each part and total elongation. E = 210 GPa.

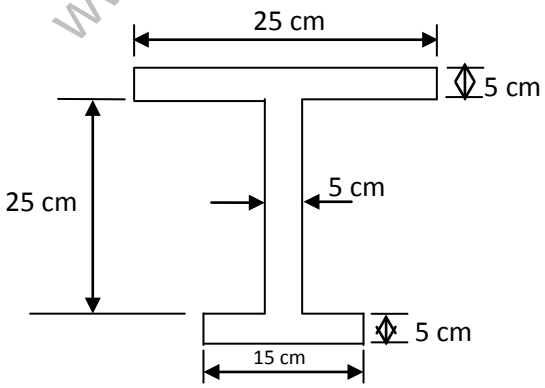


2 A horizontal girder which is freely supported at its ends and has a span of 9 m supports a uniformly distributed load of 20 kN/m run over the whole span and also two concentrated loads of 30 kN and 40 kN at points 6 m and 7.5 m respectively from the left support. Draw the bending moment and shearing force diagrams and state the values of the maximum bending moment and maximum shear force.

3 (a) What are the assumptions made in the theory of simple bending?

(b) Derive the equation for the simple bending of the beam.

4 A cast iron bracket subjected to bending has a cross-section of I-shape with unequal flanges as shown in figure below. If the tensile stress in top flange is not to exceed 17.5 MPa, what is the bending moment the section can take? If the section is subjected to a shear force of 1 kN, draw the shear distribution over the depth of the section.



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5 (a) Derive the relation for a circular shaft when subjected to torsion as given below.

$$\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{l}$$

(b) A solid shaft is to transmit 300 kW at 100 r.p.m. If the shear stress is not to exceed 80 MPa, 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?

6 (a) A beam AB of span 5 m is simply supported at A and B. A cantilever DC of length 3 m which is fixed at D meets the beam AB at mid-point C, there by forming a rigid joint at C. A vertical load of 200 kN is applied vertically at common joint C. Find out reactions at ends of simply supported beam.

(b) A beam AB simply supported at the ends is 4 m long. It carries a uniformly distributed load of intensity 20 kN/m over a length of 2 m starting at a distance of 1 m from left end support together with a concentric load 40 kN at a distance of 3 m from the left end support. Calculate the deflection at the centre, if E = 210 GPa, I = 9600m^4.

7 (a) Derive an expression for hoop stress and longitudinal stress in a thin cylinder with ends closed by rigid flanges and subjected to an internal fluid pressure p. Take the internal diameter and shell thickness of the cylinder to be d and t respectively.

(b) Derive from the first principles the expressions for circumferential and longitudinal stresses in a thin cylinder closed at both ends and subjected to internal fluid pressure.

8 (a) A thick cylinder of inner radius 10 cm and outer radius 15 cm is subjected to an internal pressure of 12 MPa. Determine the radial and hoop stresses in the cylinder at the inner and outer surfaces.

(b) A steel tube, which has an outside diameter of 10 cm and inside diameter of 5 cm, is subjected to an internal pressure of 14 MPa and an external pressure of 5.5 MPa. Calculate the maximum hoop stress in the tube.

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