

(02 Hours)

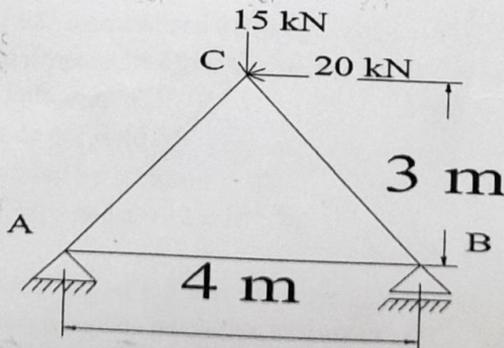
Total Marks: 60

Instructions:

1. Question No. 1 is compulsory.
2. Answer any Three Question from the remaining.
3. Each full question carries 15 marks.
4. Assume suitable data, if needed and state it clearly

Q. 1 Attempt any five

- a The following observations were made during a tensile test on a mild steel specimen 40 mm in diameter and 200 mm long. Elongation with 40 kN load (within limit of proportionality), $\delta l = 0.0304$ mm, Yield load = 161 kN, Maximum load = 242 kN
Length of specimen at fracture = 249 mm
Determine:
 - i. Young's modulus of elasticity
 - ii. Yield point stress
- b Draw Shear force diagram and Bending moment diagram for a simply supported beam of span 5 m, carries a uniformly distributed load of intensity 20 kN/m and point load of 10 kN at midspan. 3
- c Define core or kernel of section, Locate the Core of the solid circular of diameter 300 mm. 3
- d Calculate the moment of inertia of a Equilateral triangle about centroidal axis (XX axis and YY axis) having a side of 300 mm. 3
- e Calculate the forces in member AC and AB, where support A is hinged and B is roller. 3



- f What is effective or Equivalent length of column? Write effective length for various end condition showing sketch of buckling length. 3

Q. 2

- a Two wooden planks $200 \text{ mm} \times 50 \text{ mm}$ each are connected to form a T-section of a beam. If a moment of 20 kN.m is applied around the horizontal neutral axis, inducing tension below the neutral axis, find the stresses at the extreme fibres of the cross-section. Also calculate the total tensile force on the cross-section. 08
- b An element in a stressed material has tensile stress of 500 MPa and a compressive stress of 350 MPa acting on two mutually perpendicular planes and equal shear stresses of 100 MPa on these planes. Find principal stresses and position of the principal planes. Find also maximum shearing stress. 07

Q. 3

- a Draw AFD, SFD and BMD for the figure 01, where support A is hinged and B is roller. 12

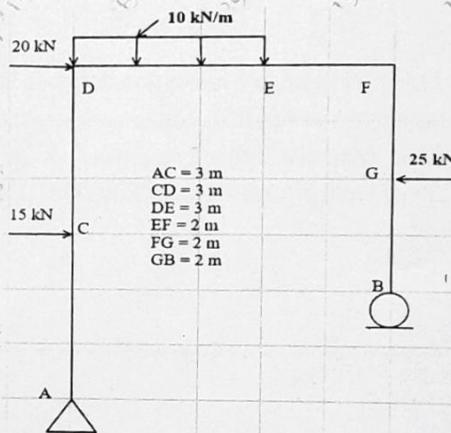


Fig: 01

- b State the assumption made in theory of Torsion 3
- Q. 4
- a A steel rod of 35 mm diameter and 6 m long is connected to both ends and the rod is maintained at a temperature of 95°C . determine the stress and pull exerted when the temperature falls to 30°C if, 10
- The ends do not yield
 - The ends yield by 1.2 mm ,
- Take $E = 2 \times 10^5 \text{ MPa}$ and $\alpha = 12 \times 10^{-6} / ^\circ\text{C}$.
- b What must be the length of a 5 mm diameter aluminium wire so that it can be twisted through one complete revolution without exceeding a shearing stress of 42 MN/m^2 ? Take: $G = 27 \text{ GN/m}^2$. 05

Q. 5

- a A cast-iron bracket, has a cross-section of I-shape with unequal flanges of top flange as 250 mm x 50 mm, web as 50 mm x 250 mm and bottom flange as 150 mm x 50 mm. If the section is subjected to shear force of 80 kN, draw the shear stress distribution over the depth of the section. 10
- b Derive the relation between Load, Shear Force and Bending Moment. 5

Q. 6

- a A three hinged symmetrical parabolic arch has a span of 40 m and a central rise of 6m. It is loaded with 25 kN/m on the left half of the arch and a point load of 40 kN at 10 m from right hand support. 08
- Calculate Normal Thrust and Radial Shear force at 5m from left hand support.
 - Draw BMD.
- b A hollow cylindrical cast iron column is 4 m long with both ends fixed. Determine the minimum diameter of the column, if it has to carry a safe load of 250 kN with a factor of safety of 5. Take the internal diameter as 0.8 times the external diameter. Take: $\alpha = 1/1600$ in Rankine's formula and $\sigma_c = 550$ MPa. 07

