

(02 Hours)

Total Marks: 60

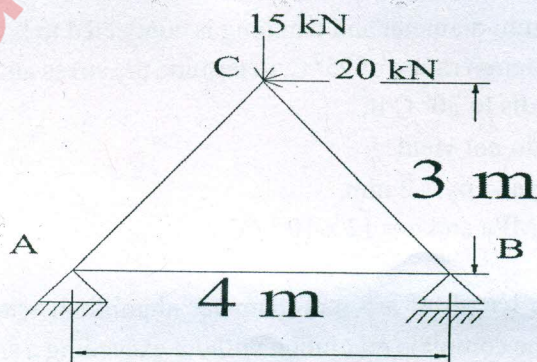
Q.P. 20000380

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 08  
of a beam. If a moment of  $20 \text{ kN.m}$  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.
- b An element in a stressed material has tensile stress of  $500 \text{ MPa}$  and a compressive stress of  $350 \text{ MPa}$  acting on two mutually perpendicular planes and equal shear stresses of  $100 \text{ MPa}$  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

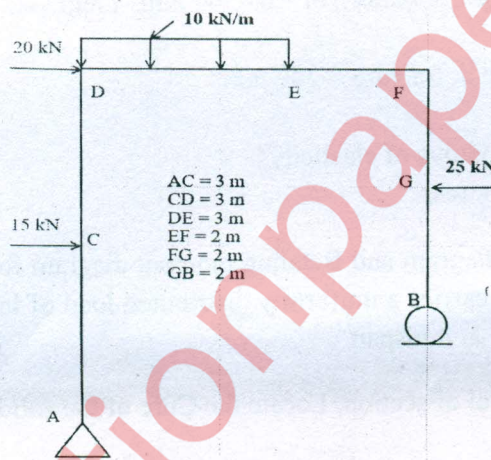


Fig: 01

- b State the assumption made in theory of Torsion 3

Q. 4

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

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

i. Calculate Normal Thrust and Radial Shear force at 5m from left hand support.

ii. 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