Paper / Subject Code: 51622 / Strength of Materials

SE Sem III (R-2019 C Scheme) "Mechanical" May'23

26/5/2023

(3 Hours) [Total Marks :80]

N.B.
1. Question No.1 is compulsory.
2. Answer any three questions from remaining questions.
3. Assume suitable data if required.
4. Figure to the right indicates full marks.

Q1 **Answer any four.** Each question carries same mark 5x4=20

a For a two-dimensional state of stress What do you mean by principal stresses and maximum shear stress? Explain with example.

b Derive expression for deformation of uniformly tapering circular section bar.

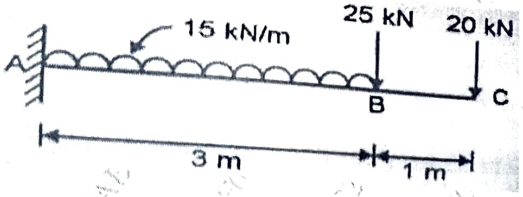
c Write the assumptions made in theory of pure torsion and derive torsional formula.

d What are the different end conditions used in columns?

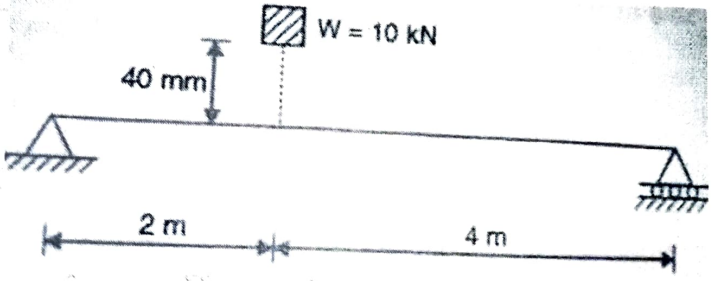
e Explain the stress strain diagram for ductile material.

Q2 a A bar of 25 mm diameter is tested in tension. It is observed that when a load of 60kN is applied, the extension measured over a guage length of 200 mm is 0.12 mm and contraction in diameter is 0.0045 mm. Find Poisson's ratio and elastic constants E, G, K. 10

b Calculate deflection at point B and C for the beam as shown in figure using any method. Take EI=32000KN.m$^2$. 10



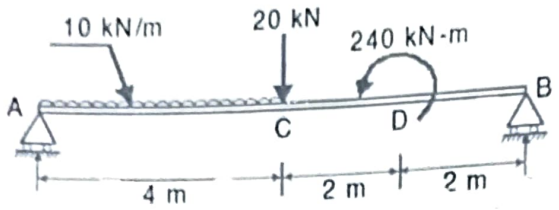

Q3 a A weight of 10 KN is dropped on to a simply supported beam for a height of 40 mm. Assuming the impact to be perfect without any loss of energy, Determine the instantaneous deflection at the impact point. Take EI= constant. 10




b An I section beam 350mm x 150 mm has a web thickness 10mm and flange thickness 20mm. If the shear force acting on the section is 40 KN find: 10

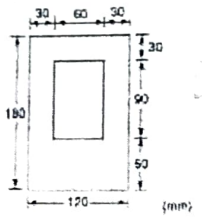
1 Max shear stress developed in the section
2 Sketch the shear stress distribution diagram.
3 The total shear force carried by web.

Q4 a A beam of span 8 m has roller support at A and hinge support at B as shown in Fig. Calculate SF and BM at important points and Draw SF and BM diagrams **10**




b Derive bending equation. Also state the assumption made in the analysis **10**

Q5 a The cross section of the beam is shown in figure. Determine the moment of resistance for both positive and negative of bending moment about horizontal neutral axis. Take tensile and compressive stresses as 24 and 85 $N/mm^2$ respectively. **10**




b A short hallow cylindrical column of 200 mm external diameter, 100mm internal diameter and 8m long has both ends fixed. It is subjected to axial compression load. Taking FOS as 5, $\sigma_c$=450 MPa & $\alpha$ = 1/1600. Determine safe Rankine's load. **10**

Q6 a A cylindrical shell is 150 cm long, 22cm internal diameter of 8mm thick plates is subjected to internal pressure 15 $N/mm^2$, E=2.1 X $10^5$ $N/mm^2$, Bulk modulus of water is 200 $N/mm^2$ and 1/m=0.28. Find the change in volume of the shell. **10**

b A bar of brass 20 mm is enclosed in a steel tube of 40 mm external diameter and 20 mm internal diameter. The bar and the tubes are initially 1.2 m long and are rigidly fastened at both ends using 20 mm diameter pins. If the temperature is raised by 60°C, find the stresses induced in the bar, tube and pins. **10**

$Es = 2 \times 10^5\ N/mm^2$
$Eb = 1 \times 10^5\ N/mm^2$
$\alpha s = 11.6 \times 10^{-6}/°C$
$\alpha b = 18.7 \times 10^{-6}/°C.$

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