Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023
CIVIL ENGINEERING

(2020 SCHEME)

Course Code : **20CET201**

Course Name: **Mechanics of Solids**

Max. Marks : **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

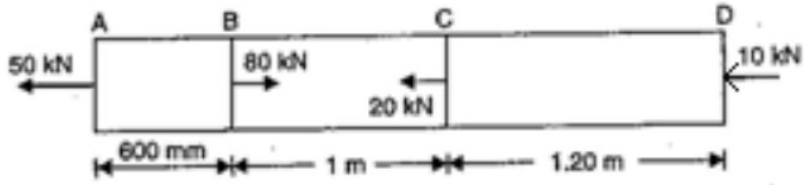
1. Explain the main types of stresses and strains?
2. Define elastic limit? How is it significant in assessing material behaviour?
3. Discuss types of elastic constants related to isotropic materials.
4. Explain Circumferential stress (or hoop stress) and Longitudinal stress?
5. Define shear force and bending moment.
6. Define point of contra flexure? In which beam it occurs?
7. Write the formula to find a shear stress at a fiber in a section of a beam?
8. Write the theory of simple bending equation.
9. What are the limitations of Euler's formula to calculate the buckling load of slender columns?
10. Define principal stresses and principal planes?

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. A brass bar, having cross-sectional area of 1000 mm^2 , is subjected to axial forces as shown in fig. Find the total elongation of the bar, Take E = 1.05 x 10^5 N/mm^2 (14)



OR

12. A compound tube consists of a steel tube 140mm internal diameter and 160mm external diameter and an outer brass tube 160mm internal (14)

diameter and 180mm external diameter. The two tubes are of the same length. The compound tube carries an axial load of 900kN. Find the stresses and the load carried by each tube and the amount if 21 shortens. Length of each tube is 140mm. Take E for Steel as 2 x 10^5 N/mm2 and for brass as 1 x 10^5 N/mm^2.

MODULE II

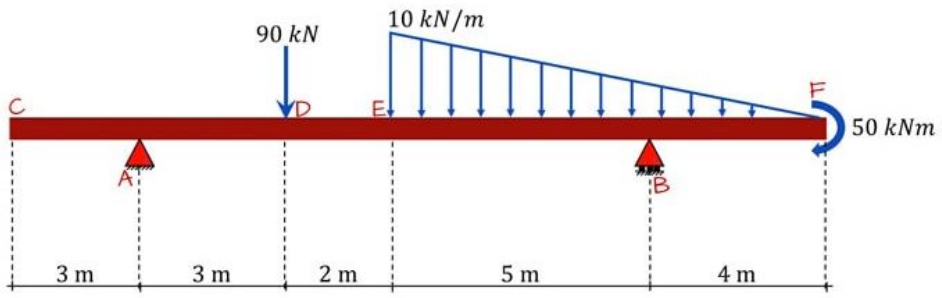
13. Determine the changes in length, breadth and thickness of a steel bar which 5cm long, 40mm wide and 30mm thick and is subjected to an axial pull of 35KN in the direction in length take the young's modulus and poisson's ratio 200GPa and 0.32 respectively. (14)

OR

14. An aluminium rod 22mm in diameter passes through a steel tube of 25mm internal diameter and 3mm thick. The rod and tube are fixed at a temperature 180°C. Find the stresses in the rod and tube, when the temperature falls to 60°C. E_s=200kN/mm^2, E_a=70kN/mm^2, α_s =12x10^{-6}/°C, α_a= 23x10^{-6}/°C. (14)

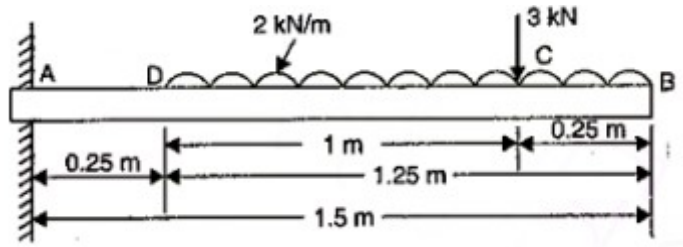
MODULE III

15. Draw Shear force diagram and Bending moment diagram of the beam shown in figure. Mark the salient points. Also find the location of point of contraflexure. (14)



OR

16. Draw the SFD and BMD of the beam loaded as shown in Fig. Find the maximum BM . (14)

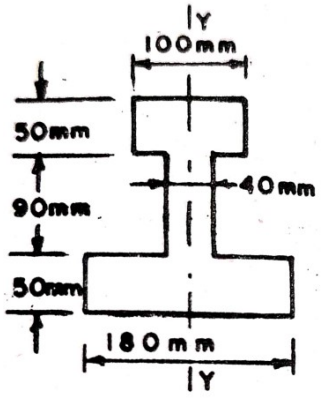


MODULE IV

17. An I section beam 350mm x 200mm has a web thickness of 12.5mm and a flange thickness of 25mm. It carries a shearing force of 200kN at a section. Sketch the shear stress distribution across the section. (14)

OR

18. A cast iron beam has an un-symmetrical I section as shown in figure. Find the safe UDL that the beam can carry over a simply supported span of 5m if allowable tensile stress and compressive stress be 40N/mm^2 and 70N/mm^2 respectively. (14)



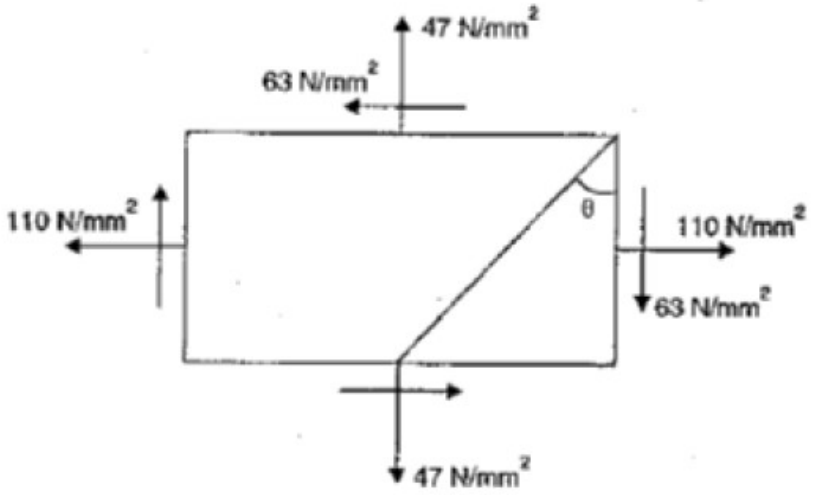
MODULE V

19. a) Determine the limiting length of a pin-ended column section 60mm x 100mm so that the critical stress is 250 N/mm^2. Assume E=2x10^{5}N/mm^2. (6)

    b) A solid circular shaft transmits 75 kW power at 200 rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in 2m length of the shaft, and the shear stress is limited to 50 N/mm^2. Take modulus of rigidity, G = 1×10^5 N/mm ^{2}. (8)

OR

20. A rectangular block of material is subjected to a tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2 and that associated with the former tensile stress tends to rotate the block anticlockwise. Find: (14)
    (i) The direction and magnitude of each of the principal stress and
    (ii) Magnitude of the greatest shear stress


47 N/mm²
63 N/mm²
110 N/mm²
θ
110 N/mm²
63 N/mm²
47 N/mm²

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