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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

THIRD SEMESTER B.TECH DEGREE EXAMINATION (S), MAY 2022

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. Differentiate between yield stress, proportional limit and elastic limit.
2. Define working stress and factor of safety.
3. What is strain energy? Write an expression for strain energy stored in a body due to axial force.
4. Elucidate temperature stresses in a bar element.
5. Define bending moment and shear force.
6. What do you mean by point of contraflexure? State its significance.
7. Write the basic equation for deflection of beams and explain the terms.
8. List three important assumptions used in the theory of pure bending and their significance.
9. Define effective length of a column and mention its significance.
10. What are principal stresses and principal planes?

PART B

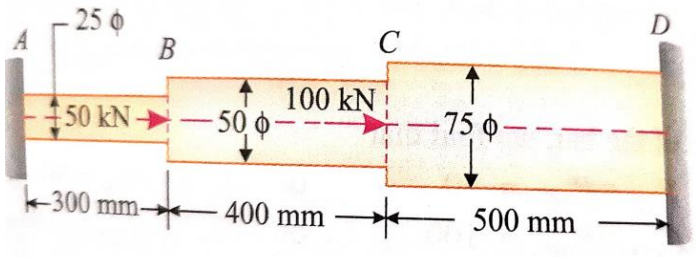
(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. A compound bar ABC 1.5 m long is made up of two parts of aluminium and steel and that the area of cross section aluminium bar is twice that of the steel bar. The rod is subjected to an axial tensile load of 200 kN. If the elongations of aluminium and steel parts are equal, find the lengths of the two parts of the composite bar. Take E for steel as 200 GPa and E for aluminium as one-third of E for steel. (14)

OR

12. A circular steel bar ABCD, rigidly fixed at A and D is subjected to axial loads of 50 kN and 100 kN at B and C as shown in figure.



(14)

Find the loads shared by each part of the bar and displacements of the points B and C. Take E for steel as 200 GPa.

MODULE II

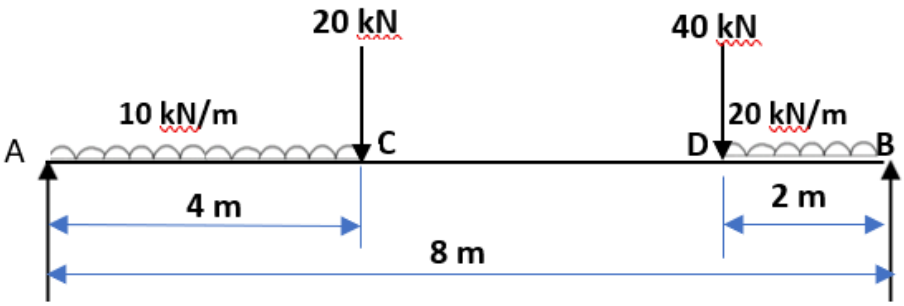
13. A steel cube of 50 mm side is subjected to a force of 6 kN (tension), 8kN (compression) and 4 kN (tension) along x, y and z direction respectively. Determine the change in volume of the block. Take E as 200 GPa and poisson's ratio is 0.3. (14)

OR

14. A flat steel bar 200mm × 20 mm × 8mm is placed between two aluminium bars 200mm × 20mm × 6mm so as to form a composite bar as shown in figure. All the three bars are fastened together at room temperature. Find the stresses in each bar, where the temperature of the whole assembly is raised through 50^0 C. Assume E for steel= 200 GPa, E for aluminium = 80 GPa, co-efficient of linear expansion of steel and aluminium are 12×10^{-6} /°C, and 24×10^{-6} /°C. (14)

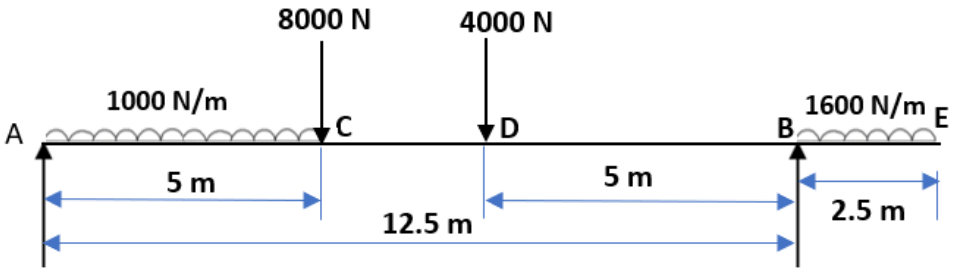
MODULE III

15. Draw the SFD and BMD of the beam loaded as shown in figure. Find the maximum BM and locate the point of maximum BM also. (14)



OR

16. An overhanging beam is loaded as shown in figure. Draw SFD and BMD. Locate the point of contraflexure also. (14)



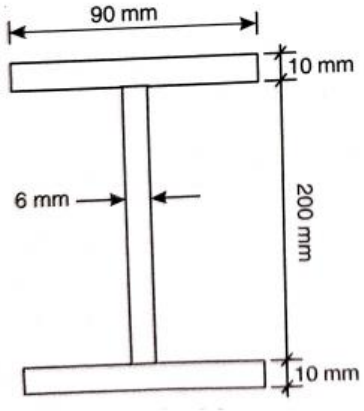
MODULE IV

17. An I section beam 350mm × 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 simply supported beam of 4 m span carrying a uniformly distributed load consists of steel joist. If the material can safely be stressed to a tensile stress of 200 (14)

N/mm^2 and a compressive stress of 150 N/mm^2, find the safe load on the beam which can carry. Also find the stresses for this loading.



MODULE V

19. An I section joist 400 mm (depth) × 200mm (flange width) × 20mm (thickness) and 6m long is used as a strut with both ends fixed. What is Euler's crippling load for the column? Take Young's modulus for the joist as 200 GPa. (14)

OR

20. The stresses at a point in a component are 100 MPa (tensile) and 50 MPa (compressive). Determine the magnitude of the normal and shear stresses on a plane inclined at an angle of 25^0 with tensile stress. Also determine the direction of the resultant stress and the magnitude of the maximum intensity of shear stress. (14)

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