Reg. No._____ Name:_____

A P J ABUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017

CE 201: MECHANICS OF SOLIDS (CE)

Max. Marks:100 Duration: 3 Hours

PART A

Answer any 2 complete questions each having 15 marks

1. (a) In an experiment, a bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on a guage length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the value of the three moduli. (10)

   (b) Define the terms stress and strain. What ate the different types of stresses and strains? (5)

2. (a) A compound bar consists of a circular rod of steel of diameter 20 mm rigidly fitted into a copper tube of internal diameter 20 mm and thickness 5 mm. If the bar is subjected to a load of 100 kN , find the stresses developed in the two materials. Take Es = $2x10^5$ N/mm^2 and Ec =$1.2x10^5$ N/mm^2 (10)

   (b) What is strain energy? Give the expression for strain energy due to axial force. (5)

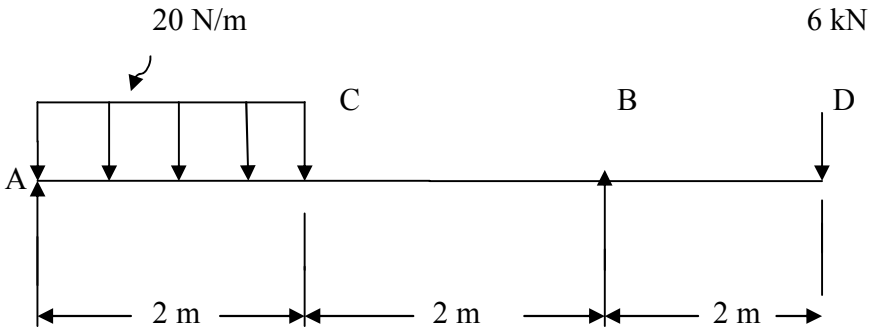
3. (a) A railway line is laid so that there is no stress in the rails at 8^0C. Calculate (a) the stress on the rails at 50^0C if there is no allowance for expansion. (b) the stress in the rails if there is an expansion allowance of 8 mm. (c) the expansion allowance if the stress in the rails is to be zero . (d) the maximum temperature to have no stress in the rails if the expansion allowance is 12 mm. The rails are 30 mm long. Take $\alpha = 12 \times 10^{-6}$ per ^{0}C and $E = 2 \times 10^5$ N/mm^2 (10)

   (b)Derive the expression for deformation of a bar of constant section due to self weight. (5)

PART B

Answer any 2 complete questions each having 15 marks

4. (a) Draw the shear force and bending moment diagram for the beam given.



(10)

(b) Derive the relation between intensity of loading, shear force and bending moment. (5)

5. (a) A simply supported beam AB of 4 m span carries a uniform load of 30 kN/m over the right hand half of the span. Draw SFD and BMD. (10)
   (b) Distinguish between bending moment and moment of resistance (5)
6. (a) A cast iron beam has an I-section with top flange 80 mm x 40 mm, web 120 mm x 20 mm and bottom flange 160 mm x 40 mm. If tensile stress is not to exceed 30 N/mm^2 and compressive stress 90 N/mm^2, what is the maximum UDL the beam can carry over a simply supported span of 6 m if the larger flange is in tension? (10)
   (b) Sketch the bending stress as well as shear stress distribution diagram for a beam of rectangular cross section. (5)

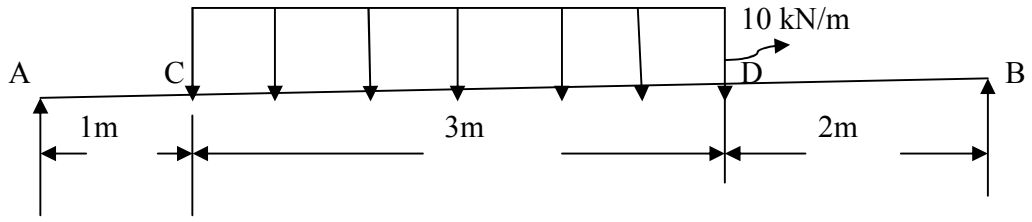
PART C

Answer any 2 complete questions each having 20 marks

7. (a) At a point in a material stress components are p_x = 500 MPa (tensile), p_y = 10 MPa (tensile) and q = 20 MPa. Determine (i) the planes on which shear stress is maximum, (ii) principal planes and (iii) stress components on these planes. (12)
   (b) Derive the torsion equation for a solid circular shaft. (8)

8. (a) A beam AB is 6m long and has a moment of inertia of 450×10^6 mm^4. It is supported at A and B and carries a UDL of 10 kN/m as shown in figure. Calculate (i) Slope at A and (ii) maximum deflection.

   Take E = 200 kN/mm$^{2.}$



(15)

(b) State and explain moment area theorems. (5)

9. (a) A hollow metallic tube of 60 mm external diameter, 50 mm internal diameter and 8 m long is fixed at one end and its upper end is free. Calculate the maximum load that it can withstand. Crushing strength of the material = 300 MPa, Rankine's constant = 1/7500.

(12)

(b) What are the assumptions made in Euler's column theory? (8)

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