Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION(S), May 2019

Course Code: CE201

Course Name: MECHANICS OF SOLIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Define Bulk modulus. Calculate the change in volume of a cubical block of side 120 mm subjected to a hydrostatic pressure of 70 MPa. Take Poisson's ratio 0.28 and young's modulus 200 GPa. (5)

b) A steel rod 2 m long and 3 mm in diameter is extended by 0.75 mm when a weight W is suspended from the wire. If the same weight is suspended from a brass wire, 2.5 m long and 2 mm in diameter, it is elongated by 4.64 mm. Determine the modulus of elasticity of brass if that of steel be 2×10^5 N/mm^2. (10)

2 a) State and explain principle of superposition. (5)

b) Calculate the total deformation of the bar shown in fig.1 What will be the diameter of a bar of uniform cross section, to have the same strain as that of the stepped bar? Take Young's modulus as 200 GPa. (10)

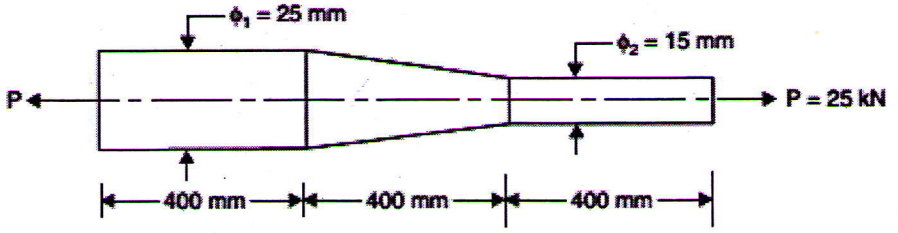

Fig.1

3 a) The composite bar shown in fig.2 is rigidly fixed at the ends A and B. Determine the reaction developed at ends when the temperature is raised by 25^0c. Given E_{cu} =140 kN/mm^2 , E_s =200 kN/mm^2, α_{cu} = $17.5\times10^{-6}/^0C$, α_s = $12\times10^{-6}/^0C$ (10)

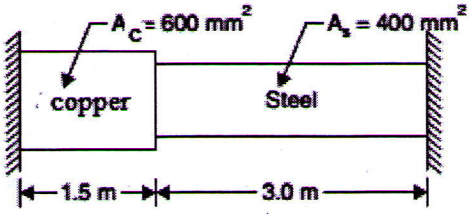

Fig.2

b) Define the terms i) Resilience ii) Proof resilience iii) Modulus of resilience (5)

PART B

Answer any two full questions, each carries 15 marks.

4 a) Explain the following: (5)

i) Shear force and bending moment in a beam.

ii) Hogging and sagging moments.

iii) Point of contra flexure.

b) Determine the load P such that reactions at supports A and B are equal in the beam shown in fig3.Draw the shear force and bending moment diagrams and mark the values at salient points. (10)

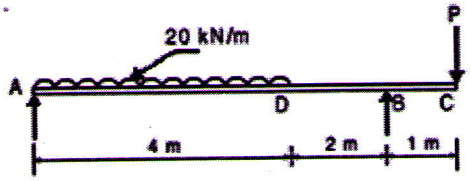

Fig.3

5 a) What is meant by pure bending? Sketch an example of a beam subjected to pure bending. (3)

b) A simply supported beam of length 3 m carries a point load of 12 kN at a distance of 2 m from left support. The cross section of the beam is as shown in Fig.4 b. (12)

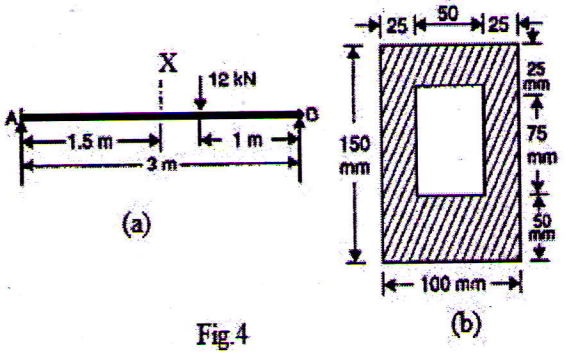

Fig.4

Determine the bending stresses at extreme fibres at section X-X. Take moment of inertia about neutral axis of the section as 2.56×10^7 mm^4.

6 a) Calculate the strain energy stored in a cantilever beam of length 2 m subjected to a point load 10 kN at the free end. Take E = 200 GPa and I= 1.5×10^7mm^4. (5)

b) Calculate the moment of resistance of a composite beam made of wood and steel. The cross section is rectangular,with wood 150 mm wide and 300 mm deep, strengthened by fixing steel plates of 12 mm thickness and 300 mm deepth on either side.If the maximum stress in wood is 8 N/mm^2, what is the corresponding maximum stress attained in steel?.Take E_w=10 GPa and E_s=200 GPa. (10)

PART C

Answer any two full questions, each carries20 marks.

7 a) At a point in a strained material a direct tensile stress of 70 N/mm^2 and a direct compressive stress of 50 N/mm^2 are acting on planes at right angles to each other. If the maximum principal stress is limited to 75 N/mm^2 tensile, determine the shear stress that may be allowed on these planes. Also determine the i) minimum principal stress ii) maximum shear stress and iii) direction of principal planes. (12)

b) A solid shaft of 200 mm diameter has the same cross sectional area as that of a hollow shaft of the same material with inside diameter of 150 mm. Find the ratio of the power transmitted by the two shafts at the same speed. (8)

8 a) A thin cylinder of internal diameter 2 m contains a fluid at an internal pressure of 3 N/mm^2. Determine the maximum thickness of the cylinder if i) the longitudinal stress is not to exceed 30 N/mm^2 and ii) the hoop stress is not to exceed 40 N/mm^2. (6)

b) Write down Mohr's theorems for slope and deflection of beams. (4)

c) A cantilever beam is 2 m long and has a flexural rigidity of 25MN-m^2. It carries a point load of 3 kN at mid length and a u.d.l of 2 kN/m along its entire length. Calculate the deflection and slope at the free end by Macaulay's method. (10)

9 a) What is meant by kern of a section? Sketch the kern of i) circular and ii) square sections. (6)

b) A hollow rectangular cast iron column having outside width and depth 250×500 mm and thickness 20 mm is fixed at one end and hinged at the other end. Length of the column is 8 m. Calculate the safe load that can be applied on the column assuming a factor of safety of 4. Use Rankine's theory. Take α =1/1600 and σ_c =600 N/mm^2.Compare the value by Euler's theory. Take E= 95 kN/mm^2 (14)