Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third semester B.Tech examinations (S) September 2020

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

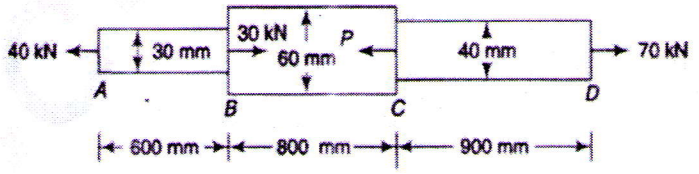
1 a) Plot stress strain diagram for mild steel. Explain its salient features. (7)

b) Calculate the diameter of a circular bar of length 10m, if the elongation of the bar due to an axial load of 100kN is 0.15mm. E=200GN/m^2 (4)

c) Define the following terms a) Poissons's ratio b)Bulk modulus c)Modulus of resilience d) Rigidity modulus (4)

2 a) Derive an expression to determine the elongation of a uniformly tapering circular section. (7)

b) A circular steel bar having three segments is subjected to various forces at different cross-sections as shown in figure. Determine the necessary force to be applied at section C for the equilibrium of the bar. Also find the total elongation of the bar. Take E=2x10^{5}N/mm^2. (8)



3 a) A mild steel rod of 20mm diameter and 300mm long is enclosed centrally inside a hollow brass tube of external diameter 30mm and internal diameter of 25 mm. The ends of the tube and rods are brazed together and the composite bar is subjected to an axial pull of 40kN. If E for steel and brass is 200 GN/mm^2 and 100 GN/mm^2 respectively, find the stresses developed in the rod and tube. Also, find the extension of the rod. (10)

b) A rod is 2 m long at a temperature of 10°C. Find the expansion of the rod when the temperature is raised to 80°C. If this expansion is prevented, find the stress induced in the material of the rod. Take E=1x10^{5}N/mm^2 and α=0.000012 per degree centigrade. (5)

PART B

Answer any two full questions, each carries 15 marks.

4 a) A 10 m long simply supported beam carries two point loads of l0kN and 6kN at 2m and 9m respectively from the left end. It also carries a uniformly distributed load of 4kN/m run for the length between 4m to 7m from the left end. Draw shears force and bending moment diagrams. State the position and magnitude of maximum bending moment. (10)

b) What are the assumptions in theory of simple bending? (5)

5 a) A cantilever beam of span L, fixed at the left end, carries a gradually varied load from zero at free end to w per m length at fixed end. Draw the SFD and BMD. (6)

b) A 225mm x 100mm I beam is simply supported over a span of 12m. The web thickness is 7.5mm and flange thickness is 11.5mm. If the maximum permissible stress is 80N/mm^2, what concentrated load can be carried at a distance of 4m from the support? (7)

c) Define a)point of contra flexure b)Moment of resistance (2)

6 a) A cast iron tee section having overall depth 150mm with flange width and thickness as 100mm and 30mm respectively is used as a cantilever bracket of length 300mm. Web thickness is 30mm. If the tensile stress is restricted to 20N/mm^2, calculate the point load that can be placed at the free end of bracket. Also calculate the compressive stress developed. (10)

b) State the governing relation to find the shear stress in beams. Sketch the shear stress distribution across depth in a)rectangular section b)I section (5)

PART C

Answer any two full questions, each carries 20 marks.

7 a) Derive an expression for the shear stress produced in a circular shaft which is subjected to torsion. State the assumptions made in derivation. (8)

b) An elemental cube is subjected to tensile stresses of 30N/mm^2 and 15N/mm^2 acting on two mutually perpendicular planes and a shear stress of 25N/mm^2 on these planes. Determine magnitude and directions of principal stresses. Also calculate greatest shear stress and its planes. (9)

c) Differentiate between closed coiled and open coiled helical springs. (3)

8 a) Show that in thin cylinders, the circumferential stress is twice the longitudinal stress when subjected to internal pressure. (6)

b) A hollow cast iron column 10m long and 10cm internal diameter and 15cm external diameter is having its one end hinged and other rigidly fixed. Find the crippling load and safe load taking factor of safety as 5. Take E=95kN/mm^2. Use Eulers formula. (7)

c) A solid steel shaft has to transmit 75kW at 200rpm. Determine the suitable diameter of shaft if the maximum torque transmitted is not to exceed the mean by 30% in each revolution. The shear stress is not to exceed 70N/mm^2. Also calculate the maximum angle of twist in a length of 4m of the shaft. G=80Gpa (7)

9 a) A beam of length 6m is simply supported at its ends and carries a point load of 48kN and 40kN at a distance of 1m and 3m respectively from the left support. Find a) deflection under each load b) maximum deflection c) point at which maximum deflection occurs by double integration method. Given E=2x10^{5}N/mm^2 and I=85x10^{6}mm^4. (10)

b) Define slenderness ratio. State the equations for Euler's crippling load for columns with different end conditions. (5)

c) Explain moment area theorems. (5)

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