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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third semester B.Tech examinations (S) September 2020

Course Code: ME201

Course Name: MECHANICS OF SOLIDS (ME,MP,MA,MT,AU,PE,SF)

Max. Marks: 100 Duration: 3 Hours

PART A

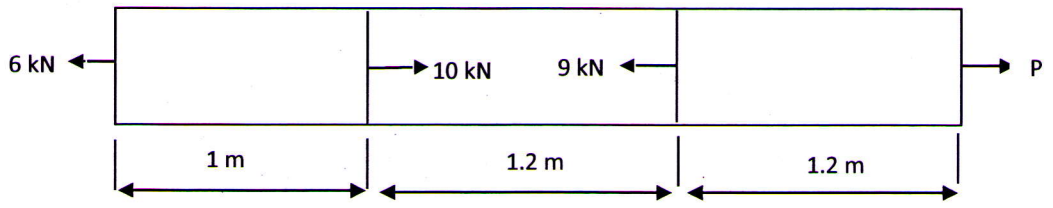
Answer any three full questions, each carries 10 marks Marks

1 a) Explain the stress strain diagram for brittle material. (3)

b) A compound bar is made of central steel plate of 60mm wide and 10mm thick to which copper plates 40mm wide by 5mm thick are connected rigidly on each side. The length of bar at normal temperature is 1metre. If temperature is raised by 80^0C, determine the stresses in each metal and change in length. Take E_{STEEL}= 200GPa α_{STEEL}=12x$10^{-6}/^0$C&E_{COPPER}= 100GPa α_{COPPER}=17x$10^{-6}/^0$C. (7)

2 a) ABC is a stepped bar subjected to axial pull of 40 KN.The length and diameter of the solid portion AB is 80 mm and 40mm and for the remaining hollow section of length 120mm is having internal diameter 20 mm external diameter 40mm.Determine total strain. What will be the diameter of the bar,if it is a solid section throughout, for the same strain. Take E=200 KN/mm^2. (6)

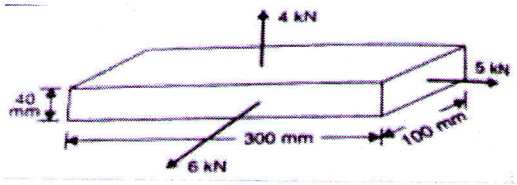
b) A steel member of uniform cross-sectional area 1000mm^2 is subjected to axial force as shown. Calculate the force "P" required for equilibrium of the member and the total change in length. (4)



3 a) With proper assumptions derive torsion equation. (5)

b) A metallic bar 300mmx 100mm is subjected to a force of 5KN,6KN&4KN along x,y and z directions respectively.Determine change in volume of the block. (5)

Take E=2x10^5 N/mm^2 and Poisson's ratio=0.25.



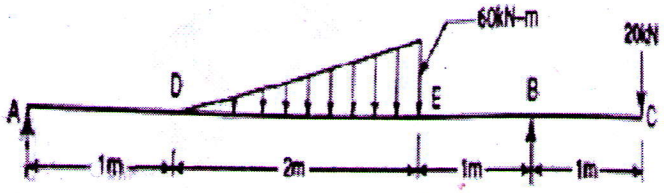
4 a) Determine the diameter of a solid shaft which will transmit 440kW at 280 rpm.The angle of twist should not exceed one degree per meter length and maximum torsional shear stress is limited to 40N/mm^2.AssumeG=84KN/mm^2. (6)

b) A rod of 1m length and diameter 20mm is subjected to tensile load of 20kN.The increase in length of rod is0.30 mm and decrease in diameter is 0.0018mm. Calculate Poisson's ratio, Young's modulus, Bulk modulusand rigidity modulus. (4)

PART B

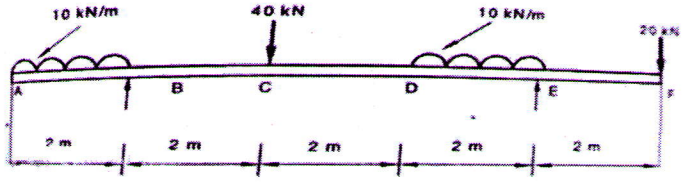
Answer any three full questions, each carries 10 marks

5 Draw shear force and bending moment diagram for the beam shown& mark its salient points. (10)



6 a) What do you understand by term point of inflection (2)

b) Draw shear force & bending moment diagram, indicate the magnitude of maximum bending moment and its position (8)



7 In a simply supported beam of 3 m span with 'T' cross section, a point load of 15kN is applied at a distance of 1 m from the left end. The flange width and thickness are 100 mm and 50 mm respectively. The total depth of the 'T' cross section is 300 mm and the web thickness is 50 mm. Determine the shear stress at a point 30 mm below the top of the flange at mid-span of the beam. Also plot the shear stress distribution across the depth of the beam. (10)

8 Derive the relation connecting bending moment and bending stress for a beam subjected to pure bending. State all assumptions. (10)

PART C

Answer any four full questions, each carries 10 marks.

9 a) Discuss on stress transformation. (2)

b) Determine the equation of deflection curve for a cantilever beam subjected to a uniform distributed load of q per unit length. (8)

10 A simply supported beam of span 10 m carries a uniformly distributed load of 5 kN/m over a length of 5 m from the centre to the right end. Calculate the deflection at the centre and slope at the right end. The beam has a rectangular cross section of height 200 mm and width 100 mm. Take E as 205 GPa. (10)

11 At a point in a material, the stresses on two mutually perpendicular planes are 120 N/mm^2 and 40 N/mm^2 both tensile. The shear stresses across these planes is 40 N/mm^2. Determine the principal stresses. Locate the principal planes and determine the normal and shear stresses on a plane inclined at 45 degrees in anticlockwise direction from the major principal plane. (10)

12 Derive Euler's buckling load for a slender column with one end fixed and other end hinged. (10)

13 A solid shaft of 150 mm diameter is transmitting a torque of 120kNm.At the same time it is subjected to abending moment of 12kNm and an axial thrust of 200kN. Find the maximum & minimum Principal stresses developed at the extreme fibre along vertical axis. (10)

14 a) Define slenderness ratio and explain its significance. (3)

b) The external and internal diameter of hollow cast iron column is 5cm and 4cm respectively. If length of this column is 3m and both of its ends are fixed, determine the crippling load using Rankine's formula. Take σ_c=550$N/mm^2$and α=$6.25x10^{-04}$ (7)

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