Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

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) A metallic bar 30mm diameter is subjected to an axial tensile load of 60kN. The measured extension on gauge length of 150mm is 0.075mm and change in diameter is 0.00375mm. Calculate Poisson's ratio, Young's modulus and modulus of rigidity. (6)

b) A rod which tapers uniformly from 50mm diameter to 30mm diameter in a length of 1.5m is subjected to an axial force of 150kN. Determine the elongation of the rod. Take E = 200GPa. (4)

2 a) State the principle of superposition. (2)

b) A steel bar is fastened between two copper bars as shown in Fig 1. The assembly is subjected to loads at positions as in figure. Calculate the total deformation of the bar. E_{steel} = 200GPa and E_{copper} = 110GPa. (8)

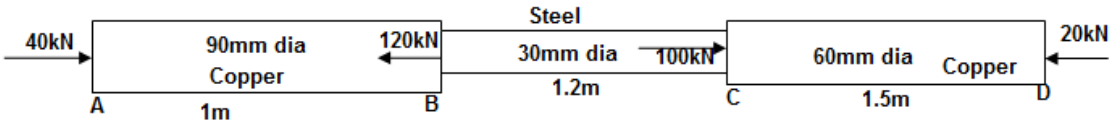

Fig 1

3 A brass bar 20mm diameter is enclosed in a steel tube of 25mm internal diameter and 50mm external diameter. Both bar and tube is of same length and fastened rigidly at their ends. The composite bar is free of stress at 20°C. To what temperature the assembly must be heated to generate a compressive stress of 48MPa in brass bar? Also determine the stress in steel tube. E_{steel} = 200GPa and E_{brass} = 84GPa, α_{steel} = 12 x 10^{-6}/°C and α_{brass}= 18 x 10^{-6}/°C. (10)

4 a) Compare the strength of a hollow shaft of diameter ratio 0.75 to that of a solid shaft by considering the permissible shear stress. Both the shafts are of same material, of same length and weight. (5)

b) The propeller shaft for a small ship is of solid steel bar 100mm diameter. If the permissible shear stress is 50MPa and angle of twist is 0.8°/metre length, calculate the maximum torque that can be applied on the shaft. G=80GPa. (5)

PART B

Answer any three full questions, each carries 10 marks

5 Draw shear force and bending moment diagram for the beamgiven in Fig 2. and mark all salient points. (10)

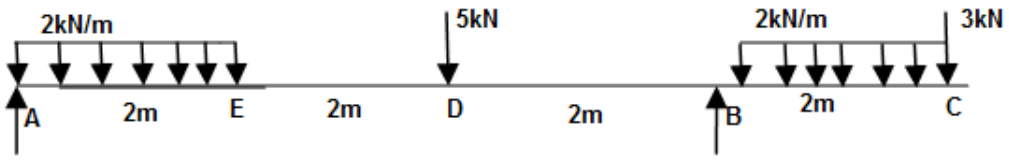

Fig. 2

6 a) Find the dimensions of the strongest rectangular section that can be cut from a solid circular log of wood of diameter D. (5)

b) A beam of rectangular cross section is 5m long. It is simply supported and carries UDL of 10kN/m over the whole span. If the maximum bending stress is limited to $5N/mm^2$, find the width and depth of section if depth is twice the width. (5)

7 An I- section has equal flanges of 150mm x 20mm and web 250mm x 20mm. Find the maximum shear stress developed across the depth for shear force of 50kN. (10)

8 A cast iron beam is of T section with thickness of 20mm for flange and web. The flange width is 150mm and overall depth is 240mm. The beam is simply supported over a span of 6m and carries uniformly distributed load of 3kN/m over the entire span. Plot the bending stress distribution diagram. (10)

PART C

Answer any four full questions, each carries 10 marks.

9 A simply supported beam of span 6m carries a UDL of 2kN/m over the full span and a concentrated load of 6kN at one third span from left support. Calculate the slope at supports and deflection at mid span. $EI=3x10^4$ kN-m^2. (10)

10 A point in a strained material is subjected to a tensile stress of 60MPa and a compressive stress of 45MPa acting on two mutually perpendicular planes. There is also a shear stress of 20MPa along these planes. Determine the principal stresses and maximum shear stress. (10)

11 a) The Euler's stress of a column whose ends are hinged is 40MPa. Calculate the slenderness ratio of the column. $E=2x10^5$ N/mm^2 (5)

b) Obtain the expression for Rankine's crippling load for a column. (5)

12 Find the crippling load for a hollow steel column 50mm internal diameter and 5mm thick. The column is 5m long with one end fixed and other end hinged. Use Rankine's formula and Rankine's constant as 1/7500 and $\sigma c=335N/mm^2$. (10)

13 a) Explain core of a section and obtain the expression for core of a rectangular section. (5)

b) A circular column of diameter 250mm carries a vertical load of 600kN at a distance of 30 mm from Y-Y axis. Find the maximum and minimum value of stresses induced in the sections. (5)

14 a) Explain the construction of Mohr's circle of stresses for a two-dimensional stress system accompanied by shear stress. (5)

b) State Moment area theorems to calculate slope and deflection. (5)

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