Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 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) Derive an equation for deformation of a uniformly tapering circular rod subjected to an axial load (5)

b) A rod of length 1.5 m and diameter 30 mm is centrally bored for 500 mm length, the bore diameter being 10 mm. Under a load of 30 kN, if the extension of rod is 0.2 mm, find the modulus of elasticity (5)

2 A brass rod 25 mm diameter is enclosed in a steel tube of 50 mm external diameter and 25 mm internal diameter. The rod and tube are both initially 1.5 m long and are rigidly fastened at both ends. Find the stress in two materials when temperature rises from 30^0C to 100^0C. Modulus of elasticity for steel and brass are 200 kN/mm^2 and 100 kN/mm^2 respectively. Coefficient of thermal expansion for steel =11.6 x $10^{-6}/^0$C Coefficient of thermal expansion for brass = 18.7 x $10^{-6}/^0$C (10)

3 a) Find the modulus of rigidity & Bulk modulus of a circular rod of diameter 20 mm and length 2 m, if the longitudinal strain in the rod during a tensile stress is four times the lateral strain. Take Modulus of Elas ticity = 2.1 x 10^5 N/mm^2 (5)

b) Draw the true stress-strain curve for a ductile material (5)

4 A composite shaft has an aluminium tube of external diameter 50 mm and internal diameter 40 mm closely fitted to a steel rod of 40 mm. If the permissible stress is 50 N/mm^2 in aluminium and 120 N/mm^2 in steel , find the maximum torque carrying capacity of the compound bar.. Take Modulus of rigidity for aluminium and steel as 27 x 10^3 N/mm^2 and 80 x 10^3 N/mm^2 respectively (10)

PART B

Answer any three full questions, each carries 10 marks

5 A simply supported beam of total span 10 m carries point loads of 20 kN & 40 kN at a distance of 1.5 m and 2.5 m respectively from left support. Also a uniformly distributed load of 10 kN/m is acting over a length of 2 m starting from left end. Draw the Shear Force and Bending moment Diagram 10)

6 a) Derive the relation between load, shear force and bending moment (5)

b) Draw the SF and BM diagram for a simply supported beam of total span 6 m subjected to a clockwise bending moment of 24 kN-m at a point 4 m from left support. (5)

7 A simply supported beam of total span 8 m carries a central concentrated load (10)

of 10 kN. The beam is of I-Section. The dimensions of I section are: top flange 200 mm x 50 mm, Web 200 mm x 50 mm, Bottom flange 130 mm x 50 mm. Determine the maximum bending stress.

8 Draw the shear stress distribution diagram for an symmetrical I-section subjected to shear force of 40 kN.The dimensions of I-section are : Top flange : 80 mm x 20 mm, web 200 mm x 20 mm , bottom flange 80 mm x 20 mm (10)

PART C

Answer any four full questions, each carries 10 marks.

9 A simply supported beam of span 9 m carries a uniformly distributed load 20 kN/m as shown in fig 1. Determine deflection of beam at midpoint of beam and also maximum deflection. Take flexural rigidity = 10 x 10^4kN m^2 (10)

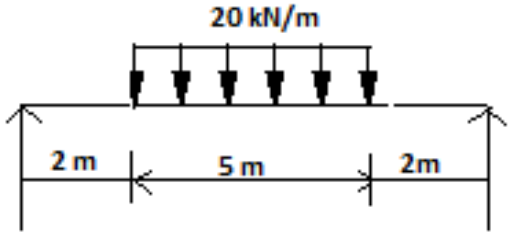

Fig:1

10 A Simply supported beam of length 6 m carries a point load of 10kN at a distance of 2 m from the right support. Determine slope at left support and deflection under point load using conjugate beam method. Take E =2 x 10^5 N/mm^2 and Moment of Inertia = 2 x 10^8 mm^4 (10)

11 In an elastic material, at a certain point, on planes at right angles to one another, direct stresses of 130 N/mm^2 tensile and 110 N/mm^2 compressive are acting. The major principal stress in the material is to be limited to 150 N/mm^2. To what shearing stress the material may be subjected on the given planes. Also find the minimum principal stress and the maximum shearing stress at that point (10)

12 Derive an equation for Euler's crippling load for a column whose both ends are fixed (10)

13 A shear force of 40 kN and a bending moment of 20 kN-m act at a certain cross section of rectangular beam 100 mm wide and 200 mm deep. Find the principal stresses at a point 20 mm below the top surface (10)

14 A hollow cast iron column has 200mm outside diameter, 150mm inner diameter and is 6m long. Both ends of the column are pinned. Using Rankine's formula, calculate the crippling load on the column. Take σ_c=550N/mm^2 and Rankine's constant as 1/1600. Compare load by Euler's formula E = 110GPa (10)

****