Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree (S,FE) Examination January 2022 (2015 Scheme)

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 10marks Marks

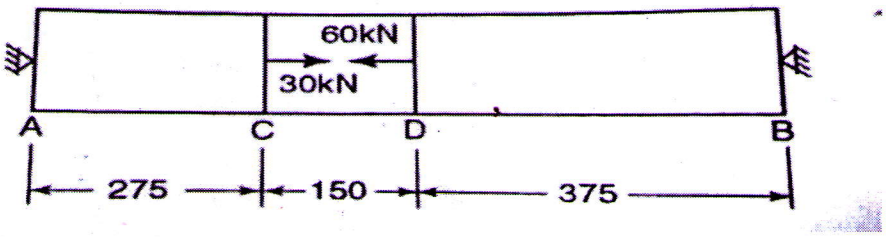
1 a) With the help of a neat sketch explain stress –strain diagram for ductile material. (4)

b) A 1.5 m long bar is having uniform diameter of 40mm for a length of 1m and in the next 0.5 m its diameter gradually reduces from 40mm to20 mm. Determine the axial load to be applied to have an elongation of 0.8488 mm. Take E=200GPa. (6)

2 a) A bar of 30mm diameter is subjected to a pull of 60kN. The measured extension for gauge length of 200mm is 0.9mm and change in diameter is 0.0039mm. Determine the values of Young's modulus, rigidity modulus and Poisson's ratio. (6)

b) Show that hollow shaft is stronger than solid shaft for same material, length & weight. (4)

3 a) A bar of 800 mm length is rigidly attached at two ends A &B as shown in figure. Determine reactions at its two ends. If the bar is of 25 mm diameter, find the change in length of each portion. Take E=200MPa. (7)



All dimensions are in mm

b) Explain thermal stresses and strain (3)

4 a) A shaft is required to transmit 245 kW Power at 240 rpm. The maximum torque (6)

exceeds mean torque by 50% and the shear stress on the shaft material is limited to 40 N/mm^2. Determine the diameter of the shaft required if (i) shaft is solid (ii) shaft is hollow with external diameter twice internal diameter (iii)% savings in weight

b) Show that volumetric strain is the sum of strains in three mutually perpendicular direction (4)

PART B

Answer any three full questions, each carries 10marks

5 a) Derive an expression for relation between shear Force and bending moment at a cross section of a beam (3)

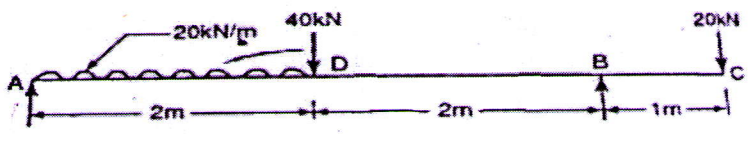
b) A simply supported beam of 8m span carries a point loads of 1kN & 5kN at a distance of 3m and 6m from right support. The beam also carries a uniformly distributed load of 2kN/m throughout its length, construct shear force & bending moment diagram. (7)

6 a) A beam of triangular cross section having base width of 100mm and height of 150mm is subjected to a shear force of 13.5 kN. Find the value of maximum shear stress and sketch shear stress distribution along dept of the beam. (4)

b) What do you mean by the term section modulus. Derive an expression of section modulus for (i) Rectangular Section (ii) circular section (4)

c) What are the limitations of Flexural formulae for beams (2)

7 Construct shear force & Bending moment diagram for the overhanging beam and mark the salient points. (10)



8 a) For a given stress, compare the moment of resistance of a beam of square section when placed (i) with two sides horizontal (ii) with its diagonal horizontal (4)

b) A hollow steel tube having external and internal diameters of 100mm and 75mm respectively is simply supported over a span of 5 m. The tube carries a concentrated load of "F" at a distance 2m from one of the supports. What is the value of this concentrated load "F" if maximum bending stress is not to exceed 100 MPa. (6)

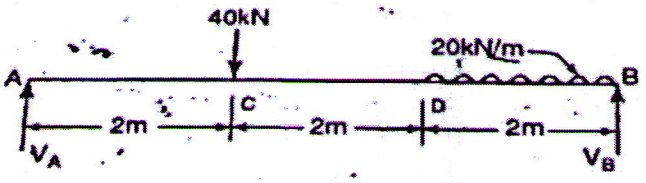
PART C

Answer any four full questions, each carries 10marks.

9 a) Show that the principal planes differ by 90^0 (7)

b) Explain state of plane stress & plane strain (3)

10 Find the maximum slope and deflection for the beam. Take $EI=15X10^9 kN\text{-}mm^2$ (10)



11 a) Derive relationship between slope, deflection and radius of curvature (5)

b) Stress at a point is given by σ_{XX}= - 80 N/cm^2, by σ_{YY}= - 90 $N/cm^2$and τ_{XY}= -40N/cm^2. If the axes are transformed by rotating them about Z axis by 60^0, (5)

find the new values of σ_{XX}, σ_{YY} and τ_{XY}.

12 The state of stress at a point in a stained material consist of tensile stress of 180N/mm^2 acting on one plane and another tensile stress of 120N/mm^2 on another plane at right angle to the former. Each of the above tensile stress is accompanied by a shear stress of 80N/mm^2. Determine: (i) Direction of principal Planes (ii) magnitude of principal stresses (iii) magnitude and direction of maximum shear stress (iv) verify the values using Mohr's circle Method. (10)

13 a) Derive an expression for Equivalent Bending and Equivalent Twisting moment (5)

b) Explain analogy between Stress and strain transformation (5)

14 A hollow shaft of 100mm external diameter and 25mm thickness is transmitting 60 kW at 500rpm.What bending moment may safely be applied to the shaft so that Principal stress does not exceed 100N/mm^2? What is the value of Minimum Principal stress? (10)

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