Reg. No._____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION JULY 2017

ME 201: MECHANICS OF SOLIDS
(AU, MA, MP, ME, MT, PE, SF)

Maximum Marks: 100 Duration: 3 Hours

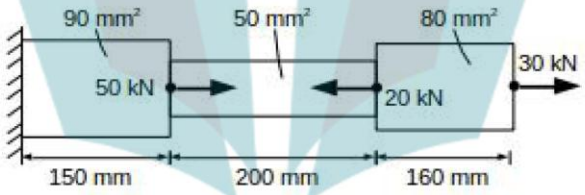
PART A

Answer any three questions.

1. a. Write two points each on linear strain and shear strain? (4)

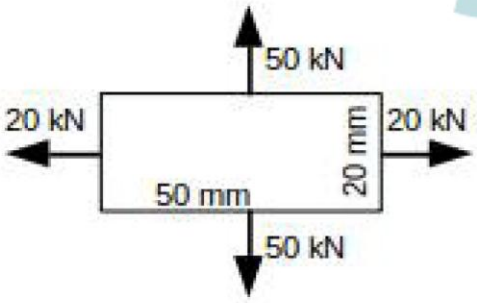
   b. Two plates of thickness 2 mm each are joined using a single rivet. The plates are subjected to a tensile load of 314 N. If the material of the rivet is having allowable shear strength of 100 MPa, determine the diameter of the rivet pin? (6)

2. A stepped bar is loaded as shown. Determine the total extension of the bar if Young's modulus is 200 GPa? (10)



3. a. Define Poisson's ratio. (2)

   b. An aluminum alloy plate of size 50 mm x 20 mm with thickness 5 mm is loaded as shown. Find the change in thickness? What must be the load to be applied to have the same change in thickness if load is applied only along thickness direction? Take Young's modulus as 1 x 10^5 MPa and Poisson's ratio as 0.25



(8)

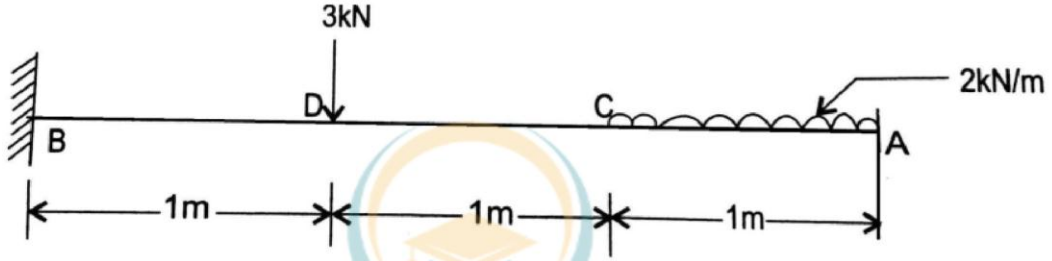
   a. List four important assumptions in the theory of torsion. (4)

   b. A shaft of 50 mm diameter is made of a material having allowable shear stress of 120 MPa. If the shaft is run at 300 rpm, what is the maximum power that can be carried by the shaft before failure? (6)

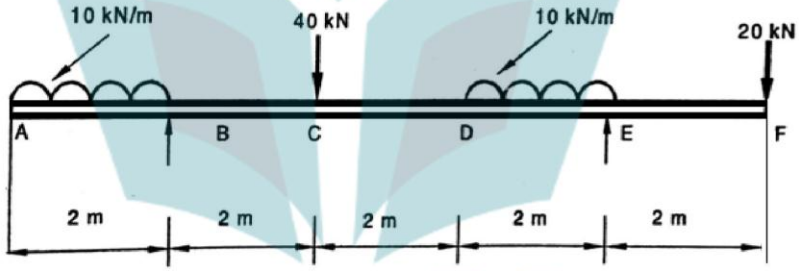
PART B

Answer any three questions.

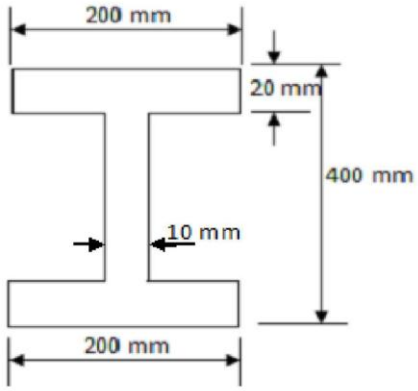
5. a. Obtain the relation between load, shear force and bending moment (5)
   b. Draw the SFD and BMD of a cantilever beam loaded as shown in figure. (5)



6. Draw the SFD and BMD for the overhanging beam shown in figure. Indicate the position and magnitude of maximum bending moment. (10)



7. a. Derive the equation for the theory of pure bending. (6)
   b. A rolled steel joist of I section has the dimensions as shown in figure. The beam carries a uniformly distributed load of 40 kN/mm^2 run on a span of 10 m, calculate the maximum stress produced due to bending. (4)



8. a. Derive the expression for shear stress in a beam. How it is distributed over the cross section of a rectangular beam? (5)
   b. A 'T' – section beam 300 mm deep and 150 mm wide has flange and web thickness of 30 mm. The length of the beam is 6 m and simply supported at its ends. It carries a UDL of 5 kN/m over its entire length. In addition to UDL, it carries a

concentrated load of 3 kN at its middle. Draw the shear stress distribution diagram for the beam. (5)

PART – C

Answer any four full questions.

9. A horizontal girder of steel having uniform section is 14 m long and is simply supported at its ends. It carries concentrated loads of 120 kN and 80 kN at two points 3 m and 4.5 m from the two ends respectively. I for the section of the girder is 16 x 108 mm^4 and Es = 210 kN/mm^2. Calculate the deflection of the girder at points under the two loads. Find also the maximum deflection. (10)

10. A rectangular block of material is subjected to a tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on a plane at right angles, together with shear stresses of 63 N/mm^2 on the same planes. Find:

    (i) The direction of the principal planes. (3)
    (ii) The magnitude of the principal stress (3)
    (iii) The magnitude of the greatest shear stress. (4)

11. At a point in a bracket the stresses on two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2 both tensile. The shear stress across these planes is 30 N/mm^2. Find using the Mohr's stress circle the

    (i) Principal stresses and (5)
    (ii) Maximum shear stress at the point. (5)

12. A round steel rod of diameter 15 mm and length 2 m is subjected to a gradually increasing axial compressive load. Using Euler's formula find the buckling load. Find also the maximum lateral deflection corresponding to the buckling condition. Both ends of the rod may be taken as hinged. Take E = 2.1 x 10^5 N/mm^2 and the yield stress of steel = 250 N/mm^2. (10)

13. a. Derive Euler's formula for a column with one end is hinged and the other end fixed. (5)

    b. Derive the differential equation for deflection curve. (5)

14. a. What is the change in the support condition between actual beam and conjugate beam? (3)

    b. Define principal planes and principal stresses. (2)

    c. Derive an expression for Rankine's crippling load for a column. (5)

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