Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
THIRD SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019
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) Explain the salient points of a typical stress-strain curve for a mild steel rod   (5)
       subjected to tension test.

   b) Three long parallel wires equal in length and in the same plane are supporting a   (5)
       rigid bar connected at their bottom, as shown in fig. The middle wire is of steel
       while the other two are of brass. All the wires are of 1cm^2 cross-sectional area.
       The rigid bar supports a UDL as shown in the figure. Determine the forces and
       elongation of wires. Take Modulus of elasticity of steel, E_s = 200 GN/m^2 and that
       of brass E_b = 100 GN/m^2.
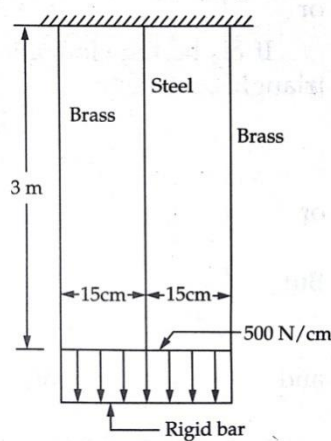
2 a) Define strain energy and explain how it is stored in a body?   (3)

   b) A composite bar made of brass and steel is fixed between two supports as shown   (7)
       in the figure. If the temperature is increased by 80^{0}C, find the stresses induced in
       the steel and brass section assuming (i) the supports do not yield (ii) the supports
       yield by 0.15mm. Take E_s = 200 GPa, E_b = 100 GPa, α_s = 12×10^{-6} /^{0}C and α_b =
       19×10^{-6} /^{0}C.
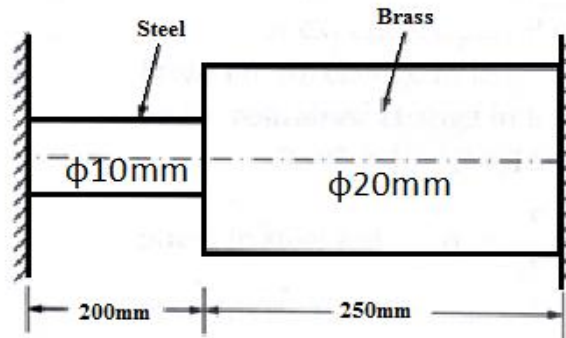
3   A rectangular block of metal of 50mm×25mm cross-section and 125mm length   (10)
carries a tensile load of 100kN along its length, a compressive load of 1MN on
its 50mm×125mm faces and a tensile load of 400kN on its 25mm×125mm faces.
If $E = 208GN/m^2$ and $\upsilon = 0.3$, find (a) change in volume of bar (b) increase
required in 1MN load to produce no change in volume.

4   a)   Define Torsional rigidity.   (2)

     b)   A 3m long solid shaft transmits 15kW at 1200rpm. Find the required diameter of   (8)
the shaft, assuming that maximum shear stress in the shaft is limited to 25MPa
and angle of twist is not to exceed 5^0. Take G=80GPa.

PART B
Answer any three full questions, each carries 10marks

5   Draw the shear force and bending moment diagrams for a beam shown in the   (10)
figure given below. Also determine the value of maximum bending moment.
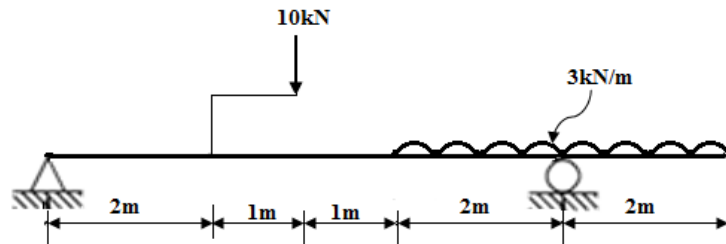
6   a)   Define point of contraflexure.   (2)

     b)   Draw the shear force and bending moment diagrams for a beam shown in the   (8)
figure given below. Locate the point of contraflexure.
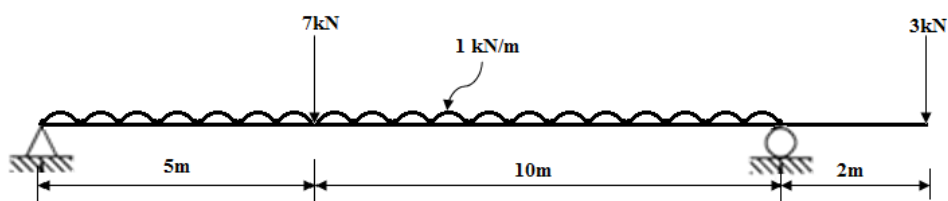
7   a)   Derive the equation of theory of pure bending.   (6)

    b)   A rectangular section is to be cut from a circular log of wood of diameter   (4)
         500mm. Find the dimensions of strongest section in bending

8   a)   Derive an expression for determining shear stress distribution in a rectangular   (4)
         cross-section of width 'b' and depth'd' and determine the maximum shear stress.

    b)   An I-section beam shown in the figure given below is subjected to a shear force   (6)
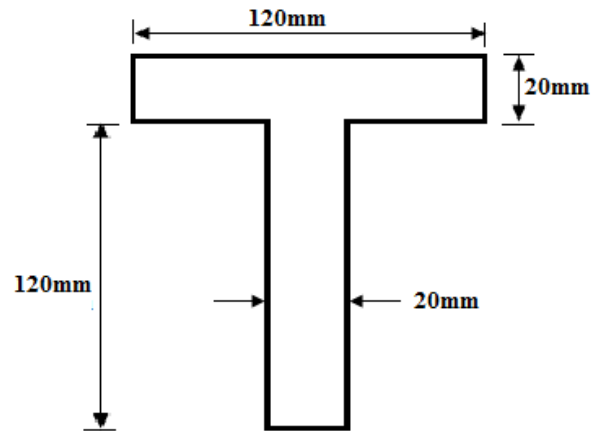   of 50kN. Draw the shear stress distribution diagram.
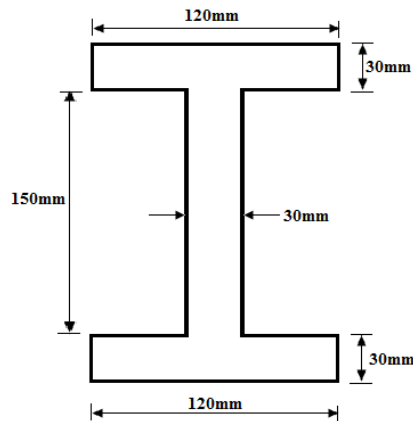
PART C
Answer any four full questions, each carries 10marks.

9   Two point loads of 5kN and 15kN are acting on a 5m simply supported beam at   (10)
         1m and 2m respectively from the left end. Find the defections under the applied
         loads. Also find the position and magnitude of maximum deflection.

10 a)   Obtain an expression for maximum slope and deflection of a simply supported   (6)
         beam subjected to a concentrated load 'W' at mid-span.

    b)   Differentiate plane stress and plane strain conditions giving examples.   (4)

11   At a point in an elastic material under strain, there are normal stresses of 60MPa (10)
         (tensile) and 35MPa (compressive) respectively at right angles to each other with
         a shearing stress of 25MPa. Find the principal stresses and position of principal
         planes. Also find the maximum shear stress and its plane.

12   A member is subjected to stresses on two mutually perpendicular planes which   (10)
         are 120MPa (tensile) and 60MPa (tensile). Shear stress across these planes is
         30MPa. Find the principal stresses and maximum shear stress at a point by using
         Mohr's circle.

13 a)   Derive expressions for equivalent bending moment and equivalent torque for a   (8)
         shaft subjected to a bending moment 'M' and torque 'T'.

b)   What is meant by slenderness ratio?   (2)

14   The figure given below shows a T-section column of mild steel 4m long with   (10) both ends hinged. Determine the Euler's crippling load. Take E=200GPa

****