

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

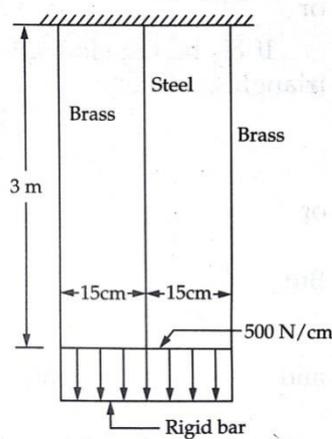
Duration: 3 Hours

**PART A**

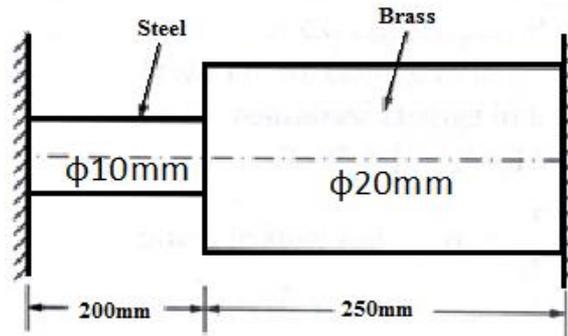
*Answer any three full questions, each carries 10marks*

Marks

- 1 a) Explain the salient points of a typical stress-strain curve for a mild steel rod subjected to tension test. (5)
- b) Three long parallel wires equal in length and in the same plane are supporting a 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  $1\text{cm}^2$  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,  $E_s = 200\text{ GN/m}^2$  and that of brass  $E_b = 100\text{ GN/m}^2$ . (5)



- 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 in the figure. If the temperature is increased by  $80^\circ\text{C}$ , 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  $E_s = 200\text{ GPa}$ ,  $E_b = 100\text{ GPa}$ ,  $\alpha_s = 12 \times 10^{-6} / ^\circ\text{C}$  and  $\alpha_b = 19 \times 10^{-6} / ^\circ\text{C}$ . (7)

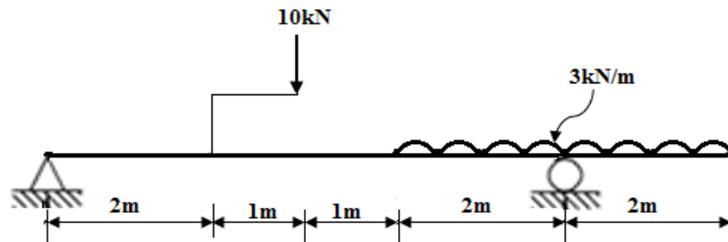


- 3 A rectangular block of metal of  $50\text{mm} \times 25\text{mm}$  cross-section and  $125\text{mm}$  length carries a tensile load of  $100\text{kN}$  along its length, a compressive load of  $1\text{MN}$  on its  $50\text{mm} \times 125\text{mm}$  faces and a tensile load of  $400\text{kN}$  on its  $25\text{mm} \times 125\text{mm}$  faces. If  $E = 208\text{GN/m}^2$  and  $\nu = 0.3$ , find (a) change in volume of bar (b) increase required in  $1\text{MN}$  load to produce no change in volume. (10)
- 4 a) Define Torsional rigidity. (2)
- b) A  $3\text{m}$  long solid shaft transmits  $15\text{kW}$  at  $1200\text{rpm}$ . Find the required diameter of the shaft, assuming that maximum shear stress in the shaft is limited to  $25\text{MPa}$  and angle of twist is not to exceed  $5^\circ$ . Take  $G=80\text{GPa}$ . (8)

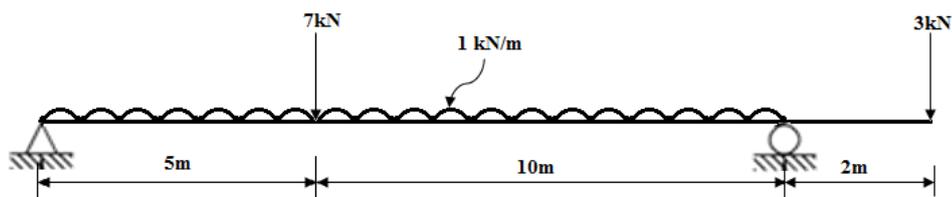
### PART B

*Answer any three full questions, each carries 10marks*

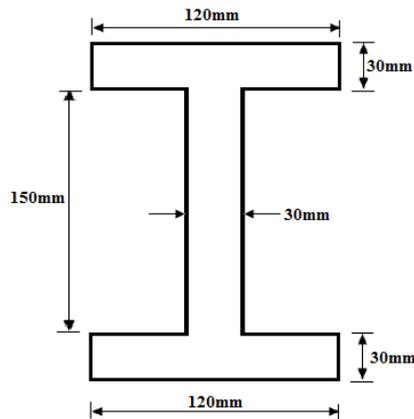
- 5 Draw the shear force and bending moment diagrams for a beam shown in the figure given below. Also determine the value of maximum bending moment. (10)



- 6 a) Define point of contraflexure. (2)
- b) Draw the shear force and bending moment diagrams for a beam shown in the figure given below. Locate the point of contraflexure. (8)



- 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 500mm. Find the dimensions of strongest section in bending (4)
- 8 a) Derive an expression for determining shear stress distribution in a rectangular cross-section of width 'b' and depth 'd' and determine the maximum shear stress. (4)  
 b) An I-section beam shown in the figure given below is subjected to a shear force of 50kN. Draw the shear stress distribution diagram. (6)

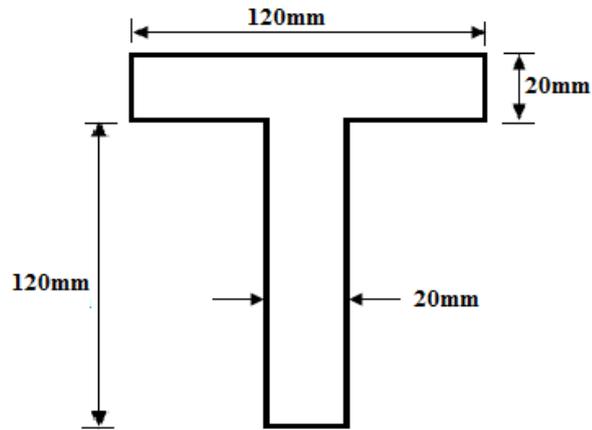


### PART C

*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 1m and 2m respectively from the left end. Find the deflections under the applied loads. Also find the position and magnitude of maximum deflection. (10)
- 10 a) Obtain an expression for maximum slope and deflection of a simply supported beam subjected to a concentrated load 'W' at mid-span. (6)  
 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 (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. (10)
- 12 A member is subjected to stresses on two mutually perpendicular planes which 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. (10)
- 13 a) Derive expressions for equivalent bending moment and equivalent torque for a shaft subjected to a bending moment 'M' and torque 'T'. (8)

- b) What is meant by slenderness ratio? (2)
- 14 The figure given below shows a T-section column of mild steel 4m long with both ends hinged. Determine the Euler's crippling load. Take  $E=200\text{GPa}$  (10)



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