LNMIIT

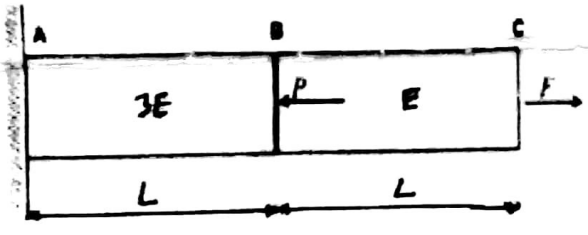
The LNM Institute of Information Technology
Department of Mechanical and Mechatronics Engineering
Mechanics of Solids
Mid Term Exam

Time: 1.5 Hrs **Date:** 29/09/2018 **Max. Marks:** 60

Note: Question no. 1-12 carry 2.5 marks each.Proper explaination is required to get full marks

Q. 1 A cantilever of length 1.2 m carries a concentrated load of 12 kN at the free end. The beam is of rectangular cross section with breadth equal to half the depth. The maximum stress due to bending is not to exceed 100 N/mm^2. The minimum depth of the beam should be

Q. 2 A horizontal bar with a constant cross-section is subjected to loading as shown in the figure. The Young's moduli for the sections AB and BC are 3E and E, respectively. For the deflection at C to be zero, the ratio P/F is



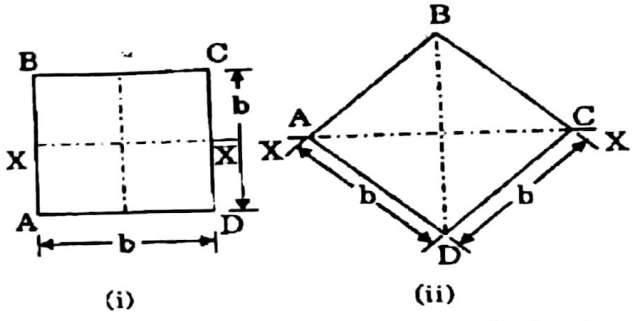
Q. 3 Draw Mohr's circle (Not on scale) for a 2-dimensional stress field subjected to (a) Pure shear (b) Pure biaxial tension (c) Pure uniaxial tension and (d) Pure uniaxial compression

Q. 4 For a loaded cantilever beam of uniform cross section, the bending moment (in N-mm) along the length is M (x) = 5 x^2 + 10 x, where x is the distance (in mm) measured from the free end of the beam. The magnitude of shear force (in N) in the cross section at

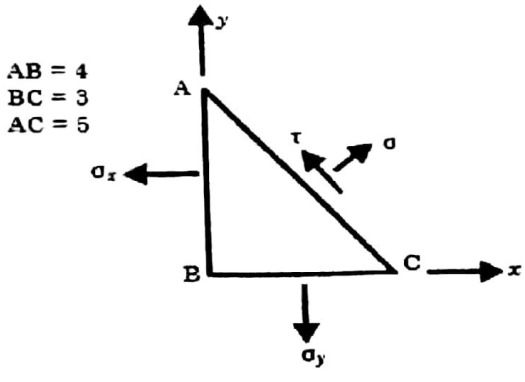
x = 10 mm is.....

Q. 5

The ratio of the moments of resistance of a square beam (Z) when square section is placed (i) with two sides horizontal (Z_1) and (ii) with a diagonal horizontal (Z_2) as shown is

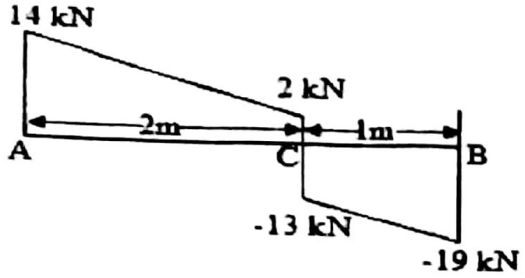


Q. 6 In a two dimensional stress analysis, the state of stress at a point is shown below. If σ =120MPa and τ = 70MPa, then σx and σy are respectively.

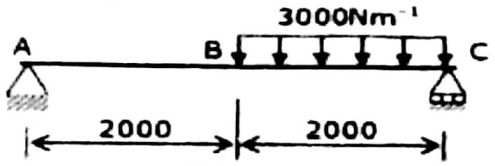


Q. 7 The state of stress defined as $\begin{bmatrix} 30 & 40 \\ 40 & -30 \end{bmatrix}$ Mpa. The center and radius of Mohr's circle for this state of stress will be.....

Q. 8 The shear force diagram of a loaded beam is shown in the following figure: The maximum Bending Moment of the beam is:



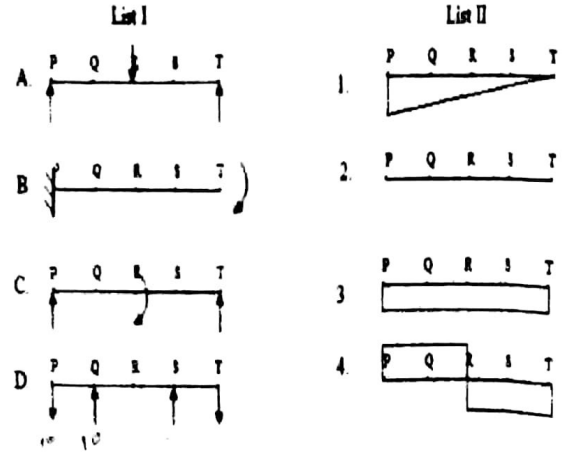
Q. 9 A mass less beam has a loading pattern as shown in the figure. The beam is of rectangular cross section with a width of 30 mm and height of 100 mm. The maximum bending moment occurs at



Q. 10 The maximum magnitude of bending stress (in MPa) in the beam of Q. 9 will be..

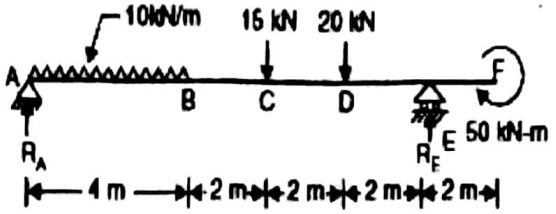
Q. 11 A cantilever beam of 2 m length supports a triangularly distributed load over its entire length, the maximum of which is at the free end. The total load is 37.5 kN. What is the bending moment at the fixed end?

Q. 12 Match the list I (Beams) with List II (SFD)

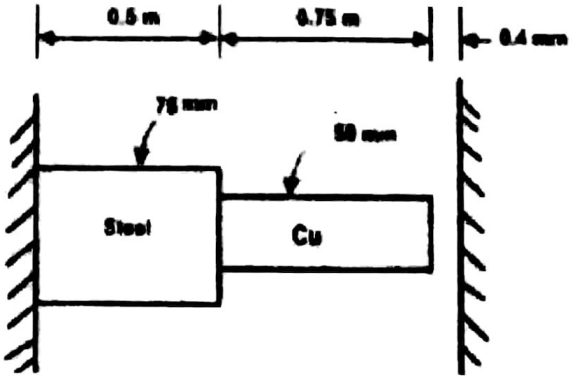


Q. 13 Draw the bending moment and shear force diagram for the beam loaded as shown in Fig. Mark the values at the salient points. Also determine the point of contra flexure.

[12 Marks]



Q. 14 A rod consists of two parts that are made of steel and copper as shown in figure. The elastic modulus and coefficient of thermal expansion for steel are 200 GPa and 11.7 $\times 10^{-6}$ per °C respectively and for copper 70 GPa and 21.6 $\times$ 10^{-6} per °C respectively. If the temperature of the rod israised by 50°C, determine the forces and stresses acting on each part of the rod. [7 Marks]



Q.15 The principal tensile stresses at a point across two perpendicular planes are 100 MPa and 50 MPa. Find the normal and tangential stresses and the resultant stress and its obliquity on a plane at 20^0 with the major principal plane either analytical method or by Mohr's circle method. [6 Marks]