PRN:		Course Code :	UAE301

Second Year **B. Tech** End Semester Examination Winter 2023

Mechanics of Materials

Day and Date: Tuesday, 28/11/2023 Max Marks: **100**

Time : 10.30 am to 1.30 PM Duration: **03** hrs

Instructions: 1. All questions are compulsory.
2. Use of Non Programmable calculator is allowed

Q.1	**Attempt the following.**	Marks	Bloom's Level	CO
a)	Derive the relation between Young's Modulus (E) and Bulk Modulus (K) with usual notations.	08	L1	1
b)	A brass bar of cross sectional area of 1000 mm^2, is subjected to axial force as shown in figure 1 b. Find total elongation if $E=1.05x10^5$ N/mm^2	08	L2	1

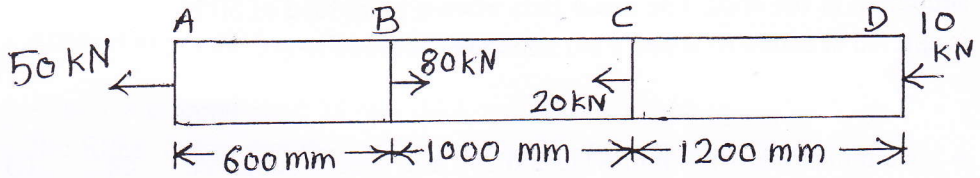


Fig 1 b.

OR

b)	A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter 4 cm. The composite bar is then subjected to an axial pull of 45000 N. If length of each bar is equal to 15 cm, determine stresses in rod and tube. Assume $E_{steel}=2.1X10^5$ N/mm^2 and $E_{copper}=1.1X10^5$ N/mm^2	08	L2	1

Q.2	**Attempt the following.**			
a)	Explain with suitable diagram different types of beam.	08	L1	2
b)	Draw SFD and BMD for following loading Diagram (Fig 2.b.1)	08	L3	2

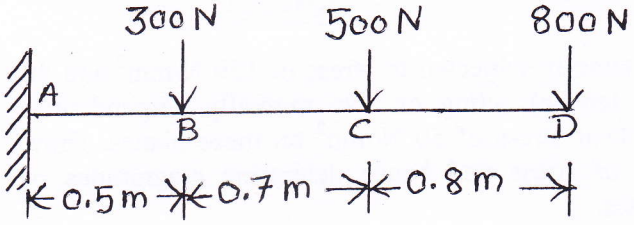


Fig 2.b.1

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OR

b) Draw SFD and BMD for following loading Diagram (Fig 2.b.2) 08 L3 2

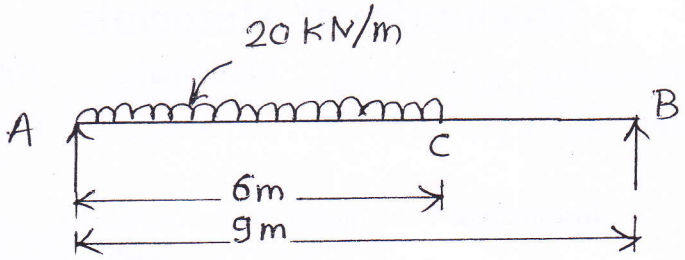


Fig 2.b.2

Q.3 **Attempt any two from the following.**

a) Derive the equation for bending stress at any section in beam with usual notations. 08 L1 3

b) A square beam 20 mm X 20 mm in section and 2 meter long is supported at the ends. The beam fails when a point load of 50 N is applied at centre of beam. Find maximum bending stress. 08 L2 3

c) A rectangular beam 100 mm wide and 250 mm deep is subjected to a maximum shear force of 50 kN. Determine, 08 L3 3

1. Average shear stress
2. Shear stress at a distance of 25 mm above Neutral Axis.

Q.4 **Attempt any two from the following.**

a) Explain Mohr's circle method for plane stress with suitable example. 08 L2 3

b) The stresses at a point in machine component are 150 MPa and 50 MPa both tensile. Find intensities of normal, shear and resultant stresses on a plane inclined at an angle of 35^0 with the axis of major tensile stress. Also find out maximum shear stress in the component. 08 L3 3

c) An elemental cube is subjected to stress of 120 N/mm^2 and 40 N/mm^2 (Both tensile) acting on two mutually perpendicular planes and a shear stress of 50 N/mm^2 on these planes. Draw Mohr's circle of stress and hence determine magnitudes of principal stresses. 08 L3 3

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Q.5 **Attempt any Two from the following.**

a) An overhanging beam is shown in figure 5.a. with a 10 kN point load at C. Calculate slope at A, B and C points. Also calculate deflection at C and maximum deflection. Use Mecaulay's method. — 09 — L3 — 4

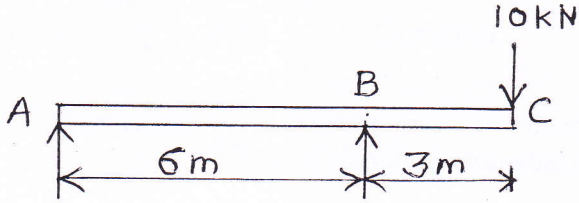


Fig 5.a

b) Derive deflection equation for a simply supported beam with a uniformly distributed load w unit/length over its entire length — 09 — L2 — 4

c) Define deflection and slope in beams. Derive deflection equation with usual notations. — 09 — L2 — 4

Q.6 **Attempt any Two from the following.**

a) A hollow circular shaft 20 mm thick transmits 300 kW power at 200 RPM. Determine the external diameter of the shaft if shear strain due to torsion is not to exceed 0.00086. Take modulus of rigidity as 0.8×10^5 N/mm^2. — 09 — L2 — 5

b) Derive torsion equation with usual notations. Also discuss rigidity criteria of design of shaft. — 09 — L2 — 5

c) A hollow cylindrical column is 4 m long with both ends fixed. Determine the minimum diameter of the column if has to carry a crippling load of 1250 kN. Take internal diameter as 0.8 times the external diameter, stress in compression as 550 N/mm^2 and a = 1/1600 — 09 — L3 — 5

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