VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF MECHANICAL ENGINEERING

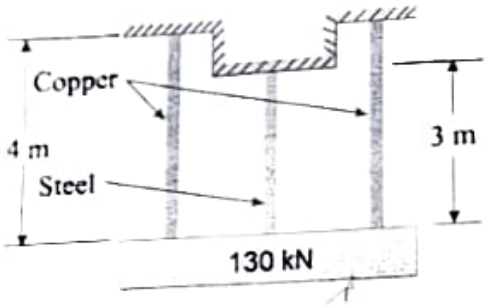
CONTINUOUS ASSESSMENT TEST – I

SLOT: C1+TC1

FALL SEMESTER 2022-2023

Programme Name & Branch : B.Tech. (Mech./Auto/Manufacturing)
Course Code/Name : **BMEE202L, Mechanics of Solids**
Faculty Name(s) : Dr. Rajasekhara Reddy Mutra, Dr. Edwin Sudhagar P, Dr. Saurabh Gupta, Dr. Rajesh M, Dr. Murugan M
Class Number(s) : VL2022230100566, VL2022230100571, VL202223010 0 68, VL2022230100563, VL2022230100570
Duration: 90 min. **Max. Marks: 5**

General instruction(s): Answer all questions, answer to the point, assume any missing da suitably, and tabulate your final results.

Q. No	Question	Marks	Course Outcome (CO)	Bloom's Taxonomy (Bl
1.	A load of 130 kN is jointly supported by three rods of 20 mm diameter as shown in Figure 1.  Fig. 1. Determine the final stresses in steel and copper. Take E for copper as 100 GPa and for steel as 200 GPa.	10	1	BL
2.	A steel tube of 30 mm external diameter and 20 mm internal diameter encloses a copper rod of 15 mm diameter to which it is rigidly joined at each end. If, at a temperature of 10°C, there is no longitudinal stress, evaluate the stresses in the rod and tube when the temperature was raised to 200 °C. Take E for steel and copper as 2.1×10^5 N/mm^2 and 1×10^5 N/mm^2 respectively. The value of co-efficient of linear expansion for steel and copper is given as 11×10^{-6}/°C and 18×10^{-6}/°C respectively.	10	1	Bl
3.	Determine the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 30 mm and of length 1.5 m. If the longitudinal strain in a bar during a tensile stress is four times the lateral strain, find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 N/mm^2. Take E= 1×10^5 N/mm^2.	10	1	B

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4.	At a certain point in a material under stress, the intensity of the resultant stress on a vertical plane is 1000 N/mm^2 inclined at 30^o to the normal to that plane and the stress on a horizontal plane has a normal tensile component of intensity 600 N/mm^2, as shown in Figure 2. Determine the magnitude and direction of the resultant stress on the horizontal plane and the magnitude and directions of the principal stresses.	10	1

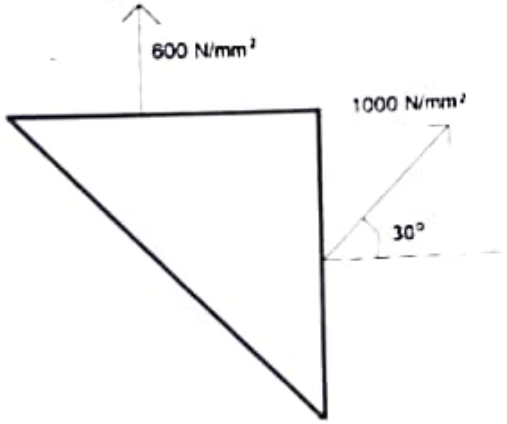

Fig. 2.

5.	At a point in a strained material is subjected to stresses is shown in Figure 3. Using Mohr's circle method, determine the normal and tangential stresses across the oblique plane.	10	1

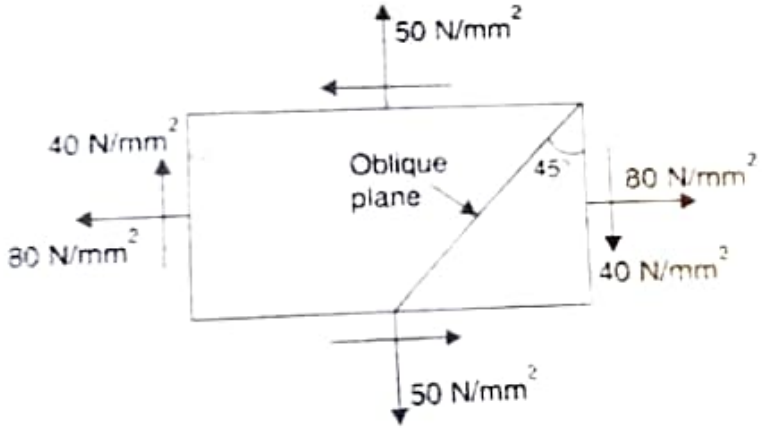

Fig. 3

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CONTINUOUS ASSESSMENT TEST – I

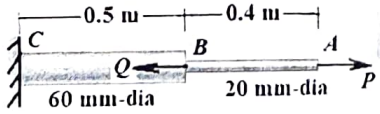
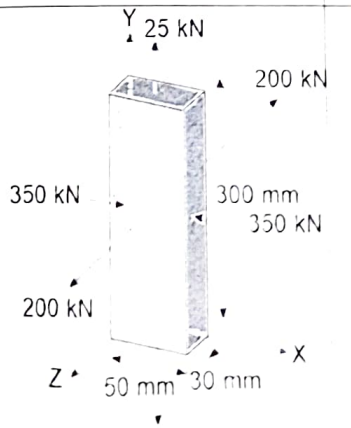
SLOT: C2+TC2

FALL SEMESTER 2022-2023

Programme Name & Branch : B.Tech. (Mech./Auto/Manufacturing)
Course Code/Name : BMEE202L, Mechanics of Solids
Faculty Name(s) : Dr. VELU M, Dr. SHARAN CHANDRAN M, Dr. ARIVARASU M , Dr. RAHUL SINGH SIKARWAR, Dr. AKASH MOHANTY
Class Number(s) : VL2022230100573, VL2022230100575, VL2022230100577, VL2022230100579, VL2022230100574

Duration: 90 min. **Max. Marks: 50**

General instruction(s): Answer all questions, answer to the point, assume any missing data suitably, and tabulate your final results.

Q. No	Question	Marks	Course Outcome (CO)	Bloom's Taxonomy (BL)
1.	The rod *ABC* shown in Figure 1, is made of aluminum for which E = 80 GPa. Knowing that P = 5 kN and Q = 38 kN, determine the deflection of (a) point *A*, (b) point *B*.  Fig. 1	10	1	BL 5
2.	The aluminium shell (E_{Al} = 70 GPa, α_{Al} = 23.6 x 10^{-6} /°C) is fully bonded to the brass core (E_{Br} = 105 GPa, α_{Br} = 20.9 x 10^{-6} /°C). The core diameter is 25 mm and the inner, outer diameter of the shell is 25 mm and 60 mm respectively. Both the core and shell are having the same length. The assembly is unstressed at a temperature of 15°C. Considering only axial deformations, determine the stress in the aluminum when the temperature reaches to 195°C.	10	1	BL 5
3.	A C.I. flat, 300 mm long and of 30 mm × 50 mm uniform section, is acted upon by the following forces uniformly distributed over the respective cross-section as shown in Figure 2; 25 kN in the direction of length (tensile); 350 kN in the direction of the width (compressive); and 200 kN in the direction of thickness (tensile). Determine the change in volume of the flat. Take E = 140 GN/m², and Poisson's ratio μ = 0.25.  Fig. 2	10	1	BL 5

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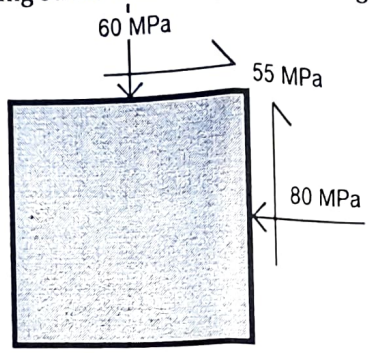
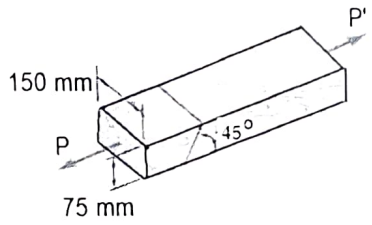
4.	For the state of plane stress shown in Figure 3, determine (i) the principal planes, (ii) the principal stresses (iii) the maximum shearing stress and the corresponding normal stress.  Fig. 3.	10	1	BL 5
5.	Two wooden members of uniform rectangular cross section are joined by the simple glued scarf splice shown in Figure 4. Knowing that the maximum allowable tensile stress in the glued splice is 560 kPa, determine (*a*) the largest load P that can be safely applied, (*b*) the corresponding shearing stress in the splice.  Fig. 4.	10	1	BL 5