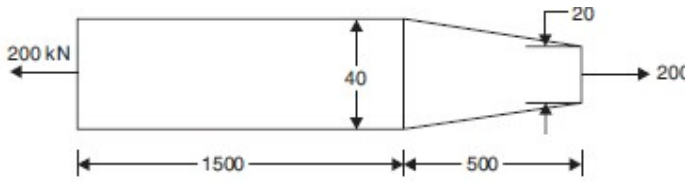
BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION)

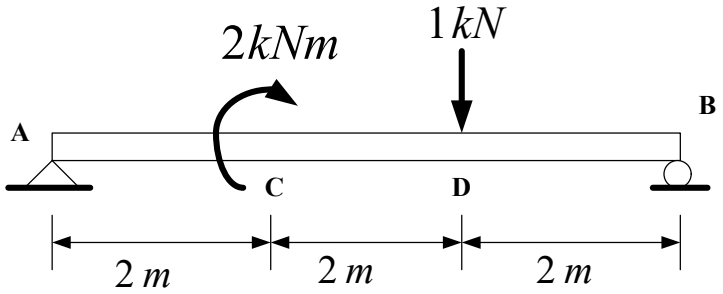
CLASS: BTECH — **SEMESTER:** III
BRANCH: CIVIL ENGG. — **SESSION:** MO/2022

SUBJECT: CE201R SOLID MECHANICS

TIME: 2 HOURS — **FULL MARKS:** 25

INSTRUCTIONS:
1. The total marks of the questions are 25.
2. Candidates attempt for all 25 marks.
3. Before attempting the question paper, be sure that you have got the correct question paper.
4. The missing data, if any, may be assumed suitably.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q1	(a)	A mild steel specimen of 2cm in diameter and 20 cm long was tested in tension and the following observations were made: 1. Extension under load of 10 kilo Newton is 0.032 mm 2. Load at yield point is 82 kilo Newton. 3. Maximum load during test is 133 kilo Newton 4. Length of the specimen after fracture is 25.2 cm, 5. Diameter at the neck is 1.26 cm. Find out the following from the above data: 1. Modulus of elasticity, 2. Yield point stress 3. Ultimate Stress, 4. Percentage (%) Elongation of the specimen. 5. Percentage (%) reduction in area of the specimen. **Working stress if the factor of safety is 3.**	**[3]**	**CO1**	**K3**
Q1	(b)	A 2.0 m long steel bar is having uniform diameter of 40 mm for a length of 1 m and in the next 0.5 m its diameter gradually reduces from 40 mm to 20 mm as shown in Fig. Determine the elongation of this bar when subjected to an axial tensile load of 200 kN. Given E = 200 GN/m^2. 	**[2]**	**CO1**	**K4**
Q2	(a)	If the shear modulus is 'G', modulus of elasticity is 'E' and Poisson's ratio is 'μ' then show that E = 2G (1+μ)	**[3]**	**CO1**	**K2**
Q2	(b)	A vertical circular bar 20 mm in diameter 4 m long carries a tensile load 40 kN. Calculate (i) the elongation of the bar and (ii) volumetric strain if Poisson's ratio = 0.3 and Modulus of Elasticity E = 2 x 10^5 N/mm^2.	**[2]**	**CO1**	**K4**
Q3	(a)	Derive the differential equations involved for the relationship between the load intensity (w), bending moment (M) and shear force (V) for a beam.	**[2]**	**CO2**	**K2**
Q3	(b)	A horizontal beam 6 m long simply supported and carries a vertical load 1 kN at a distance 2 m from the right support. A couple of 2 kNm acts at a distance of 2 m from the left support as shown in the following figure. Draw the Shear Force and Bending Moment diagram for the beam.	**[3]**	**CO2**	**K3**



Q4 (a) State the assumptions involved in the derivation of the bending equation for the pure bending case? **[2] CO2 K1**

Q4 (b) A wooden beam 2 m long is simply supported at its ends and has a cross section 15 cm wide and 60 cm deep. It carries a uniformly distributed load of 90 kN/m over the entire span. Calculate the bending stress at a point 20 cm above the bottom of the beam and 60 cm from the left support. **[3] CO2 K4**

Q5 (a) Explain the conceptual difference between the torsion and bending with suitable sketch? **[2] CO3 K2**

Q5 (b) What do you mean by pure torsion of a circular bar? What are the assumptions involved in the derivation of the torsion equation for the pure torsion of a circular bar case? **[3] CO3 K1**

:::::: 27/09/2022 M ::::::