BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2023)

CLASS: BTECH — SEMESTER : III
BRANCH: CIVIL — SESSION : MO/2023

SUBJECT: CE201R SOLID MECHANICS

TIME: 02 Hours — FULL MARKS: 25

INSTRUCTIONS:
1. The question paper contains 5 questions each of 5 marks and total 25 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

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			CO	BL
Q.1(a)	Draw the stress-strain diagram for Mild steel bar indicating the important points in it?	[2]	1	K1
Q.1(b)	A solid uniform metal bar of diameter 'D' and length 'l' is hanging vertically from it's upper end. Find the total elongation of the bar due to it's own weight, if 'γ' is the unit weight and 'E' is the modulus of elasticity of the material of the bar.	[3]	1	K3
Q.2(a)	A member formed by connecting a steel bar to an aluminum bar is shown in Fig. 1 Calculate the magnitude of force P that will cause the total length of the member to decrease 0.20 mm. The values of elastic constant for steel and aluminum are 210 KN/mm^2 and 70 KN/mm^2, respectively.	[2]	1	K4

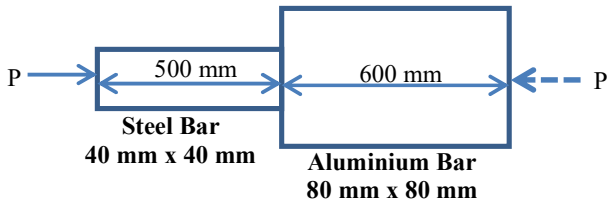

Fig. 1 Assembly of Steel and Aluminum bar

Q.2(b)	A rectangular block 250 mm x 100 mm x 80 mm is subjected to axial loads 480 KN in *x* direction, 1000 KN in *y* direction and 900 KN in *Z* direction. Assuming Poisson's ratio as 0.25 and E =2x10^5 N/mm^2. Calculate the change in volume of the block due to the loading specified above.	[3]	1	K4
Q.3(a)	Consider the following beam with various loadings as shown in Fig. 2. Draw Shear force diagram for the beam. Indicate numerical values at all important sections.	[2]	1	K4

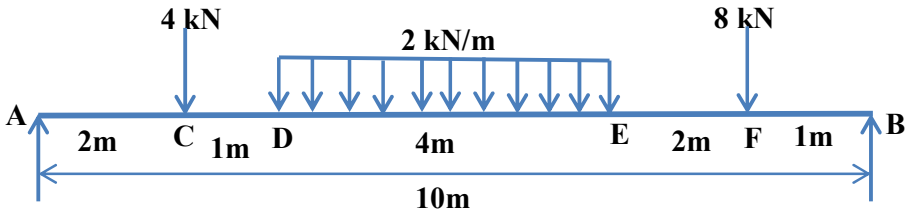

Fig. 2 Beam with concentrated and uniformly distributed load

Q.3(b)	Draw Bending moment diagram for the beam shown in Fig. 2. Indicate numerical values at all important sections.	[3]	1	K4

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Q.4(a)	What is the moment of inertia for a hollow rectangular beam section with external width as B and external depth as D and thickness as t.	[2]	1	K2
Q.4(b)	A beam 500 mm deep of a symmetrical section has I = 1 x 10^8 mm^4 and is simply supported over a span of 10 meters. Calculate (a) the uniformly distributed load it may carry if the maximum bending stress is not exceeded to 150 N/mm^2. (b) The maximum bending stress if the beam carries a central point load of 25 kN.	[3]	1	K5
Q.5(a)	What are the assumptions used in the derivation of the torsion equation for the pure torsion of a circular shaft?	[2]	1	K1
Q.5(b)	What do you mean by polar moment of inertia? Determine the polar moment of inertia of solid circular shaft with 30 cm diameter?	[3]	1	K2

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