Code No: R2021012 **R20** SET - 1

II B. Tech I Semester Supplementary Examinations, July - 2023
STRENGTH OF MATERIALS - I
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions, each Question from each unit
All Questions carry **Equal** Marks
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UNIT-I

1 a) A bar ABCD is made by rigidly connecting three bars of different materials and different diameters and subjected to loading as shown in Fig.1. Find the stresses in each part of the bar and total elongation of the bar. Take the values of E for steel, brass and aluminium as 200 GPa, 100 GPa and 70 GPa respectively. [7M]

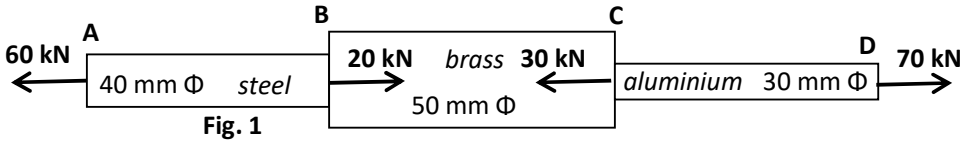

Fig. 1

b) A compound bar made of a steel rod 25 mm in diameter is enclosed in a brass tube of 26 mm internal diameter and 32 mm external diameter. The compound bar, 2400 mm long, is fixed at the upper end and is rigidly fixed to a rigid plate at the lower end. Determine the stresses in the bars when the combination is subjected to impact loading due to a weight of 10 kN falling through a height of 5 mm. E for steel = 200 GPa and E for brass is 100 GPa. [7M]

OR

2 a) A solid brass cylinder 20 mm diameter is rigidly attached and surrounded by an aluminium tube of internal diameter 20 mm and thickness 5 mm. If the assembly is stress free at 28°C, find the stresses in the two materials when the temperature rises to 90°C. For brass, E = 90 GPa and $\alpha = 20 \times 10^{-6}$/°C, and for aluminium E = 70 GPa and $\alpha = 23 \times 10^{-6}$/°C [7M]

b) A bar of cross section 10 mm x 10 mm is subjected to an axial pull of 8500 N. The lateral dimension of the bar is found to be changed to 9.9985 mm x 9.9985 mm. If the modulus of rigidity of the material is 0.75×10^5 N/mm^2, determine the Poisson's ratio, modulus of elasticity and bulk modulus of the material. [7M]

UNIT-II

3 a) Draw the SFD and BMD for the simply supported beam as shown in Fig.2. And also find the location, magnitude of maximum bending moment. [7M]

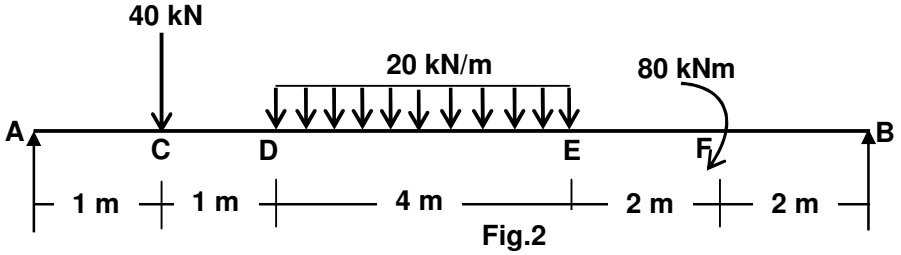

Fig.2

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b) Find the reactions at the fixed end of the cantilever loaded as shown in Fig.3. Also draw the Shear Force and Bending Moment diagrams. [7M]

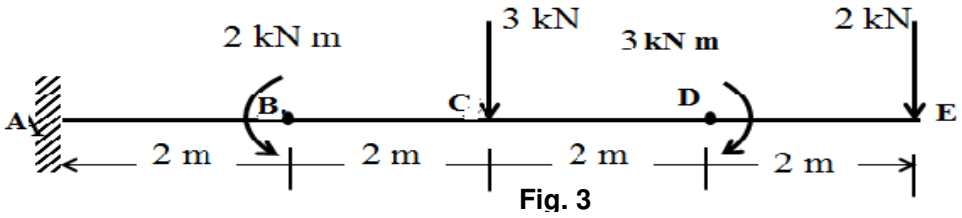

Fig. 3

OR

4 a) Find the maximum bending moment and its position from A, for a beam loaded and supported as shown in Fig.4 and draw SFD and BMD. [7M]

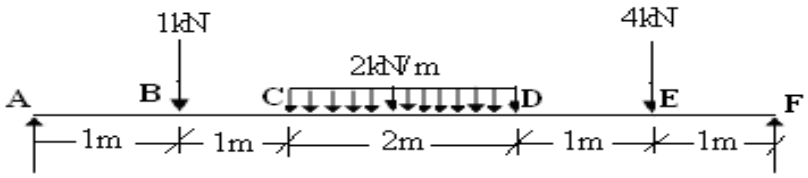

Fig. 4

b) A cantilever of span 4 m, carries a uniformly distributed load of 10 kN/m over the entire length, in addition to point load of 30 kN at the free end and a couple of 20 kN-m at mid span. Draw the SF and BM diagrams indicating salient values. [7M]

UNIT-III

5 a) A simply supported beam of span 4 m carries a point load of 15 kN at a distance of 3 m from left support. The cross section of the beam is as shown in Fig.5. Determine the tensile and compressive strength at a section which is at a distance of 3.25 m from the left support. [7M]

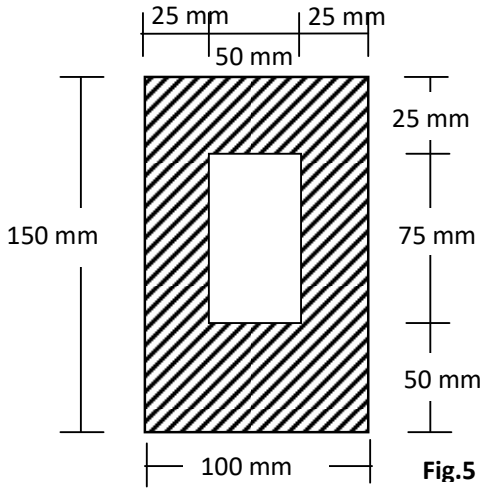

Fig.5

b) A T – section has a flange width of 200 mm, depth 150 mm and thickness 20 mm. It is subjected to shear force of 120 kN at a section, find the maximum shear stress and also draw the shear stress distribution diagram. [7M]

OR

6 a) A timber beam is simply supported at a span of 6 m. It carries an udl of 12 kN/m and a point load of 9 kN at 3.5 m from the right support. Design a suitable rectangular beam with depth is twice the width, if the bending stress in timber is not to exceed 8 N/mm^2. [7M]

b) A beam of I – section is having overall depth as 500 mm and overall width as 190 mm. The thickness of flanges is 25 mm whereas thickness of web is 15 mm. If the section carries a shear force 40 kN, calculate the maximum shear stress and also draw the shear stress distribution across the section. [7M]

UNIT-IV

7 a) Determine the maximum deflection of a simply supported beam of 8 m span with an overhang of 2 m at left end and also subjected to a clockwise moment of 100 kN-m at 3.5 m from its left support. Assume EI = 20 MNm^2. [7M]

b) A cantilever 4 m long carries a load varies uniformly from 0 kN at free end to 18 kN at the fixed end. Determine the values of slope and deflection at the free end. Take E = 200 GPa and I = 5000 cm^4. [7M]

Or

8 a) A beam 9 m long is supported at the right end and supported 1 m from left end. It carries a point load 10 kN at over hanging end and 15 kN at the mid point between the supports. Calculate the slopes and at the supports and deflection under the loads. Take E = 200 GPa and I = 6000 cm^4. [7M]

b) A simply supported beam of span 5 m subjected to a point load of 20 kN acting at 2 m from left end. Calculate slopes at the ends and deflection under the load by using moment area method. Take EI as constant. [7M]

UNIT-V

9 a) Derive an expression for hoop stress and longitudinal stress in a thin cylinder with ends closed by rigid flanges and subjected to an internal fluid pressure **p**. Take internal diameter and shell thickness of the cylinder is **d** and **t** respectively. [7M]

b) Find the thickness of metal necessary for a steel cylindrical shell of internal diameter 200 mm to withstand an internal pressure of 50 MPa. The maximum hoop stress in the section is not to exceed 150 MPa. [7M]

OR

10 a) A cylinder 120 cm long and 20 cm internal diameter having thickness is 15 mm is filled with fluid at atmospheric pressure. If an additional 20 cm^3 of fluid is pumped into cylinder, find the pressure exerted by the fluid on the cylinder and hoop stress. Take E = 200 GPa and $\nu = 0.3$. [7M]

b) A thick cylinder of internal radius 50 mm and external diameter 100 mm is subjected to an external pressure of 25 MPa and internal pressure of 70 MPa. Find the maximum hoop and radial stresses. [7M]