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

II B. Tech I Semester Supplementary Examinations, July - 2022
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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1 a) A circular bar ABCD has aluminium, brass and steel sections and subjected to axial loads as shown in Fig.1. If the permissible stresses in aluminium, brass and steel are 85 N/mm^2, 70 N/mm^2 and 125 N/mm^2 respectively, find the required diameter for each bar. Find the change in length of each bar and also find the total change in length of the bar, if E_s = 200 GPa, E_{al} = 70 GPa and E_b = 105 GPa. [8M]

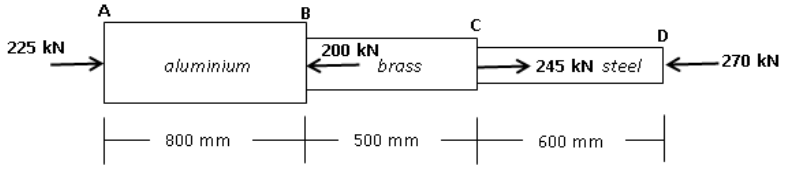

Fig. 1

b) Deduce an expression among three elastic of a material. [6M]

OR

2 a) A bar of steel is of square section 60 mm x 60 mm and 180 mm long. It is subjected to an axial compressive load of 300 kN. The lateral strain is prevented by the application of uniform external pressure. If ν = 0.3 and E = 200 GPa, find the change in length of the bar. [7M]

b) Three wires of the same material and cross-section support a rigid bar which further supports a weight of 5 kN. The length of the wires is 5m, 8m and 6m in order. The spacing between the wires is 2m and the weight acts at 1.6m from the first wire. Determine the load carried by each wire. [7M]

3 A simply supported beam of length 6 m, carries a uniformly distributed load of 2 kN/m over a length of 2 m from left end. There is a clockwise couple of 1500 Nm applied at the centre of the beam. Draw the shear force and bending moment diagrams for the beam and also find the magnitude and location of maximum bending moment. [14M]

OR

4 A beam 8 m long is supported at 2m from both left end and at the right end. It carries a uniformly distributed load 20 kN/m over a length of 6 m from the left support and a point load of 90 kN at the right end. Draw the shear force and bending moment diagrams. Find the position of the point of contra flexure and the location and magnitude of the maximum bending moment. [14M]

5 a) A cast iron beam of I - section with top flange 100 mm x 40 mm, web 140 mm x 20 mm and bottom flange 180 mm x 40 mm. If tensile stress does not exceed 35 MPa and compressive stress 95 MPa, what is the maximum uniformly distributed load the beam can carry over a simply supported beam of span 6.5 m, if the larger flange is in tension. [7M]

b) A wooden beam 100 mm wide and 150 mm deep is simply supported over a span of 4 m. If shear force at a section of the beam is 45 kN, find the shear stress at a distance of 25 mm above the neutral axis. [7M]

OR

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6 a) A T – beam having flange 150 mm x 20 mm and web 20 mm x 160 mm is simply supported over a span of 6 m. It carries a u d l of 5 kN/m, including the self-weight over its entire span, together with a load of 3.5 kN at mid span. Find the tensile and compressive stresses occurring in the beam section and draw the stresses across the section. [7M]

b) An unsymmetrical I – section has a top flange of dimensions 100 mm x 10 mm, bottom flange 60 mm x 10 mm and web 180 mm x 10 mm. If it is used as cantilever beam of span 3 m and subjected to u d l of 10 kN/m over the entire span, then find the shear stress at neutral axis and draw the shear stress distribution. [7M]

7 A simply supported beam of span 9 m subjected to loading as shown in Fig.4. Calculate the slope at the ends and also find the deflection at mid span. Take I = 5000 cm^4 and E = 2 x 10^5 N/mm^2. [14M]

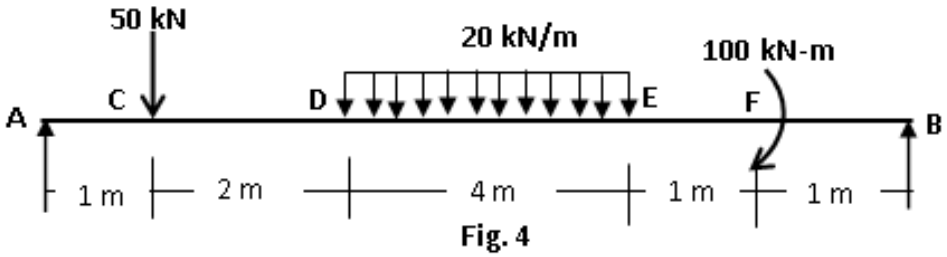

Fig. 4

OR

8 A beam ABC is loaded as shown in Fig.5. Compute the deflection at free end C, slope at A, and maximum deflection. Take I = 3000 cm^4 and E = 2 x 10^5 N/mm^2. [14M]

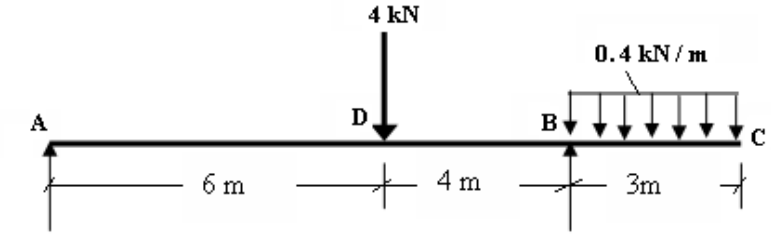

Fig. 5

9 a) A cylindrical shell 100 cm long and 20 cm internal diameter having thickness of metal 10 cm 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 also find the hoop stress induced. Take E = 2 x 10^5 N/mm^2 and ν = 0.3. [7M]

b) A closed cylindrical shell has an internal diameter of 400 mm and an external diameter of 500 mm. It is 1.2 m long and is subjected to an internal pressure of 6 MPa. Determine the change in internal volume and thickness. Take E = 200 GPa and ν = 0.25. [7M]

OR

10 A thick cylinder has inner and outer diameters as 120mm and 180mm respectively. It is subjected to an external pressure of 9 MPa. Find the value of the internal pressure which can be applied if the maximum stress is not to exceed 30 MPa. Draw the curves showing the variation of hoop and radial stresses through the material of the cylinder. [14M]

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