K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:III
Class:SY	Program:B.Tech
Branch Code:CIV	Pattern:2022
Name of Course:Mechanics of Structures	Course Code:CIV222002
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 3 pages.
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Question No. 1 Attempt following Question

1a) A bronze bar is fastened between a steel bar and an aluminum bar as shown in Fig 1. Axial loads are applied at the positions indicated. Find the largest value of P that will not exceed an overall deformation of 3.0 mm, or the following stresses: 140 MPa in the steel, 120 MPa in the bronze, and 80 MPa in the aluminum. Assume that the assembly is suitably braced to prevent buckling. Use Est = 200 GPa, Eal = 70 GPa, and Ebr = 83 GPa. (6) CO1

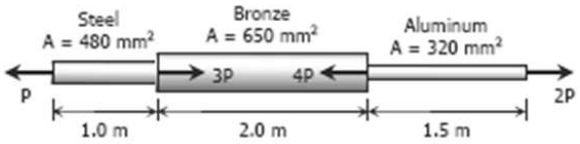

Fig. 1

Question No. 2 Attempt following Question

2a) A simply supported beam 10m long carries a point loads 80kN at 2m from left support as shown in Fig.2. The self-weight of the beam is 10 kN/m. Draw SFD & BMD for the beam. (6) CO2

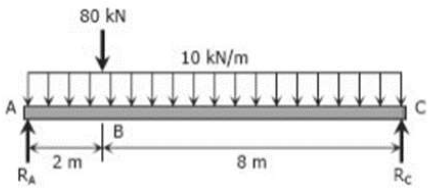

Fig. 2

3a) Determine the minimum height h of the beam shown in Fig. 3a, if the flexural stress is not to exceed 20 MPa. (8) CO3

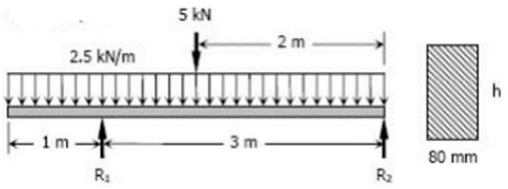

Fig. 3a

OR

3b) A rectangular steel bar, 15 mm wide by 30 mm high and 6 m long, is simply supported at its ends. If the density of steel is 7850 kg/m^3, determine the maximum bending stress caused by the weight of the bar. (8) CO3

3c) A 7.5 cm x 5 cm rolled steel I – section is freely supported over an effective span of 3 m. The flanges are 0.5 cm thick while the web is 3.7 mm thick. Calculate the UDL the joist can carry if the maximum intensity of shear stress induced is limited to 40 N/mm^2. (8) CO3

OR

3d) An I section 55 cm x 19 cm having flange and web thicknesses 1.5 cm and 0.99 cm respectively is used as a beam. If at a section, it is subjected to shear force of 100000 N, find the greatest intensity of shear stress in the beam and plot shear stress distribution diagram. (8) CO3

Question No. 4 Attempt following Question

4a) A steel propeller shaft is to transmit 4.5 MW at 3 Hz without exceeding a shearing stress of 50 MPa or twisting through more than 1° in a length of 26 diameters. Compute the proper diameter if G = 83 GPa. (8) CO4

OR

4b) An aluminum shaft with a constant diameter of 50 mm is loaded by torques applied to gears attached to it as shown in Fig. 4b. Using G = 28 GPa, determine the relative angle of twist of gear D relative to gear A. (8) CO4

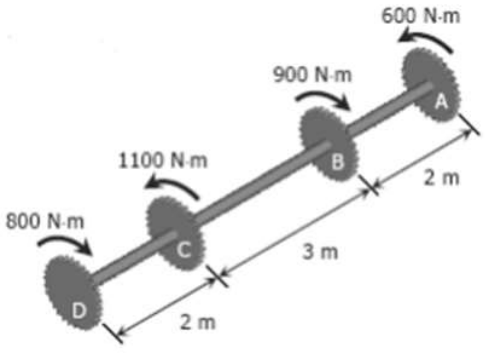

Fig. 4b

4c) At a point in a strained material, the principal stresses are 100 MPa (tensile) and 60 MPa (Compressive). Determine normal, shear and resultant stress on a plane inclined at 50^0 to the axis of major principal stress. Also determine the maximum shear stress at that point. (8) CO4

OR

4d) A steel bolt 2.5 cm diameter is subjected to a direct tension of 1500 kg and a shearing force of 1000 kg. Determine the intensities of normal and shear stress across a plane inclined at angle of 60^0 to the longitudinal axis of the bolt. Also determine the resultant stress. (8) CO4

Question No. 5 Attempt following Question

5a) An I section 40 cm x 20 cm x 2 cm and 6 m long is used as a strut with both ends fixed. Calculate the Euler's crippling load for the column. Take E = 2 x 10^6 kg/cm^2. (8) CO5

OR

5b) A T section 15 cm x 12 cm x 2 cm is used as a strut of 4 m long with hinged at its both ends. Calculate the crippling load, if Young's Modulus for the material be 2 x 10^6 kg/cm^2 and centroid of T section lies at 3.4 cm from top of the flange. (8) CO5

5c) Find the Euler's crippling load for a hollow cylindrical steel column of 38 mm external diameter and 2.5 mm thick. Take length of the column as 2.3 m and hinged at its both ends. Take E = 205 kN/mm^2. Also determine the crippling load by Rankin's formula using Yield stress as 335 N/mm^2 and Rankin's constant as 1/7500. (8) CO5

OR

5d) A cast iron hollow circular column of 200 mm external diameter and 160 mm internal diameter is 4m long. It is fixed at its both ends subjected to an eccentric load of 15 tonnes. Determine the maximum eccentricity in order that there is no tension anywhere on the section. Take E = 0.94 x 10^6 kg/cm^2. (8) CO5

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