Department of Civil Engineering

NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

Monsoon Semester 2022

Mid Sem Exam, 27 Sep 2022

Name:_____

Roll. No:_____

Sl. No:_____S_3 C_A/C_B/ Mat

CE2001D MECHANICS OF SOLIDS

Duration: 10 am to 12 noon Maximum Marks: [30]

Note: (a) *Answer* **all** *questions* (b) Provide neat sketches (c) Assume missing data suitably (d) Read the questions carefully

1. A steel plate 25 mm wide and 10 mm thick is connected to one end using a steel bolt of 10 mm diameter as shown in Fig. 1. If the ultimate stress of steel in tension and shear are 280 MPa and 360 MPa respectively, estimate the maximum safe load P (ignore bond-stress and the presence of the bolt-hole). Use factors of safety of 1.5 and 2 in tension and shear respectively. [4]

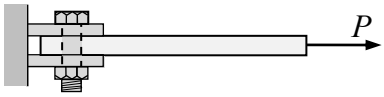

Figure 1

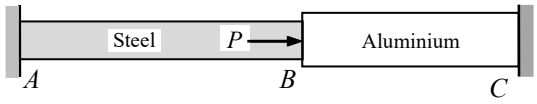

Figure 2

2. A steel rod AB of 20 mm diameter and 1 m length is rigidly connected to an aluminium rod BC of 30 mm diameter and 0.7 m length and loaded as shown in Fig. 2. Given: $E_s = 200$ GPa, $E_a = 70$ GPa and $P = 25$ kN. (a) Find the stresses in steel and aluminium, and (b) the displacement of B. [6]

3. A brass rod of 30 mm diameter and 800 mm length is rigidly connected to a steel rod of 20 mm diameter and 500 mm length and fastened to rigid supports at the ends as shown in Fig. 3. The assembly is heated up from a room temperature of 27° C to 67° C. If $E_b = 90$ GPa, $E_s = 200$ GPa, $\alpha_b = 17\times10^{-6}$/° C and $\alpha_s = 12\times10^{-6}$/° C, determine (a) the stresses developed in the two bars, and (b) the displacement of point B. [6]

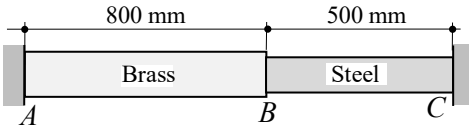

Figure 3

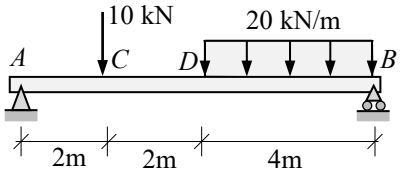

Figure 4

4. For the simply supported beam shown in Fig. 4, calculate the support reactions, write the shear force and bending moment equations in each segment, and neatly sketch the shear force and bending moment diagrams indicating all salient points. [10]

5. A simply supported steel beam of span 8 m is subjected to a uniformly distributed load of 25 kN/m. The cross-section of the beam is as shown in Fig. 5. Determine the maximum normal stresses due to bending. [4]

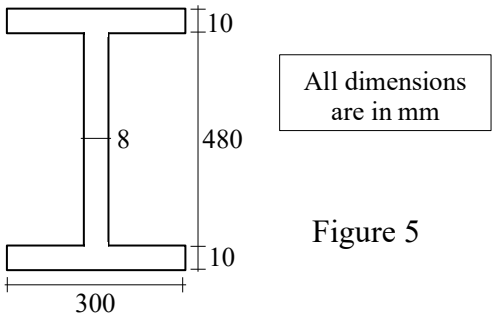

Figure 5

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