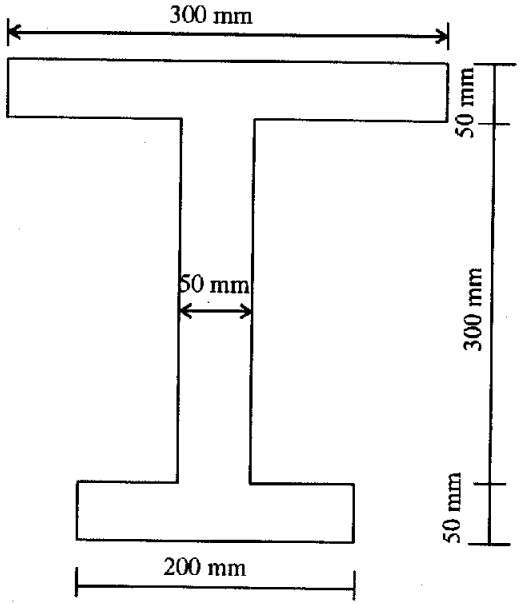

6. A simply supported beam of 8 m length carries two point loads of 64 kN and 48 kN at 1 m and 4 m respectively from the left-hand end. Find the diflection under each load and the maximum deflection using Macaulay's method. Take E = 210 GPa and $I = 180 \times 10^6$ mm^4. **10**

Section D

7. Explain the following theories of elastic failure with derivations and graphical representations : **10**

   (i) maximum shear stress theory

   (ii) maximum shear strain energy theory.

Roll No. ..... **Total Pages : 05**

July-22-00228

B. Tech. EXAMINATION, 2022

Semester III (CBCS)

STRENGTH OF MATERIALS-I (ME, AE)

ME-301

Time : 3 Hours *Maximum Marks : 60*

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D. Q. No. **9** is compulsory. Use of non-programmable calculator is allowed. Assume missing data suitably if any and specify the same.

Section A

1. A railway is laid so that there is no stress in the rails at 8°C. Calculate (a) the stress on the rails at 50°C if

there is no allowance for expansion (b) the stress in the rails at 50°C if there is an expansion allowance of 8 mm per rail (c) the expansion allowance if the stress in the rail is to be zero when the temperature is 50°C (d) the maximum temperature to have no stress in the rails if the expansion allowance is 12 mm per rail. The rails are 30 m long. Take $\alpha = 12\times10^{-6}$ per °C and $E = 2\times10^5$ N/mm^2. **10**

2. A flat brass plate was stretched by tensile forces acting in direction X and Y at right angle. Strain gauges show that strains in X-direction was 0.00108 and in the Y-direction 0.00024. Find (a) stresses acting in X and Y directions, and (b) direct and shearing strains on a plane inclined at 40° to the X-direction (c) normal and shearing stresses on that plane. Take $E = 80$ kN/mm^2 and $\mu = 0.3$. **10**

Section B

3. A timber beam of rectangular section is to support a load of 20 kN over a span of 4 m. If the depth of the section is to be twice the breadth and the stress in the timber is not to exceed 60 N/mm^2, find the dimensions of cross-section. How would you modify the cross-section of the beam if it were a concentrated load placed at the centre with the same ratio of breadth to depth. **10**

4. A hollow steel shaft 5 m long is to transmit 160 kW of power at 120 rpm. The total angle of twist is not to exceed 2° in this length and the allowable shear stress is 50 N/mm^2. Determine the inside and outside diameters of the shaft taking $N = 0.85\times10^5$ N/mm^2. **10**

Section C

5. A cast iron bracket, subjected to bending has a cross-section of I-shape with unequal flanges as shown in figure given below. If the section is subjected to a shear force of 1600 kN, draw the shear stress distribution over the depth of the section, indicating the principal values. **10**

8. Derive an expression for strain energy stored in a body when load is applied (i) gradually (ii) with impact. **10**

(Compulsory Question)

9. (i) Define the term factor of safety and state its importance.
   (ii) State Hooke's law.
   (iii) What do you mean by principal planes and principal stresses ?
   (iv) What do you mean by the terms 'neutral axis' and neutral surface ?
   (v) Write the assumptions for finding out the shear stress in a circular shaft subjected to torsion.
   (vi) What assumptions are taken in the analysis of shear stress in beams ?
   (vii) What is moment-area method ? Where is it conveniently used ?
   (viii) State maximum principal stress theory of failure.
   (ix) State maximum strain energy theory of failure.
   (x) Define strain energy. **2×10=20**

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