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BICE-008

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

December, 2015

BICE-008 : STRUCTURAL ANALYSIS – I

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***five*** *questions. Use of scientific calculator is allowed. Assume missing data, if any.*

1. A composite bar made up of copper, steel and aluminium is rigidly attached to the end support as shown in Figure 1. Determine the stresses in the three portions of the bar when the temperature of the composite system is raised by 20°C, when the supports are rigid.

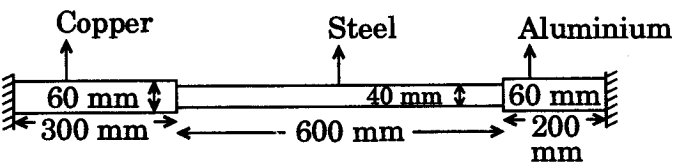

Figure 1

$\alpha_{copper} = 18 \times 10^{-6}$ m/m/°C

$\alpha_{steel} = 12 \times 10^{-6}$ m/m/°C

$\alpha_{aluminium} = 23 \times 10^{-6}$ m/m/°C *14*

2. (a) Show that the shear stress in a body acted upon by two perpendicular stresses is zero. 7

(b) What is a Mohr's stress circle ? Explain with an example. 7

3. (a) A 4 m long fixed end hollow cast-iron column supports an axial load of 1 MN. The external diameter of the column is 200 mm. Determine the thickness of the column by using Rankine formula taking a constant of 1/6400 and working stress as 78 MN/m^3. 9

(b) Define slenderness ratio of a column. What is its importance ? 5

4. Draw SFD and BMD for the beam shown in Figure 2. 14

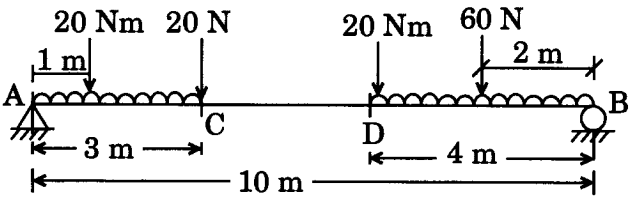

Figure 2

5. (a) Show that the product of inertia of a T-section about a centroidal axis is zero. 7

(b) What is shear centre ? Explain it with an example. 7

6. (a) What is middle third rule for rectangular section ? 5

(b) A composite beam consists of a 180 mm × 140 mm timber section bonded with 10 mm × 140 mm steel plates at top and bottom. Determine the stresses in the beam when it is subjected to a shear force of 100 kN. Also find the spacing of bolts of 12 mm ϕ for the shear connection between the flitches and the timber beam. Allowable shear stress in steel = 100 MPa, E_{steel} = 210 GPa and E_{timber} = 15 GPa. *9*

7. (a) Write short notes on any ***two*** of the following : *3×2=6*

(i) Principle of hardness testing

(ii) Section modulus with example

(iii) Principal stresses and strains

(b) Derive the relationship between torsional moment, twist and shear stress. *8*

8. The tension flange of a cast-iron I-section beam is 240 mm wide and 50 mm deep, the compression flange is 100 mm wide and 20 mm deep, whereas the web is 300 × 30 mm. Find the load per m run which can be carried over a 4 m span by a simply supported beam, if the maximum permissible stresses are 90 MPa in compression and 24 MPa in tension. *14*