ACHARYA INSTITUTE OF TECHNOLOGY
Bangalore - 560090

CBCS Scheme

USN | | | | | | | | | | |

15AE34

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Write the equilibrium equations for a 3 dimensional stress system. **(03 Marks)**

b. Define Plane stress and Plane strain. **(04 Marks)**

c. Displacement field at a point on a body is given as follows : $u = (x^2yz + z^2)$, $v = (xy^2z + y^2)$, $w = (xyz^2 + x^2)$. Determine strain components at (2, 1, 2) and express them in a matrix form. **(09 Marks)**

OR

2 a. Write a note on constitutive laws for anisotropic materials. **(04 Marks)**

b. Draw a stress – strain diagram for ductile material and mention the salient points. **(04 Marks)**

c. A composite bar is a shown in fig. Q2(c). Determine the stress developed in each member. Take $E_{al} = 0.7 \times 10^5 N/mm^2$; $E_{steel} = 2 \times 10^5 N/mm^2$. **(08 Marks)**

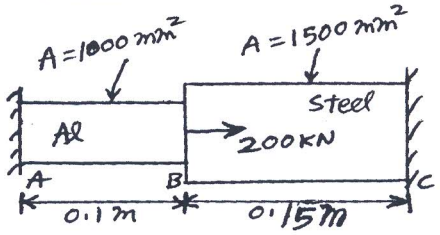


Fig.Q2(c)

Module-2

3 a. What are the Euler – Bernoulli assumptions and its implications? **(06 Marks)**

b. A symmetric I section beam with flanger dimension 180mm × 15mm and web dimension 280 × 15mm is subjected to a bending moment 120KN – m and a shear force of 60kN. Determine the bending stress and shear stress distribution along the depth of the section. **(10 Marks)**

OR

4 a. What is Three – dimensional beam theory? Give its kinematic description. **(08 Marks)**

b. What are the Governing equations for a three dimensional beam? Explain. **(08 Marks)**

Module-3

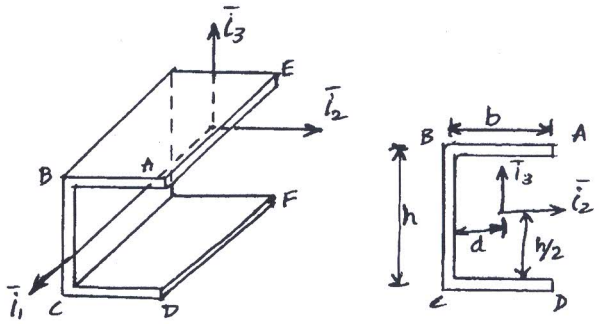
5 a. A 2 meters long hollow cylinder shaft has 80mm outer diameter and 10mm wall thickness. When the torsional load on the shaft is 6kN-m, determine i) maximum shear stress induced and ii) angle of twist. Also draw the distribution of shear stress in the wall of the shaft. Take G as 80GPa. **(10 Marks)**

b. Discuss the application of Von Mises criterion and Tresca's criterion for a propeller shaft under torsion and thrust. **(06 Marks)**

OR

6 a. Evaluate the distribution of shear flow over thin walled C – channel shown in fig. Q6(a). The section has a uniform thickness t, a vertical web height h, a flange width b and is subjected to a vertical shear force V_3, at the specific span – wise location where the shear flow is to be computed. **(10 Marks)**

Fig.Q6(a)



b. Explain the procedure to determine the shear flow distribution over the open cross – section of a thin walled beam subjected to transverse shear forces. **(06 Marks)**

Module-4

7 a. Define principle of virtual work for a particle. Obtain the equilibrium of a particle. **(08 Marks)**

b. What are the differences between principle of virtual work and principle of complementary virtual work? **(08 Marks)**

OR

8 a. Define a conservative force and obtain the work done by conservative force along any path joining two points. **(08 Marks)**

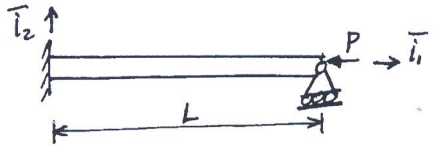
b. Explain Clapeyron's theorem. **(08 Marks)**

Module-5

9 a. Obtain the buckling load for a cantilever beam with tip support by energy approach and show the buckling mode shape. Cantilever beam shown in fig.Q9(a). **(10 Marks)**

b. Explain Tresca's & Von Mises criterions. **(06 Marks)**

Fig.Q9(a)



OR

10 a. Explain Kirchhoff plate theory and mention its assumptions. **(08 Marks)**

b. What are the constitutive laws for laminated composite plates? **(08 Marks)**

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