

CBCS Scheme

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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.

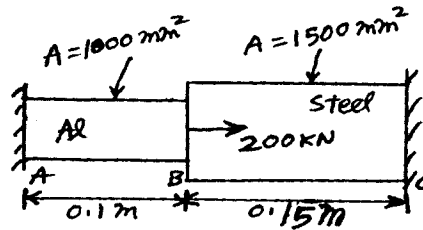
Module-1

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 shown in fig. Q2(c). Determine the stress developed in each member.
 Take $E_{ac} = 0.7 \times 10^5 \text{ N/mm}^2$; $E_{steel} = 2 \times 10^5 \text{ N/mm}^2$. (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)

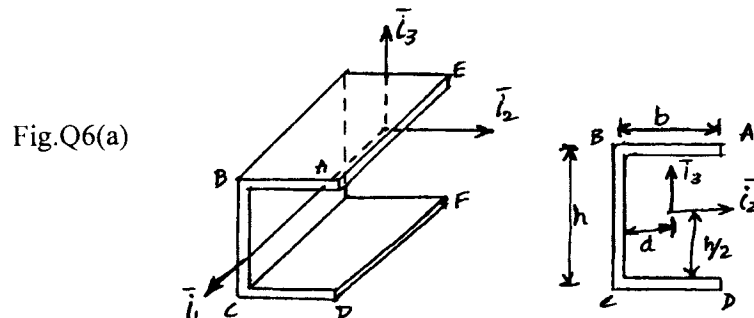
Module-3

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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any retaking of identification, appeal to evaluator and/or equations written eg. 4Z+8 – 50, will be treated as malpractice.

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)



- 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

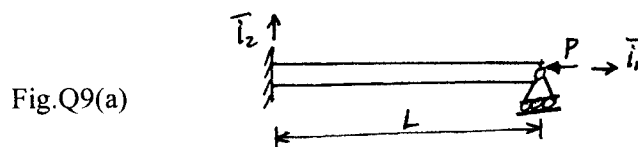
- 7 a. Define principle of virtual work for a particle. Obtain the equilibrium of a particle. (08 Marks)
 b. What are the differences between principle of virtual work and principle of complementary virtual work? (08 Marks)

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)



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)
