CBCS SCHEME

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17AE/AS34

Third Semester B.E. Degree Examination, Dec.2018/Jan.2019
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Derive the equilibrium equations in polar co-ordinate for a two dimensional state of stress. **(10 Marks)**

b. Displacement field at a point on a body is given as follows :
$u = (x^2 + y)$, $v = (3 + z)$, $w = (x^2 + 2y)$
Determine strain components at (3, 1, -2) and express them in Matrix form. **(06 Marks)**

c. Define plane stress and plane strain. **(04 Marks)**

OR

2 a. Draw stress – strain curve for ductile material and mention the salient points. **(06 Marks)**

b. Define the term load factor and allowable stress. **(04 Marks)**

c. A composite bar is shown in Fig Q2(c). Determine the stress developed in each member. Take $E_{al} = 70Gpa$; $E_{steel} = 200GPa$ **(10 Marks)**

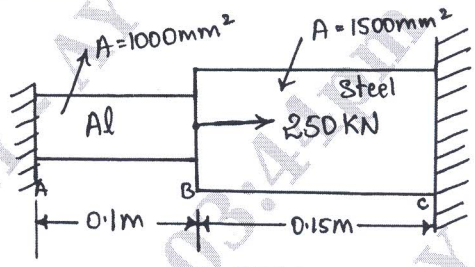

Fig Q2(c)

Module-2

3 a. Explain in detail the implications of Euler Bernoulli assumptions and derive the expression for the same. **(08 Marks)**

b. An symmetric I – section beam 350mm × 200mm has a web thickness of 12.5mm and a flang thickness of 25mm. It carries a shearing force of 200kN and Bending moment of 120kN-m. Determine the bending stress and shear stress distribution along the depth of the section. **(12 Marks)**

OR

4 a. What is Three-dimensional beam theory? Give its Kinematic description. **(06 Marks)**

b. What are the governing equation of a three dimensional beam? Explain. **(06 Marks)**

c. What are the equilibrium equations for a beam subjected to transverse loads? **(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 ii) Angle of twist. Also draw the distribution of shear stress in the wall of the shaft. Take G as 80 Gpa. Also find torsional stiffness. **(12 Marks)**

b. Discuss the application of Von Mises crierion and Tresca's criterion for a propeller shaft under torsion, Bending and thrust. **(08 Marks)**

OR

6 a. Explain the following terms with respect to the basic equations for thin walled beam:
i) The thin wall assumption ii) Stress flows iii) Stress resultants. **(12 Marks)**

b. What is wraping of thin- walled beam under torsion? Give the kinematic description. **(08 Marks)**

Module-4

7 a. Calcualte the vertical deflection of the joint 'B' and the horizontal movement of support 'D' in the truss shown in Fig Q7(a). The cross section area of each member is 1800mm^2 and Young's modulus for the material of the member is 200 × 10^{3}N/mm^2. Using unit load method. **(12 Marks)**

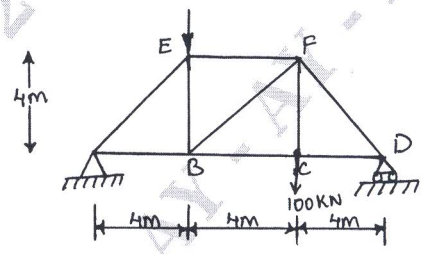

Fig Q7(a)

b. Define the principle of virtual work for a particle. Obtain the equilibrium of a particle. **(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 Castigliano theorem and Clapeyron's theorem. **(12 Marks)**

Module-5

9 a. A rigid rod ABCD is supported by a hinge at 'A' and two wires at 'B' and 'C' as shown in Fig Q9(a). Determine the stress of the two wires. Take E_s = 200GPa and E_c = 120GPa. Also find deflection at free end. **(10 Marks)**

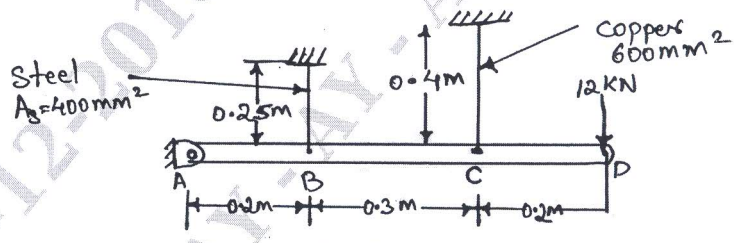

Fig Q9(a)

b. Explain Tresca's and Von Mise's criterion's in detail for uniaxial stress state, plane state of stress and pure shear state. **(10 Marks)**

OR

10 a. List the assumption of Kirchhoff plate. Derive the six strain displacement equation. **(10 Marks)**

b. Derive the five equilibrium equations of Kirchhoff plate theory. **(10 Marks)**

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