CBCS Scheme

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

15AE34

Third Semester B.E. Degree Examination, June/July 2017
Mechanics of Materials

Time: 3 hrs. Max. Marks: 80

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

Module-1

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

b. The rectangular component at a point are given as follows :
$\sigma_x = 100$Mpa, $\sigma_y = 75$Mpa, $\sigma_z = 50$Mpa, $\tau_{xy} = 70$MPa, $\tau_{yz} = 50$MPa, $\tau_{xz} = 30$Mpa. Find the stresses on octahedral plane. **(06 Marks)**

OR

2 a. Draw the stress-strain curve for mild steel and mention the salient points. **(04 Marks)**

b. Write a note on material selection for structural performance. **(06 Marks)**

c. A stepped bar of steel, held between two supports as shown in Fig Q2(c), is subjected to loads $P_1 = 80$kN and $P_2 = 60$kN. Find the reactions developed at the ends A and B. **(06 Marks)**

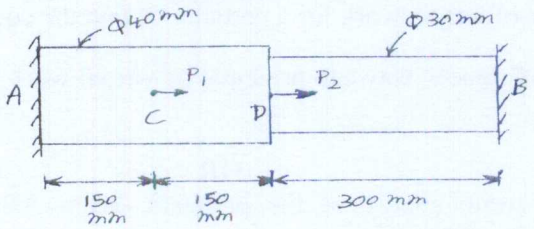


Fig Q2(c)

Module-2

3 a. A beam of T section has a length of 2.5m and is subjected to a point load as shown in Fig Q3(a). Calculate the compressive bending stress and plot the stress distribution across the cross section of the beam. The maximum tensile stress is limited to 300MPa. Calculate the value of W. **(12 Marks)**

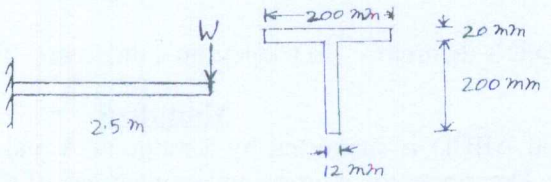


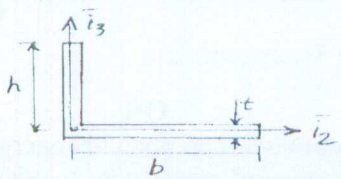
Fig Q3(a)

b. Derive relations between intensity of load, shear force and bending moment. **(04 Marks)**

OR

4 a. What is three dimensional beam theory? Give its Kinematic description. **(08 Marks)**

b. Find the principle centroidal bending stiffness of the beam shown in Fig Q4(b). The axial stiffness of section is S = Et (bth) **(08 Marks)**



h = 0.1m
b = 0.25m
t = 2.3 mm

Fig Q4(b)

Module-3

5 a. A hollow circular shaft 200mm external diameter and thickness of metal 25mm is transmitting power at 200rpm. The angle of twist over a length of 2m was found to be 0.5°. Calculate the power transmitted and the maximum shear stress induced in the section. The modulus of rigidity of material is 84 kN/mm^2. **(08 Marks)**

b. Discuss the application of Von mises criterion and Tresca's criterion for a propeller shaft under torsion and bending. **(08 Marks)**

OR

6 a. Derive equation for shear flow distribution in open section beams. **(08 Marks)**

b. Calculate the position of the shear centre of the thin walled channel section shown in Fig Q6(b). The thickness 't' of the walls is constant. **(08 Marks)**

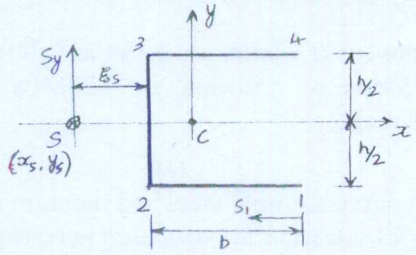


Fig Q6(b)

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. Determine the strain energy of the prismatic beam AB for the loading as shown in Fig Q8(a). Take E = 200GPa. **(10 Marks)**

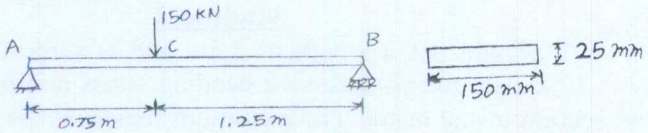


Fig Q8(a)

b. Define :
i) Castiglione's theorem ii) Clapeyron's theorem iii) Maxwell's theorem. **(06 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 stresses and elongations of the two wires. Take E_s = 200GPa and E_c = 100GPa. **(10 Marks)**

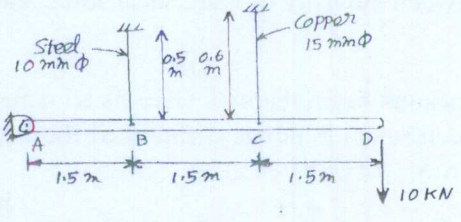


Fig Q9(a)

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

OR

10 a. Deduce the principle of minimum total potential energy for Kirchhoff plates. **(10 Marks)**

b. Explain Kirchhoff plate theory and mention its assumptions. **(06 Marks)**