(b) Figure 6 shows a frame subjected to a load of 2.4 kN. Find:

(i) The resultant stresses at points 1 and 2;

(ii) Position of the neutral axis.

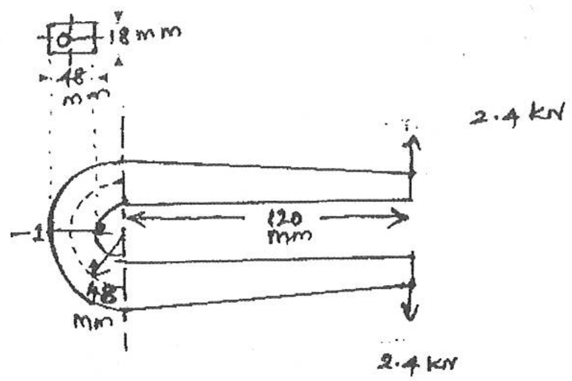

Figure 6

PART C — (1 × 15 = 15 marks)

16. (a) A cantilever of T-section (Flange: 120mm × 20mm Web; 130mm × 20mm) is 2.8 m long, carries a concentrated load W at its free end inclined at an angle of 45 degrees to the vertical. If E = 200 GPa and the deflection at the free end is not to exceed 2 mm. determine:

(i) The maximum value of W;

(ii) Direction of neutral axis with respect to vertical axis.

Or

(b) A boiler drum consists of a cylindrical portion 4m long. 1.5m in diameter and 2.25cm thick. It is closed by hemispherical ends. In a hydraulic test to 6MN/m^2, how much additional water will be pumped in after initial filling at atmospheric pressure. The circumferential strain at the junction of the cylinder and hemisphere may be assumed to be the same for both. E = 200 GN/m^2, K (for water) = 2.13 GN/m^2 and 1/m = 0.3.

03/01/2024 - FN.

Reg. No. : [ ]

Question Paper Code : 70349

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Fourth Semester

Civil Engineering

CE 8402 — STRENGTH OF MATERIALS II

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State Maxwell's Reciprocal theorem.
2. Mention the causes of lack of fit in a truss.
3. What are fixed end moments?
4. Mention the moment caused due to sinking in a beam.
5. Differentiate thick and thin cylinders.
6. What is meant by the effective length of a column?
7. State Maximum shear stress theory.
8. What causes volumetric strain in a body?
9. Recall shear centre.
10. Mention two examples of curved beams.

PART B — (5 × 13 = 65 marks)

11. (a) Figure 1 shows a loaded pin jointed truss. If the area of cross-section of all members shown in Figure.1 is 1000mm^2, determine the vertical deflection of point C using unit load method? Take E = 200 GPa for all members.

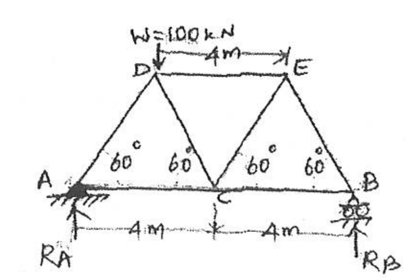

Figure 1

Or

(b) Determine the deflection at point D in the beam shown in Figure 2 using Castigliano's theorem.

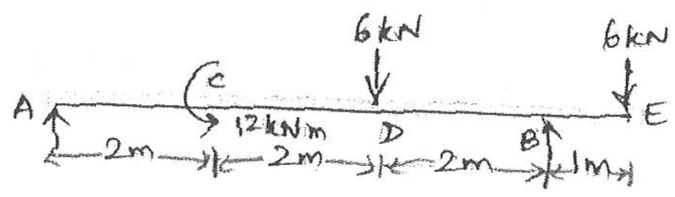

Figure 2

12. (a) Analyse the continuous beam shown in Figure.3 using the Theorem of three moments.

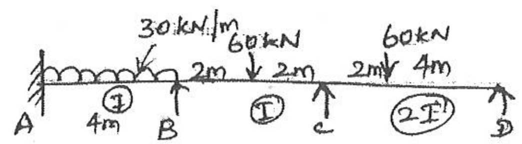

Figure 3

Or

(b) A fixed beam of 6 m span supports two point loads of 300kN each at 2 m from each end. Find the fixing moments at the ends and draw the B.M. and S.F. diagrams. Find also the central deflection. Take $I = 9 \times 10^8$ mm^4 and $E = 200$kN/mm^2.

13. (a) A bar of length 4m when used as a simply supported beam and subjected to a u.d.l. of 30 kN/m over the whole span, deflects 15mm at the centre. Determine the crippling loads when it is used as a column with following end conditions:

(i) Both ends pin-jointed;

(ii) One end fixed and other end hinged;

(iii) Both ends are fixed.

Or

(b) A compound cylinder, formed by shrinking one tube to another is subjected to an internal pressure of 90 MN/m^2. Before the fluid is admitted, the internal and external diameters of the compound cylinder are 180 mm and 300 mm respectively and the diameter at the junction is 240mm. If after shrinking on, the radial pressure at the common surface is 12 MN/m^2, determine the final stresses developed in the compound cylinder.

14. (a) At a point in a material under stress shown in Figure 4, the intensity of the resultant stress on a certain plane is 50MN/m^2 (tensile) and is inclined at 30° to the normal of that plane. The stress on a plane at right angles to this has a normal tensile component of intensity of 30MN/m^2. Find:

(i) The resultant stress on the second plane;

(ii) The principal planes and stresses;

(iii) The plane of maximum shear and its intensity.

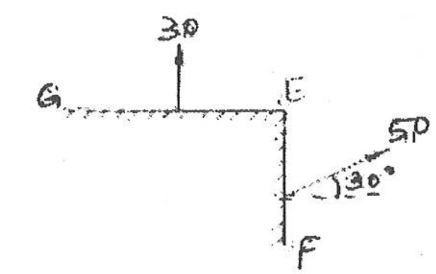

Figure 4.

Or

(b) A cylindrical shell made of mild steel plate and 12 m in diameter is to be subjected to an internal pressure of 1.5MN/m^2, If the material yields at 200 MN/m^2, calculate the thickness of the plate on the basis of the following three theories, assuming a factor of safety 3 in each case.

(i) Maximum principal stress theory;

(ii) Maximum shear stress theory; and

(iii) Maximum shear strain energy theory.

15. (a) Locate the shear centre of the section shown in Figure 5.

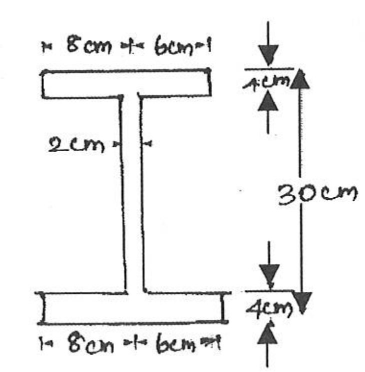

Figure 5

Or