[01 - 2112]

II / IV. B.E. DEGREE EXAMINATION

Civil Engineering

First Semester

STRUCTURAL ANALYSIS - I

(Common for Civil and Civil Environmental Engineering and Dual degree in Civil Engineering)

(Effective from the admitted batch of 2006-2007)

Time : 3 Hours Max. Marks: 70

Question No. 1 is compulsory.
Write all the bits in the same order.
Answer any FOUR questions from remaining Seven questions.
All questions carry equal marks.

1. (a) What is yield stress of a material ? State its importance.

   (b) A conical bar tapers uniformly from a diameter of 20 mm to a diameter of 50 mm in a length of 500 mm. Determine the elongation of the bar under an axial tensile force of 100 kN. Take $E = 2 \times 10^5$ N/mm^2.

   (c) Draw the shear stress distribution in a triangular section of base 'b' and height 'h'.

   (d) What is complementary shear ? Explain it with neat sketch in the material behaviour.

   (e) Define the term pure torsion with suitable examples.

   (f) Define point of contraflexure.

   (g) Distinguish between thin and thick cylinders with suitable examples.

2. (a) Derive the formula for stress and elongation produced in bar of diameter 'd' due to its self-weight.

(b) A steel rod of cross-sectional area 2000 mm^2 and two brass rods of cross sectional areas 1200 mm^2 and 1000 mm^2 respectively together symmetrically support a load of 500 kN (Figure 1). Find the stresses in each rod. Take E of steel as 2.0×10^5 N/mm^2 and E of brass as 1.0×10^5 N/mm^2.

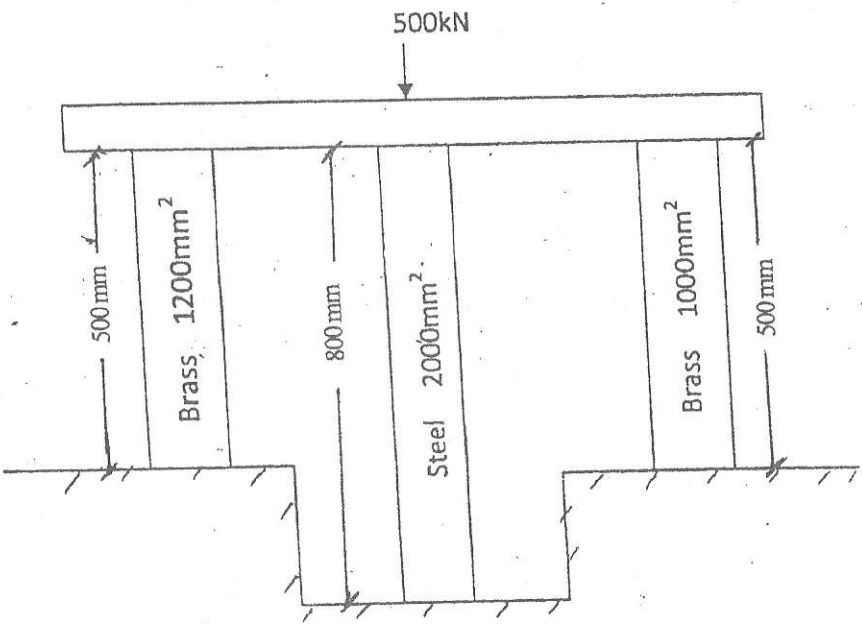

Figure - 1

3. (a) Develop the relation between B.M. and S.F. in a beam.

(b) Figure 2 shown is Shear Force Diagram for a beam which rests on two supports. Deduce from S.F.D. the loading on the beam. Draw the Bending Moment Diagram with salient features.

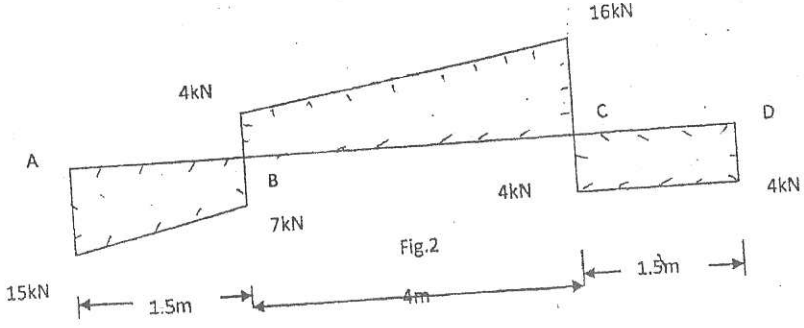

Figure - 2

4. (a) Derive an expression for the stress on an oblique section of a rectangular body when it is subjected to direct stresses in two mutually perpendicular directions.

(b) The cross-section of a cast-iron beam is shown in Figure 3. The beam resists B.M. about the horizontal neutral axis. The permissible stresses in tension and compression are 45 N/mm^2 and 100 N/mm^2. Calculate values of moment of

resistance of the section about the horizontal neutral axis for both positive and negative B.M.

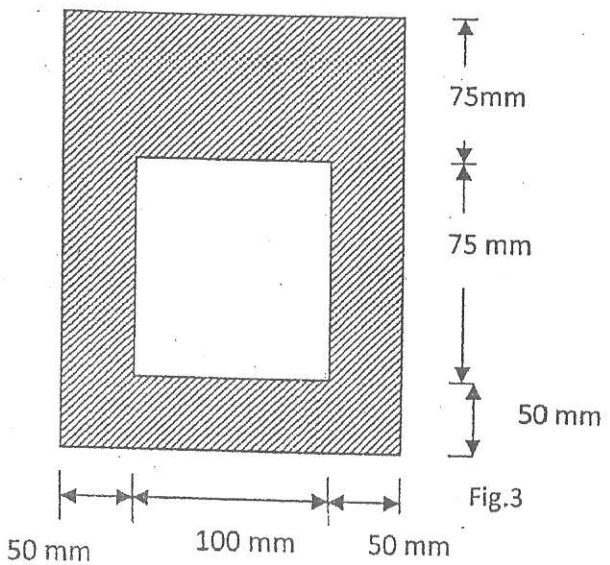

Figure - 3

5. (a) A Solid cylindrical shaft is to transmit 300 kW power at 100 r.p.m.

(i) If the shear stress is not to exceed 80 N/mm^2, find its diameter.

(ii) What percent saving in weight would be obtained if this shaft is replaced by a hollow shaft with its internal diameter equal to 0.6 of the external diameter, the length, the material and maximum shear stress being same ?

(b) Sketch the variation of shear stress across a circular shaft due to torsional moment and explain it briefly.

6. (a) Show that in the case of a thin cylindrical shell subjected to an internal fluid pressure the tendency to burst length wise is twice as great as a transverse section.

(b) A shell 3.25 m long 1 m diameter is under an internal pressure of 1 MPa. If the thickness of the shell is 10 mm, find.

(i) Hoop and longitudinal stresses
(ii) Maximum shear stress and
(iii) Change in the dimensions.

Take $E = 2 \times 10^5$ MPa and Poison's ratio = 0.3.

7. (a) A simply supported beam of span L is subjected to equal loads W/2 each at $1/3^{rd}$ span points. Find the expressions for deflection under the load and at mid span. Use McCaulay's method.

(b) Distinguish between Moment integration method and McCaulay's method with salient points.

8. (a) Discuss the Mohr's circle of stresses with its use.

(b) A truss made up of equilateral triangles is loaded as shown in the figure 4 with A and D as supports. Find graphically the forces in the various members of the truss. The side of triangle being 3 m.

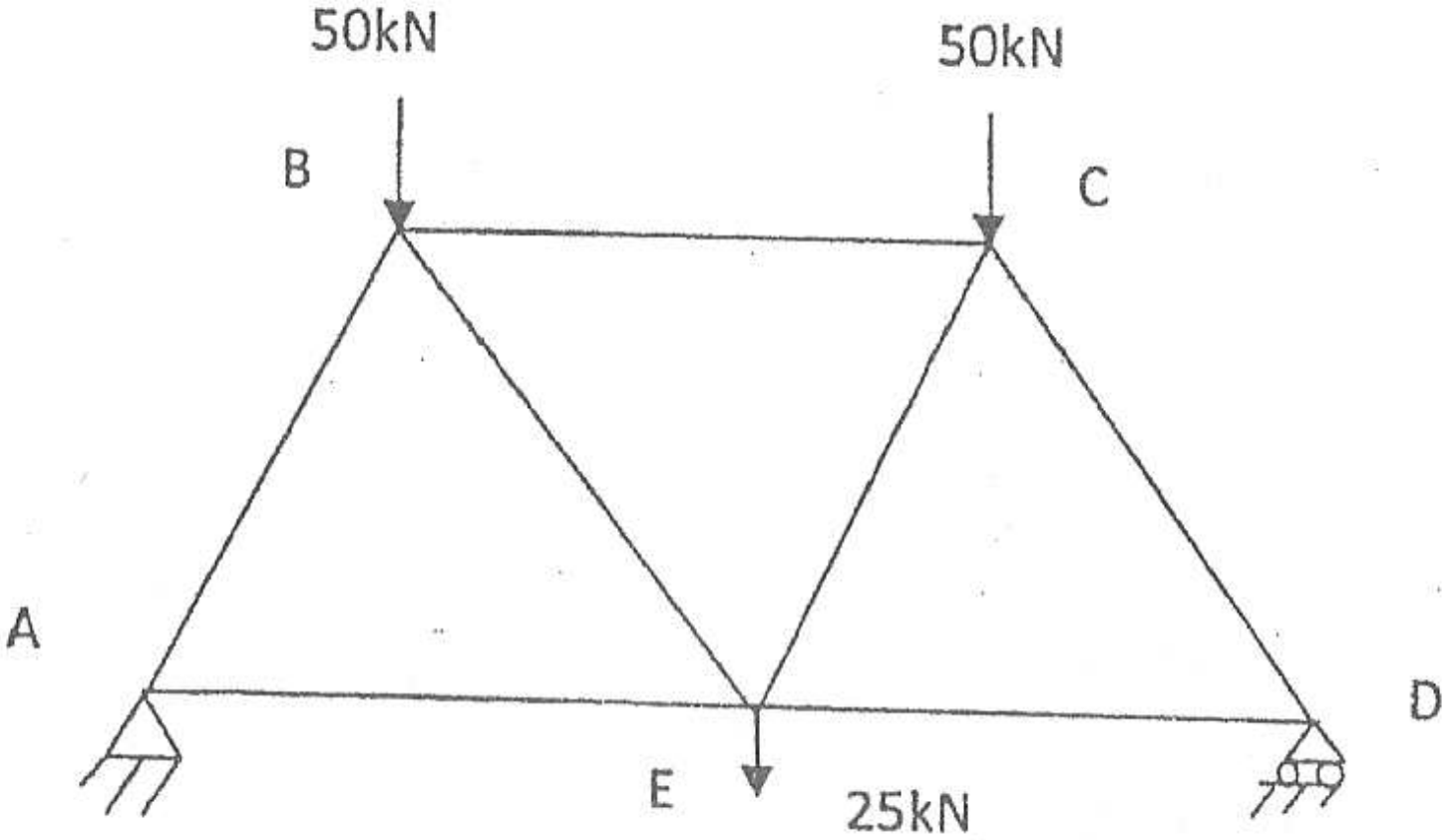

Figure - 4

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