(REVISED COURSE)

(3 Hours) [Total Marks : 100

67

1) Question No. **1** is **compulsory.**
2) Attempt any **four** questions out of remaining **six** questions.
3) Assumption made should be clearly **stated.**
4) Assume any **suitable** data wherever **required** but justify the **same.**
5) **Figures** to the **right** indicate **full** marks.

(a) A beam is simply supported and carries a uniformly distributed load of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120 N/mm² and moment of inertia of the section is 7×10^8 mm⁴, find the span of the beam. **10**

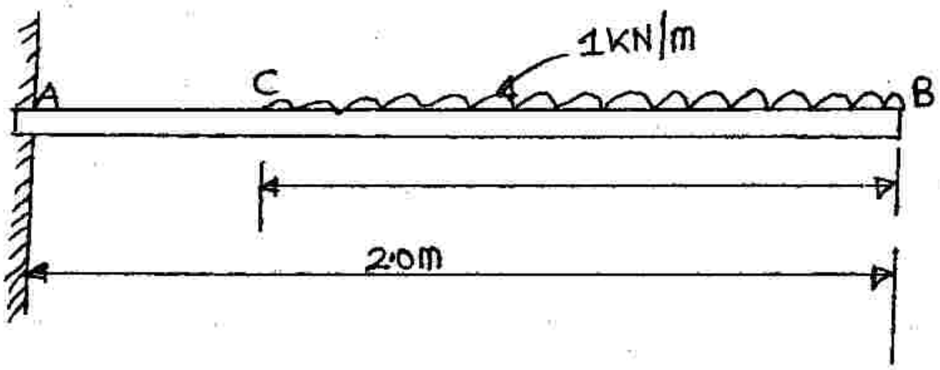
(b) State the assumptions made in theory of pure bending and derive the relation. **5**

$$\frac{\sigma}{y} = \frac{M}{I} = \frac{E}{R}$$

(c) Prove that shear stress distribution for rectangular section **5**

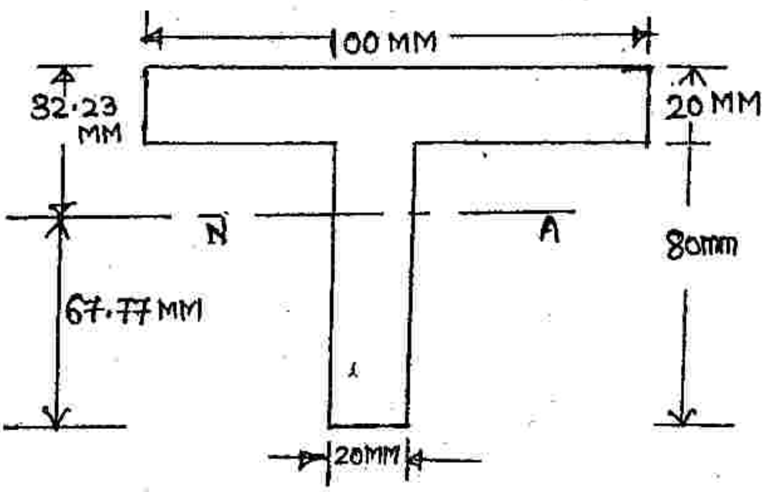
$$q\,max = \frac{3}{2}\,q\,mean$$

(a) A cantilever of length 2·0 m carries a uniformly distributed load of 1 kN/m run over a length of 1·5 m from the free end. Draw the shear force and bending moment diagrams for the cantilever. **10**



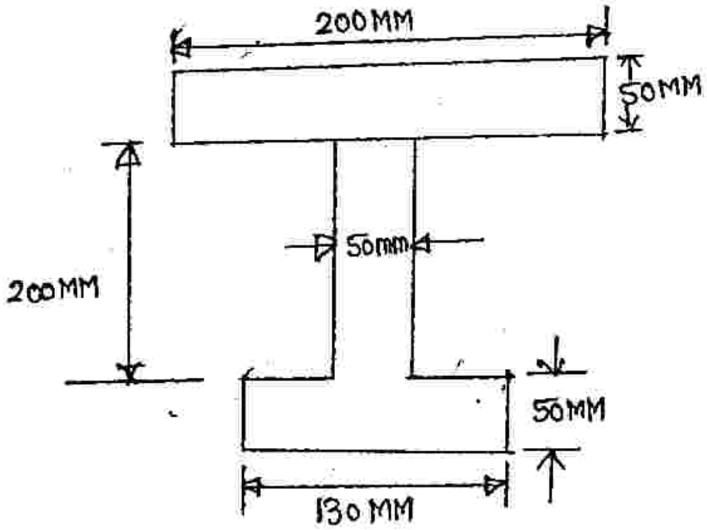
(b) Two circular beams whee one is solid of diameter D and other is a hollow of outer diameter D_o and inner diameter D_i, are of samè length, same material and of same weight. Find the ratio of section modulus of these circular beams. **10**

(a) A cast iron beam is of T section as shown in **figure.** The beam is simply supported on a span of 8 m. The beam carries a uniformly distributed load of 1·5 kN/m length on the entire span. Determine the maximum tensile and maximum compressive stresses. **10**

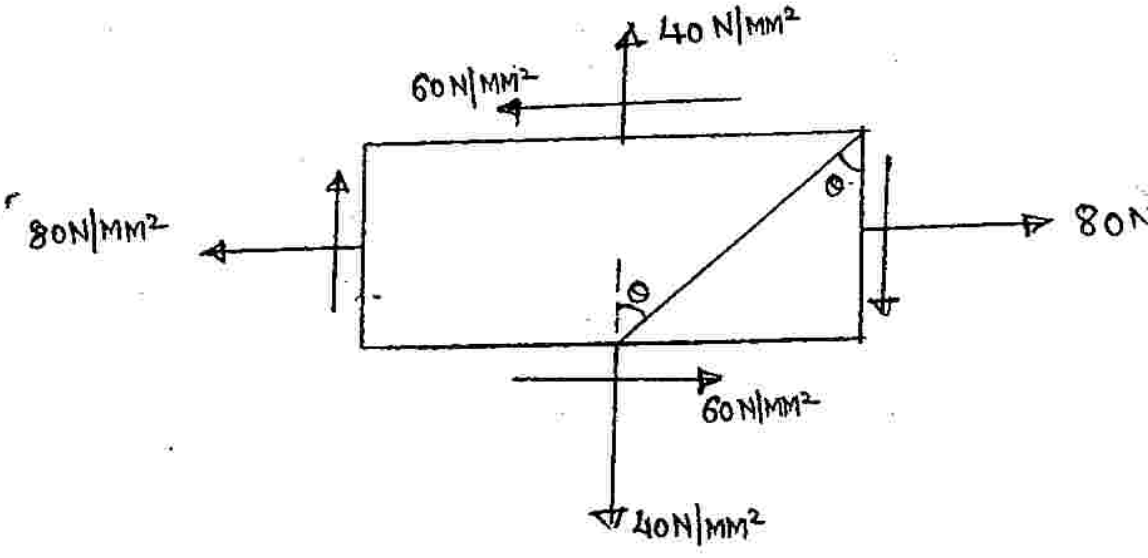


(b) Two Shafts of the same material and of same lengths are subjectd to the same to the first shaft is of a solid circular section and the second shaft is of hollow circular whose internal diameter is $\frac{2}{3}$ of the outside diameter and the maximum shea developed in each shaft is the same, compare the weights of the shafts.

4. (a) The shear force acting on a beam at an I section with unequal flanges is 50 kN as in **figure**. The moment of Inertia of the section about N.A. (Neutral Axis) is 2·84 Calculate the shear stress at the N.A. and also draw the shear stress distributi the depth of the section.

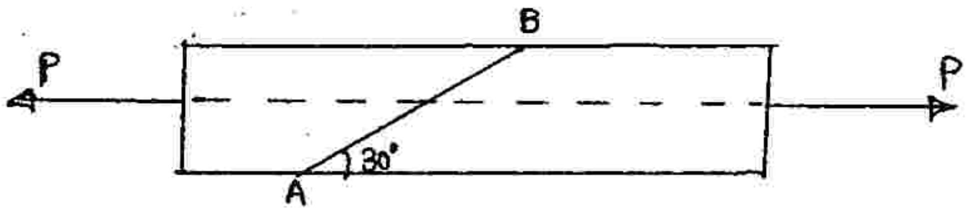


(b) At a point within a body subjected to two mutually perpendicular directions, the s are 80 N/mm² tensile and 40 N/mm² tensile. Each of the above stresses, is accor by a shear stress of 60 N/mm². Determine the normal stress, shear stress and r stress on an oblique plane inclined at an angle of 45° with the axis of minor tensile



(a) A beam 4 metre long, simply supported at its ends, carries a point load W at its centre. If the slope at the ends of the beam is not its exceed 1°, find the deflection at the centre of the beam. **10**

(b) Two wooden pieces 10 cm × 10 cm in cross section are glued together along line AB as shown in **figure** below. What maximum axial Force P can be applied if the allowable shearing stress along AB is 1·2 N/mm². **10**



(a) A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run over the entire span of 5 m. If the value of E for the beam material is 1×10^4 N/mm². Find **10**

(i) The slope at the supports

(ii) Maximum deflection.

(b) Calculate maximum deflection for the beam with constant value of E.I. through out the span for simply supported beam of span 'L' and point load 'P' at mid span. **10**

(a) A cylindrical thin drum 80 cm in diameter and 3 m long has a shell thickness of 1 cm. If the drum is subjected to an internal pressure of 2·5 N/mm². Determine : **10**

(i) Change in diameter

(ii) Change in length

(iii) Change in volume.

(b) A 1·5 m long column has a circular cross section of 5 cm diamter. One of the ends of the column is fixed in direction and position and other end is free. Taking factor of safety as 3. Calculate the safe load using : **10**

(i) Rankine's Formula, take yield stress, f_c = 560 N/mm² and $a = \frac{1}{1600}$ for pinned ends.

(ii) Euler's Formula, Young's modulus for C.I. = $1 \cdot 2 \times 10^5$ N/mm².