S.E. (chemical) (Sem-IV) (Rev.) Dec-2007 (21)

SUB:- Strength of materials.

dHf-I

4878-07. (REVISED COURSE) 10/12/07 CD-5880

(3 Hours) [Total Marks : 100

1) Question No. 1 is **compulsory**.
2) Attempt any **four** out of remaining **six** questions.
3) Assumptions made should be **clearly** stated.
4) Assume any **suitable** data wherever **required** with justification.
5) **Figures** to the **right** indicate **full** marks.
6) Illustrate answers with **sketches** wherever **required**.

a) Define and explain the following :— 6
   (i) Modulus of rigidity
   (ii) Complimentary shear
   (iii) Hooks Law.

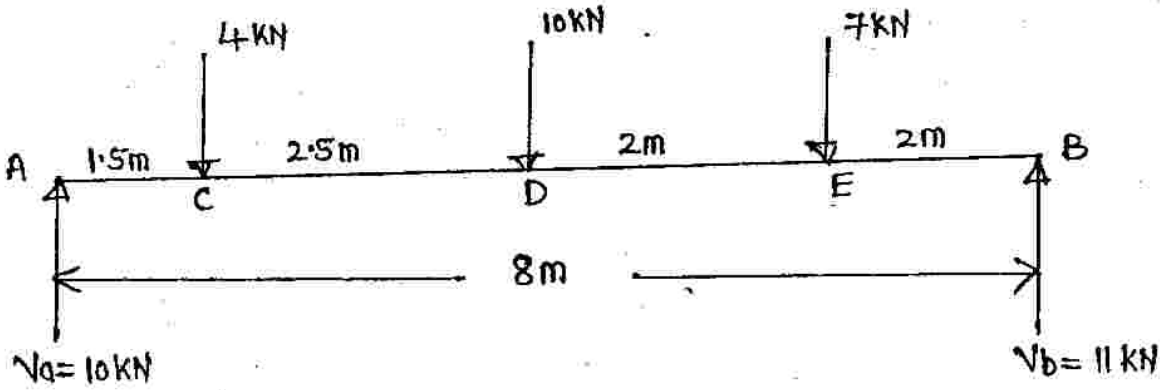
b) Derive the following expressions with usual relations :— 8

   (i) $\sigma = \frac{My}{I}$

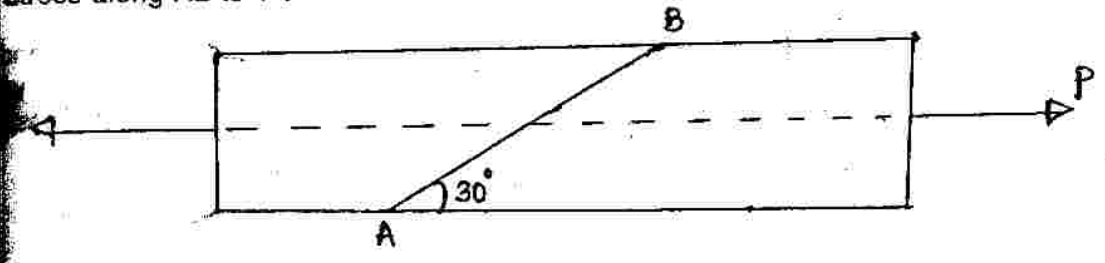
   (ii) $q = \frac{Sa\bar{y}}{Ib}$

c) Derive expression for Euler's critical load for column fixed at one end and free at other end. 6

d) Draw the SFD and BMD for a simply supported beam AB of span 8 metres carrying concentrated loads of 4 kN, 10 kN and 7 kN at distances of 1·5 metres, 4 metres and 6 metres from the left support. 10



e) Two wooden pieces 10 cm × 10 cm in cross section are glued together along line AB as shown in **figure**. What maximum axial force P can be applied if the allowable shearing stress along AB is 1·2 N/mm^2 ? 10

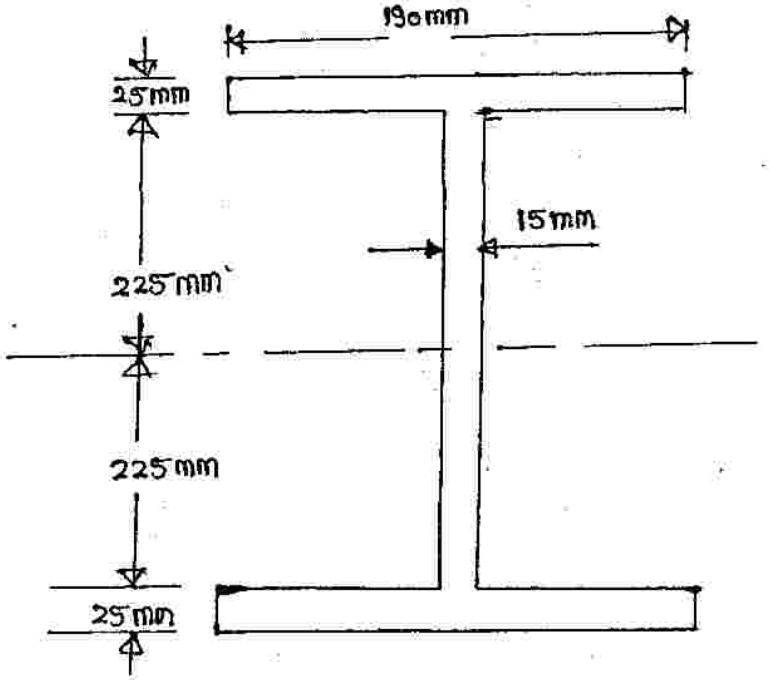


f) and explain in brief :— 20
   (a) Hooks Law
   (b) Point of Contra-flexure
   (c) Section Modulus
   (d) Care as Kernal of the section
   (e) Complimentary shear
   (f) Principal stresses
   (g) Standardness Ratio
   (h) Angle of Obliquity
   (i) Hoop stress
   (j) Torsional rigidity.

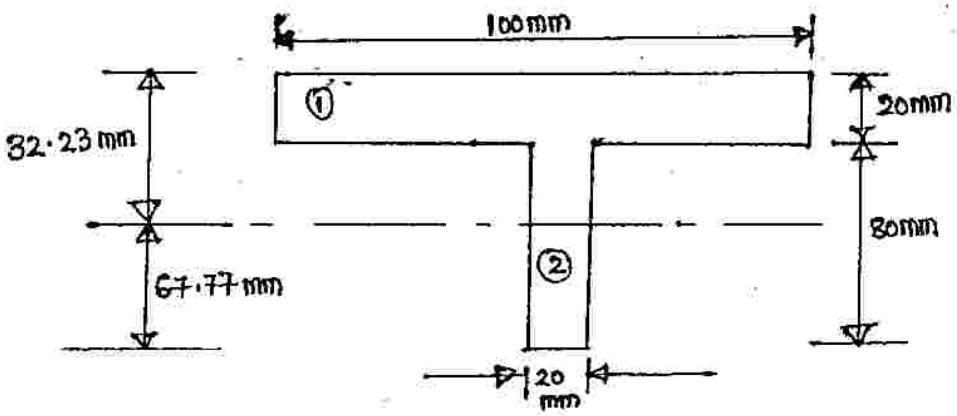
[TURN OVER

4. (a) A pilot plant reactor was charged with 50 kg napthalene and 200 kg (98% by mass) H_2So_4. ... The product distribution was found to be 18·6%.

4. A beam of I section 500 mm deep and 190 mm wide has flanges 25 mm thick and web 15 (a) thick. It carries a shearing force of 400 kN at a section. Calculate the maximum intensi shear stress in the section assuming the moment of inertia to be $6{\cdot}45 \times 10^8$ mm^4. Also calc the total shear force carried by the web and sketch the shear stress distribution across the sec

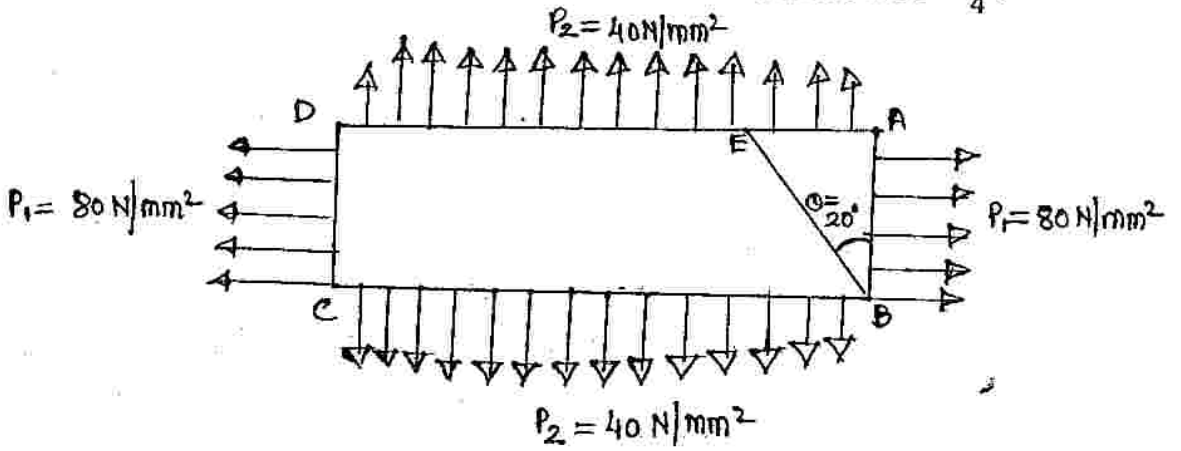


5. (a) A cast iron beam is of T section as shown in **figure.** The beam is simply supported on span of 8 m. The beam carries a uniformly distributed load of 1·5 kN/m length on the enti span. Determine the maximum tensile and maximum compressive stresses.

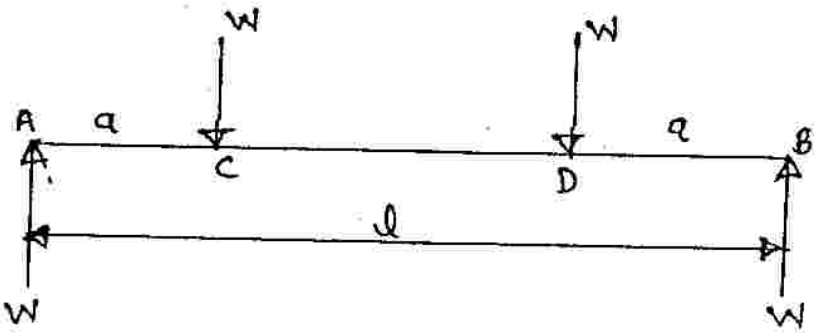


(b) Three beams have the same length, same allowable bending stress and the same bendi moment. The cross section of the beams are a square, rectangle with depth twice the wi and a circle. Find the ratios of weights of the circular and the rectangular beams with respe to square beams.

6. (a) The principal tensile stresses at a point across two perpendicular planes are 80 N/mm^2 and 40 N/mm^2. Find the normal and tangential stresses and the resultant stress and its obliquity on a plane at 20° with the major principal plane. Find also the intensity of stress which acting alone can produce the same maximum strain. Take Poisson's ratio = $\frac{1}{4}$. **10**



(b) A beam of length l is simply supported at the ends and carries a concentrated load W at a distant a from each end. Find the deflection under each load and the deflection at the centre. **10**



(a) A 1·5 m long column has a circular cross section of 50 mm diameter. One end of the column is fixed in direction and position and the other end is free. Taking a factor of safety of 3, calculate the safe load using :— **10**

(i) Rankine's formula : Take f_c = 560 N/mm^2

$$\alpha = \frac{1}{1600} \text{ for pinned ends}$$

(ii) Euler's formula : Young's modulus for cast iron = 1·2 × 10^5 N/mm^2.

(b) Differentiate between thin and thick cylinderical shell. **2**

(c) A cylindrical thin drum 800 mm in diameter and 3 metres long has a shell thickness of 10 mm. If the drum is subjected to an internal pressure of 2·5 N/mm^2. Determine — **8**

(i) the change in diameter

(ii) change in length

(iii) change in volume.

Take E = 2 × 10^5 N/mm^2. Poisson's Ratio = $\frac{1}{4}$.