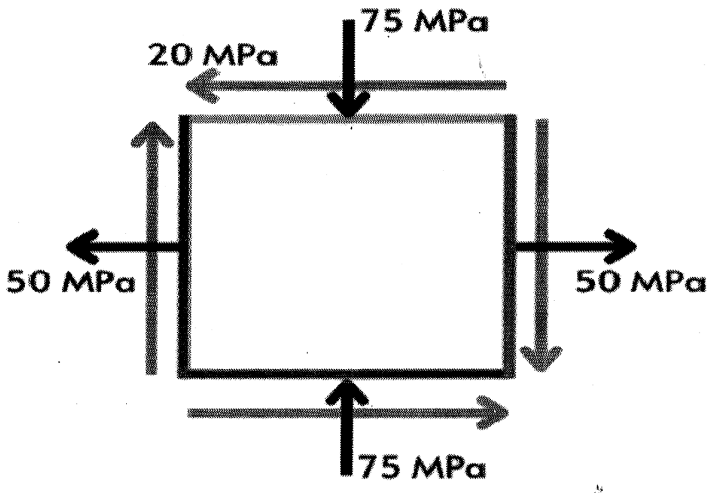
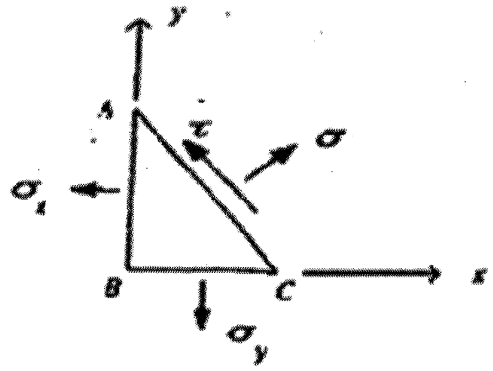
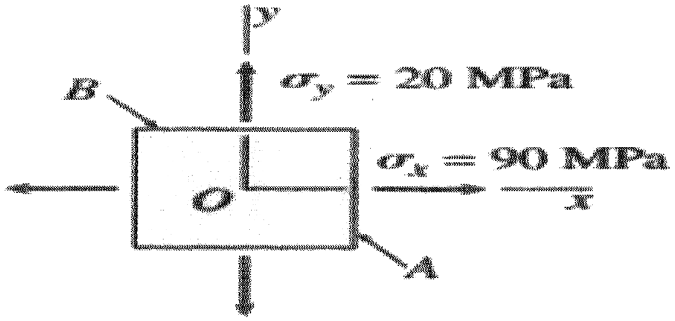
Bachelor of Architecture
Second Year First Semester -2024
Subject: Theory of Structures-I

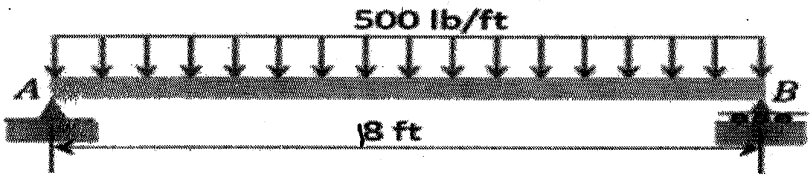
Time: Three hours | Answer any **five** questions | Full Marks: 100

No. of Qs		Marks
	1) Illustrate your answers with neat sketches wherever necessary. 2) All notations represent their standard relevant meaning. 3) Assume suitable data, if necessary.	
1 a)	Find the stresses acting on the principal planes for the below stress condition.  	4
b)	In a two dimensional stress analysis, the state of stress at a point is shown If σ= 120 MPa and τ = 70 MPa, then σ_x and σ_y are respectively AB = 4 BC = 3 AC = 5  	6

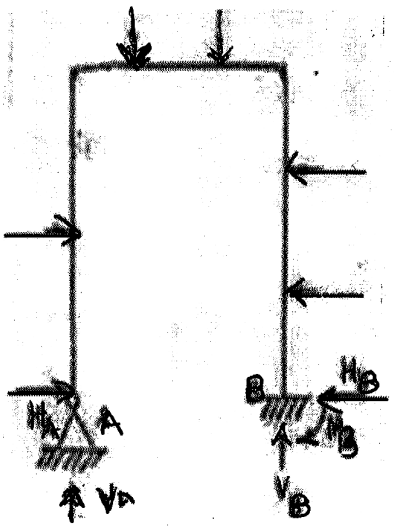
c)	Using Mohr's circle, determine the stresses acting on an element inclined at an angle $\theta=35°$	10



2a)	Define slope and deflection of a beam.	4
b)	A simply supported beam with a length of 18 ft will carry a distributed floor load of 500 lb/ft over its entire length, as shown Figure. Using the moment area theorem, determine the slope at end B and the maximum deflection.	10

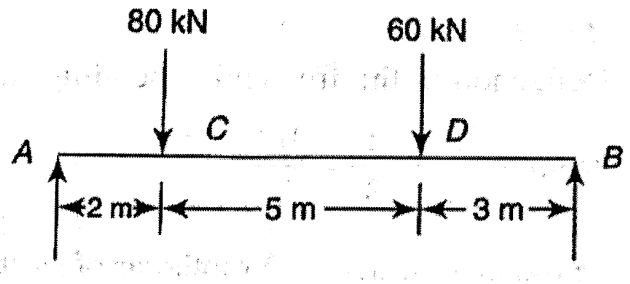


c)	Differentiate between statically determinate and statically indeterminate structures	4
d)	State the degree of redundancy of the portal frame:	2



3a) State the theorems of Conjugate beam method — 4

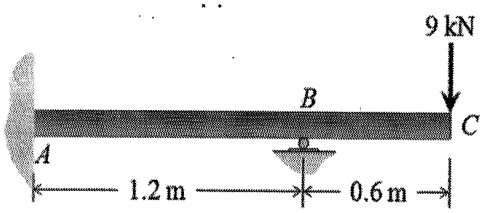
b) A 10m long simply supported beam AB carries loads of 80 KN and 60 KN at 2m and 7m respectively from A. E= 200 Gpa and I= 150 x 10^6 mm^4. Determine the deflection and slope under the loads using conjugate beam method. — 12



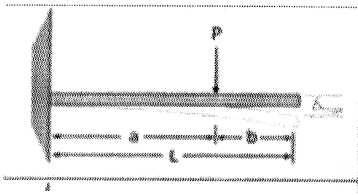
c) Define "Eccentric load" with neat sketch. — 4

4a) State the assumptions made while analysing deflection and slope of a beam using Principle of Super position. — 4

b) For the following overhanging beam with a fixed end, determine the support reactions at fixed end A and roller support B — 12



[provided: Maximum deflection for a cantilever beam as shown :



$$\delta_{max} = \frac{Pa^2(3L-a)}{6EI}$$

]

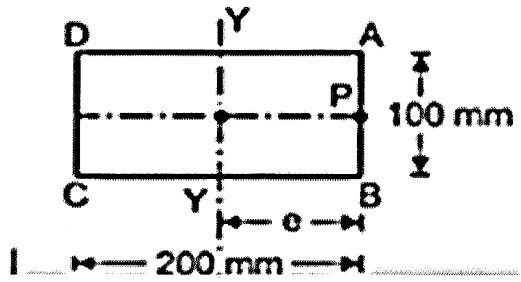
c) What is meant by effective length of a column? Give the relationship between the effective length and actual length of the column for various end conditions. — 4

Mention the assumptions made in Euler's Column Theory

5a) A mild steel tube 4 metres long, 3 cm. internal diameter and 4 mm. thick is used as a strut with both ends hinged. Find the collapsing load. — 6

b) Take E=2. 1x 10 kg. /cm^2 — 6

c) A rectangular column is 200 mm wide and 100 mm thick. It carries a load of 180 KN at an eccentricity of 100 mm in the plane bisecting the thickness. Find the maximum and minimum intensities of stress in the section. **8**



6a) A built up steel column, 8 m long and ends firmly fixed is having cross-section as shown The properties of I-section are Area = 9300 mm^2, $I_{xx} = 3 \times 10^6$ min^4, $I_{yy} = 8.4 \times 10^6$ mm^4. Determine:

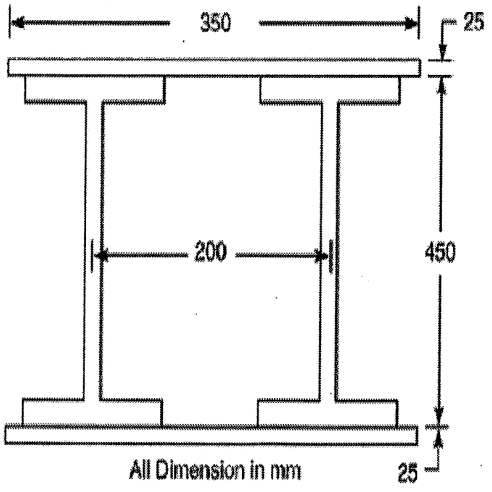
(*i*) The safe axial load the column can carry with a factor of safety of 3.5 using

(*a*) Euler's Formula, (*b*) Rankine's Formula.

(*ii*) The length of the column for which both formulae give the same crippling load.

(*iii*) The length of the column for which the Euler's formula ceases to apply.

Take $E = 2 \times 10^5$ N/mm^2, $f_c = 330$ N/mm^2, $a = 1/7500$ **14**



b) Determine the minimum eccentricity to be considered for an axially loaded RCC column of size 400 x 400 mm with unsupported length of 5m . **6**