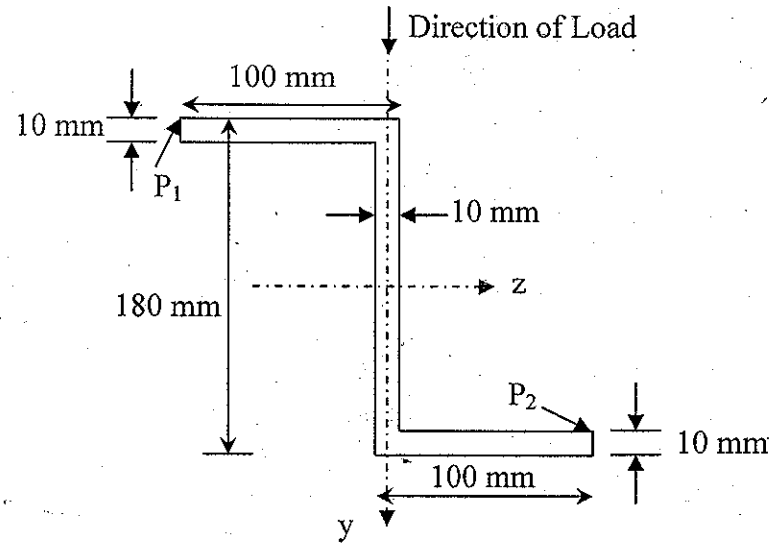
... *Bachelor of Engineering (Civil Engineering) 2nd Year 2nd Semester*... EXAMINATION, *2019*

SUBJECT .....*Theory of Structures - I*.....

Full Marks 100
(~~50 marks for each part~~)

Time: **Three hours**

~~**Use a separate Answer-Script for each part**~~

No. of Questions	~~**PART-I/II**~~	Marks
	Answer ANY FOUR questions	
1.	a) Derive the expression to find the deflection at any location along the span and the expression of bending stress at any point on the cross-section of a beam subjected to unsymmetrical bending. b) State 'theorem of three moments' and prove it.	[15+10 = 25]
2.	A **simply supported beam** of span of **2.5m** is subjected to uniformly distributed load of intensity **1.2N/m** acting vertically downward along the centroidal plane of the beam. The **Z-shaped cross-section** of the beam (shown in fig Q2) has the following dimensions: width = 100mm., depth = 180mm., thickness of flange and web = 10mm. Calculate i) the angle of inclination of principal axes and principal moments of inertia ii) the net vertical and horizontal deflections of the beam at mid-span if E = $2x10^5$ N/mm^2 and iii) the stress developed at points P_1 and P_2 (shown in Fig.Q2) of the cross-section at mid-span.  **Fig. Q2**	[25]

(Contd. to page 2)

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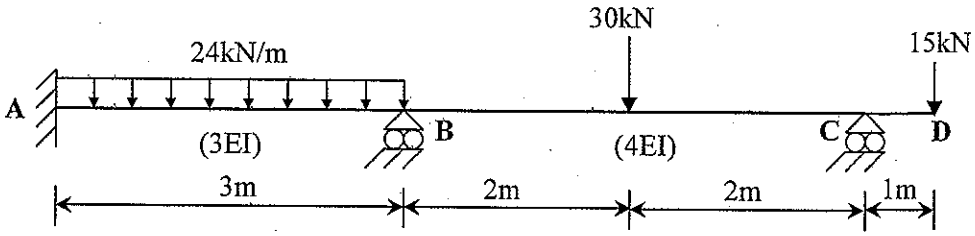
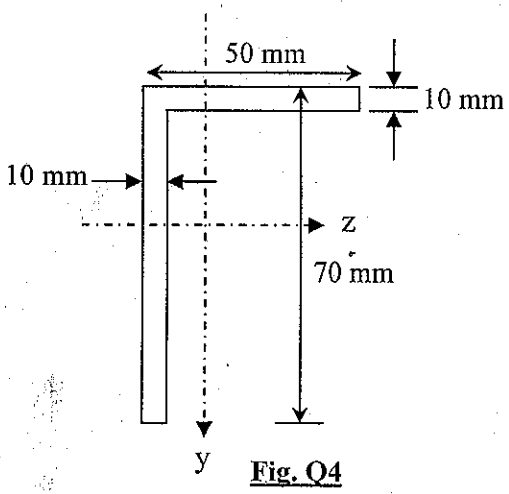
No. of Questions	~~**PART I/II**~~	Marks
	(*Contd. from page 1*)	
3.	Analyse the continuous beam ABCD as shown in Fig.Q3 by using '**Three Moment Theorem**' and calculate the support reactions. Also draw the bending moment diagram and shear force diagram for this beam. Moment of inertia: $I_{AB} = 3I$, $I_{BC} = I_{CD} = 4I$.  **Fig.Q3**	[25]
4.	a) Write the differences between short column and slender column. b) Derive the 'kern area' or 'core area' of a circular cross section [radius 'r'] of a short column. c) Derive Euler's buckling load for a slender column having both ends hinged. d) Calculate the failure load of a column of length 2.5m and having 'L-shaped cross-section' as shown in Fig.Q4 if both ends are fixed. Consider $E=2\times10^5$ N/mm^2 and $f_y = 250$N/mm^2.  **Fig. Q4**	[2+5+ 10+8 = 25]

(*Contd. to page 3*)

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No. of Questions	~~PART I/II~~	Marks
	(*Contd. from page 2*)	
5.	a) A steel tube, initially straight and hinged at both the end, has an external diameter of 50mm and internal diameter of 40mm. It is 2.5m long and carries a compressive load of 30kN acting parallel to the axis of the tube with an eccentricity of 5mm. Calculate maximum stresses developed in the tube. Given, $E=2.1\times10^5$ N/mm^2. b) Draw the influence line diagram for the members AB, BC, CD of the truss as shown in Fig.Q5.1 if a unit load passes the truss from one end to the other end.	[5+10 +10 = 25]

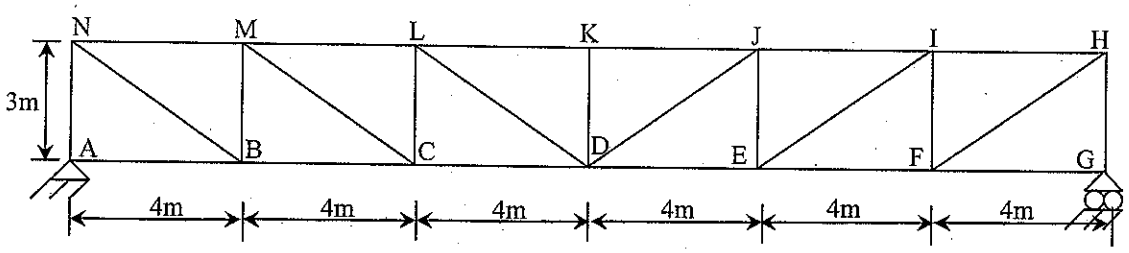

Fig. Q5.1

c) Draw the influence line diagram for the bending moment at point C of the beam of span 25m as shown in Fig. Q5.2. Calculate the maximum bending moment at point C of the beam due to the movement of the uniformly distributed load of intensity 15kN/m of length 5m.

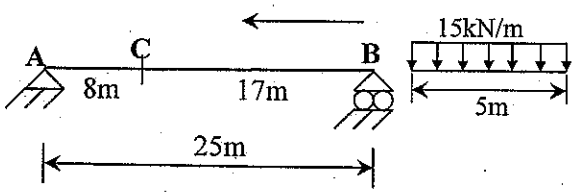

Fig.Q5.2

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