EL-MANSOURA UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENG.DEPT.

MASTER DEGREE EXAM.

23/9/2013
Maximum Credit 100 Points

THEORY OF ELASTIC STABILITY
TIME ALLOWED: 3 HOURS.

Question 1: 30(4+4+6+6+10) points

1-Write about :
Limit state design, types of bifurcation, limit load instability. and methods of analysis.

2. Mention shortly two methods for computing the first elastic critical loads and factors influencing frame stability.
3. Rearrange the portal frames shown in Figs(1) starting with the frame having the lowest critical loads, confirming your answers.
4. For a perfectly straight member shown in Fig.(2), find the stability functions S and C.
5. Find the expressions formulae to compute the deflection and moment for both beam columns shown in Figs.(3). Then, compute the maximum moments and deflections in both: case I(P = 200t , Q = 20 t , w = 3 t/m'), and case II(P=0. Q = 4 t, w = 3t/m') .

Question 2: 55(10+15+10+20) points

1-Confirm that the critical loads in both frames shown in Fig.(4) are equals .

2- For both portal frames shown in Fig.(5), sketch the various possible buckling modes. Find the determinate conditions for symmetrical modes of buckling . If both frames have one story only , give your comment.

3- For the portal frame shown in Fig.(6), prove that the prevented sway critical load occurs when (S+2)(S+4)(S+6)=0.

4. For the portal frame shown in Fig.(7) , and using the differential equations in case of sway prevented and sway permitted, show that, cosidering: Lb = Lc= L
$9.87\ EI/L^2 < P < 20.1\ EI/L^2$ (sway prevented), and $0.0 < P < 2.47\ EI/L^2$ (sway permitted)

Question 3: 25(10+15) points

1 For the frame shown in Fig.(8) compute the load P taking the buckling into consideratio if the section of column bd is B.F.I.B. 28 with given properties. If the section of the column bd is turned 90 degree recalculate the load P, giving your comment.

2. For both members ABC and EBD in column panel (Fig.9) and Cantilever column (Fig.10) compute the critical load using the differential equations.

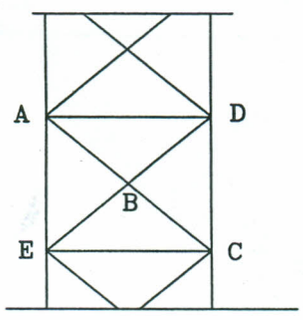


Fig.(9)

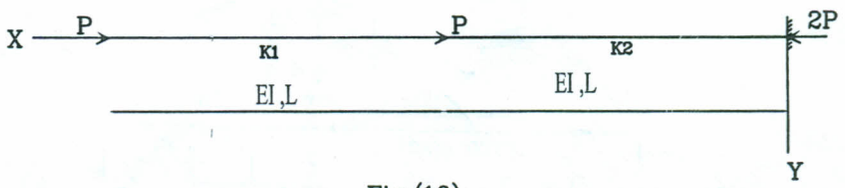


Fig.(10)

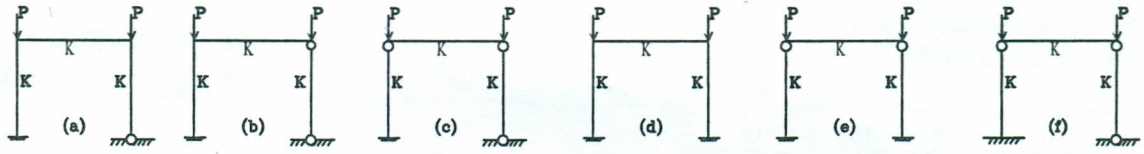


Fig.(1)

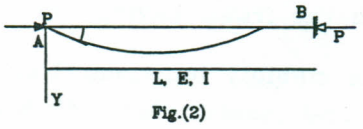
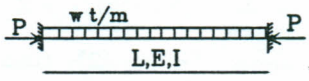


Fig.(2)



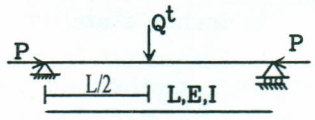
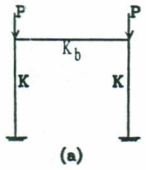


Fig.(3)



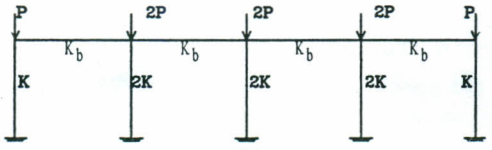


Fig.(4)

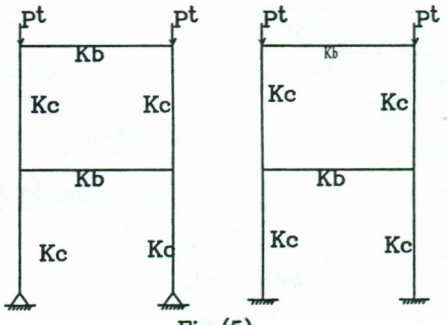


Fig.(5)

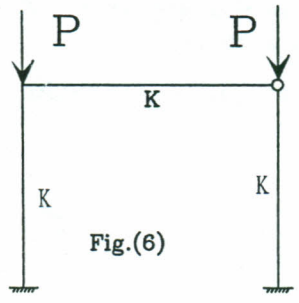


Fig.(6)

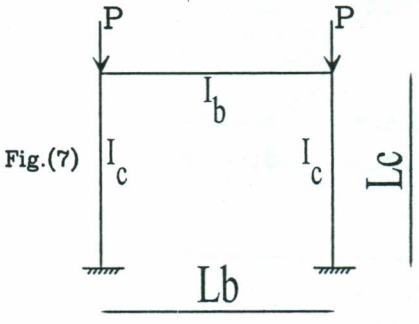


Fig.(7)

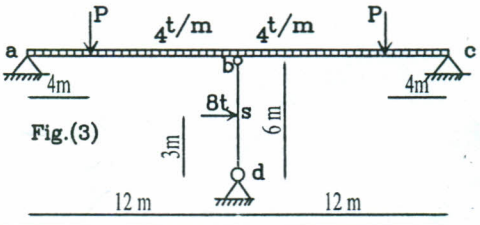
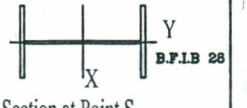


Fig.(3)

Fig.(8)

I_x = 20720 cm2
I_y = 7320 cm2
A = 144 cm2



Section at Point S

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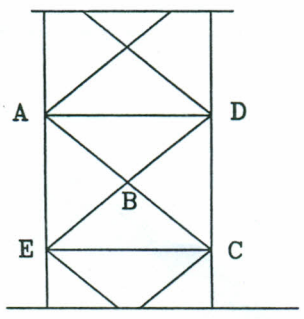

Fig.(9)

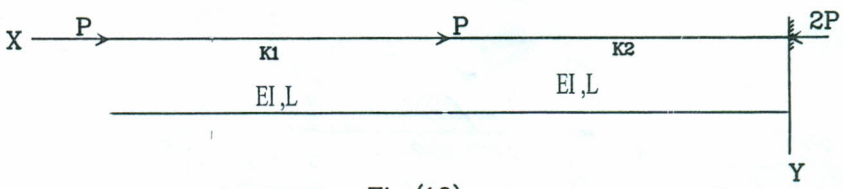

Fig.(10)