Menoufia University Faculty of Engineering Shebin El-Kom Academic Year: 2017-2018	Department: Civil Eng. Year: Level 500 Subject:Nonlinear analysis of Frame Structures Structure Time Allowed: 3 hours Date: 30/5/2018

Allowed Tables and Charts: *(None or e.g. Steam Tables)*

<u>**Answer all the following Questions**</u>

Q (1) [20]

a) Explain the different types of the nonlinearities

b) Define the plastic hinge

c) Explain the difference between

- The mechanical hinge and the plastic hinge

- The elastic and plastic material

- Working bending moment, yielding bending moment and plastic bending moment.

d) Find the equations of buckling loads for the given compression member in Fig. 1.

Q2[20]

Find the determinatal equation of prevented of sway buckling load for the two bays frame shown in Fig. 2.

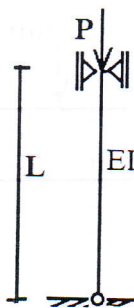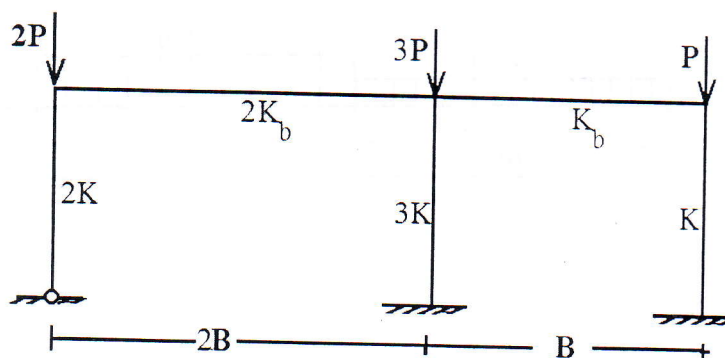Fig. 1   Fig. 2

Q3[20]

For the three stories frame from family B shown in Fig. 3, find the determinatal equation of prevented of sway buckling load (symatric).

Q4[20]

For the two stories frame shown in Fig. 4, find the determinatal equation of prevented of sway buckling load.

Fig. 3   Fig. 4

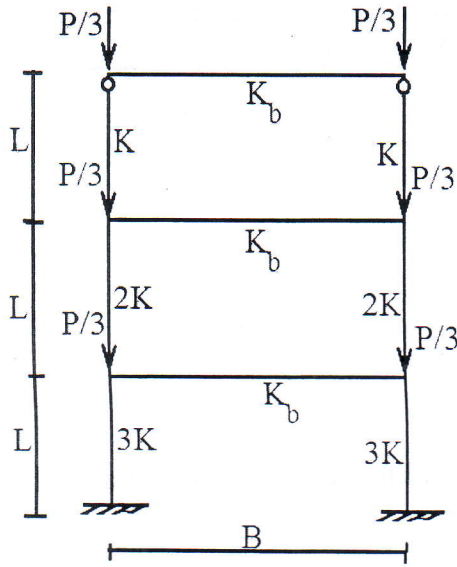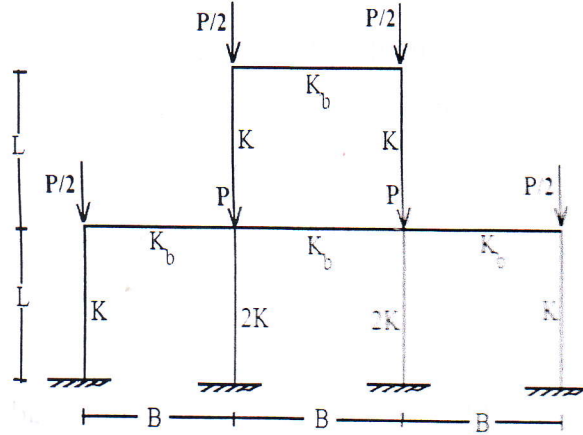## Q5 [20]

Find the plastic moment for the beam presented in Fig. 5 using the equilibrium method and virtual work methad.
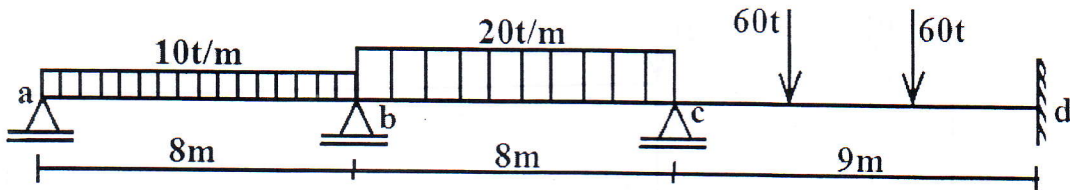

Fig. 5