Question No. 1: (10 Marks)

Classify each of the following structures shown in Fig. 1 as stable or unstable then mention the number of static and kinematic indeterminacy.
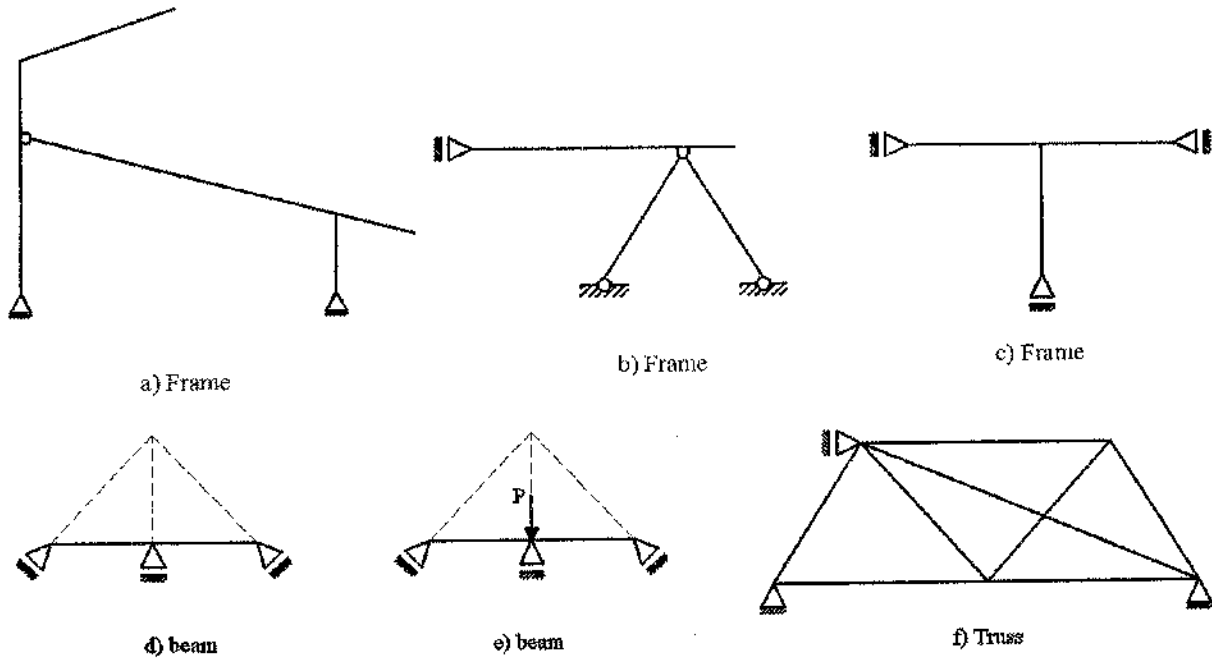

a) Frame

b) Frame

c) Frame

d) beam

e) beam

f) Truss

Fig. 1

Question No. 2: (10 Marks)

Draw N.F.D and S.F.D for the bar elements shown in Fig. 2 using the stiffness method. E= 1.5×10^6 Kg / cm^2, A_1=6 cm^2, and A_2=3 cm^2.

Question No. 3: (15 Marks)

Using the stiffness matrix method make a complete analysis for the truss shown in Fig. 3. $A = 90\ cm^2$ $E = 2100\ t/cm^2$.

60 kg
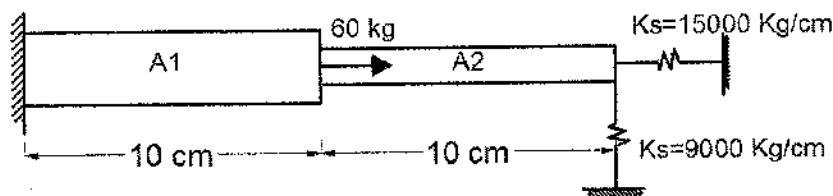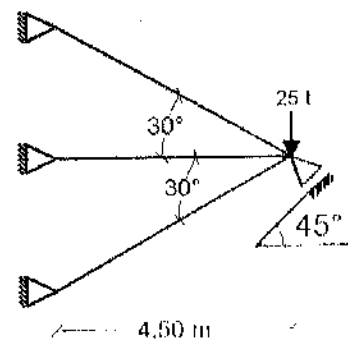
A1

A2

Ks=15000 Kg/cm

Ks=9000 Kg/cm

10 cm

10 cm

Fig. 2

25 t

30°

30°

45°

4.50 m

Fig. 3

Question No. 4: (25 Marks)

A. Using the stiffness matrix method, draw shear force and bending moment diagrams for the beam shown in Fig. 4.
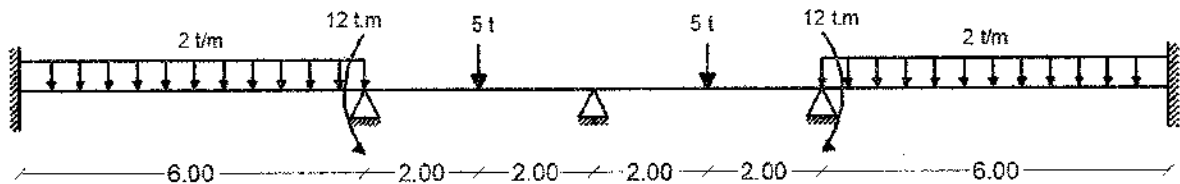

Fig. 4

B. Using the stiffness matrix method, find the force in the link member and draw the shear force diagram and bending moment diagram for the beam shown in Fig. 5. For the beam consider $E = 1900\ t/cm^2$ and $I = 24000\ cm^4$ while for the link member consider $A = 6\ cm^2$.

Fig. 5

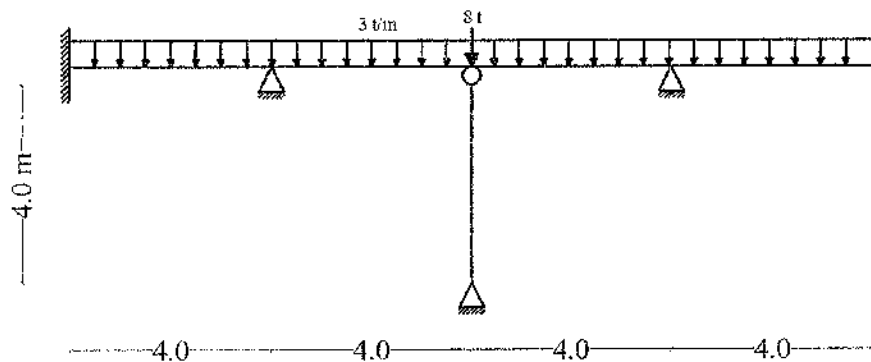## Question No. 5:   (10 Marks)

Using the stiffness matrix method, draw the normal force diagram, shear force diagram and bending moment diagram for the frame shown in Fig. 6. $EI = 300\ t.m^2$ $EA = 900\ t$

Fig. 6

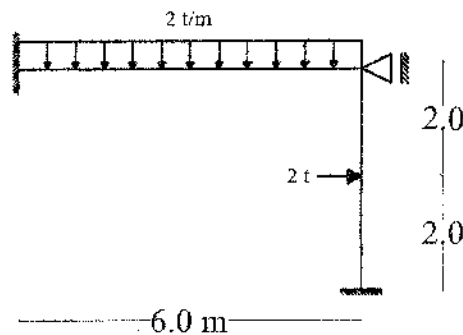## Question No. 6:   (5 Marks)

Provide with neat sketches the steps followed to analyze concrete/steel structures using the finite element analysis software ABAQUS.

Good Luck

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