ELMANSOURA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING
ANALYSIS OF STRUCTURE BY COMPUTER
THIRD YEAR CIVIL

DATE: 9/1/2013
TIME ALLOWED : 3 HOURS
FULL MARK = 90 POINTS
ACADEMIC NUMBER :8314
PROF.DR. MOHAMED NAGUIB ABOU EL SAAD

Any data missing may be assumed

MAXIMUM CREDIT = 90 POINTS

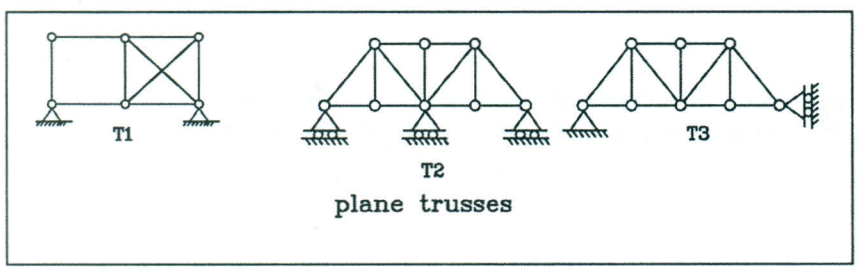
Question 1: 20 Points.

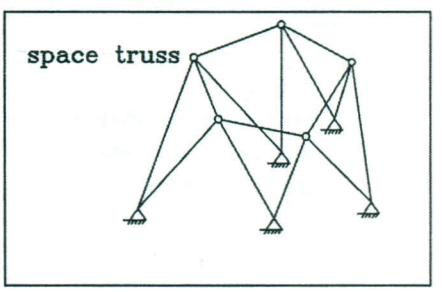
1)Distinguish between plane frame and grid structures. 2 Pts.

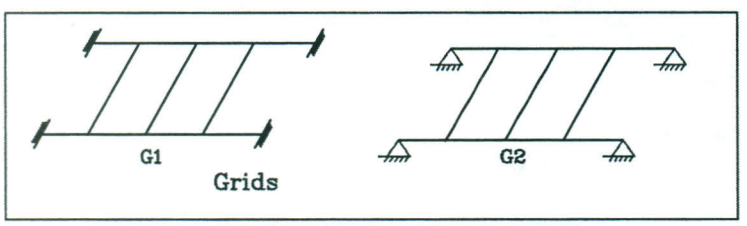
2)Write shortly about:

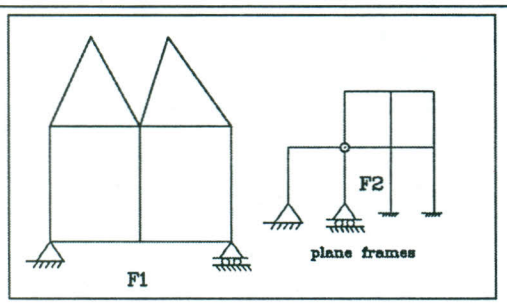
a)The relation between stiffness matrix and flexibility matrix. 1 Pts.

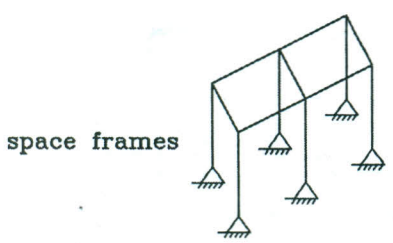
3–Classify each structure shown in Figs.(1) as stable, unstable , determinate and/or indeterminate structure. Then , transfer the unstable structure to stable and also, the indeterminate to deteminate. Finally, mention the number of degrees of freedoms for all types. 9 Pts.











Figs.(1)

Question 2: (10+10)Points.

The FORTRAN program used in the analysis of beams with source name TH2012.FOR consists of main program and eight subroutines using the stiffness method.
The following subroutine beam is used for input data:

```
SUBROUTINE BEAM
COMMON/C1/----
READ(30,*)NM,NJ,ND,NLM,NLJ,IWRT,NT,NSPRING,IDATA,IBOND,EA
READ(30,*)(MN(I),J(I),K(I),QIX(I),I=1,NM)
READ(30,*)(XCOR(I),I=1,NJ)
READ(30,*)(ID(I),I=1,NT)
IF(NSPRING.NE.0)READ(30,*)(QSP(I),I=1,ND)
IF(IBOND.EQ.1)READ(30,*)(QBP(I),I=1,NT)
IF(NLM.GT.0)READ(30,*)(I,P(I,J1),J1=1,MM),L=1,NLM)
IF(NLJ.GT.0)READ(30,*)(I,PL(I,J1),J1=1,NN),L=1,NLJ)
RETURN
END
```

REQUIRED:

i) Write step by step analysis and name of subroutines and their jobs and write subroutine LOAD.

ii) For the beam shown in Fig.(2), write data file and give the dimension of matrices [K11], [K12], [K21], and [K22].

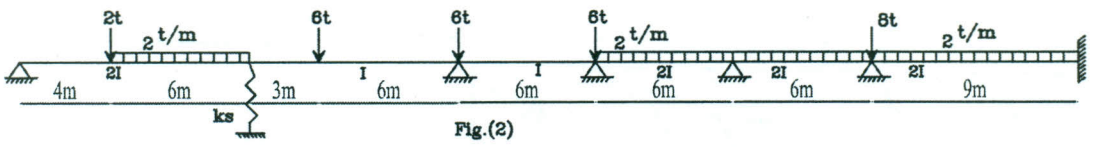


Fig.(2)

E = 2000 t/cm2 , I = 0.0001 m4 , and ks = 2000 t/m

Question 3: 20 Points.

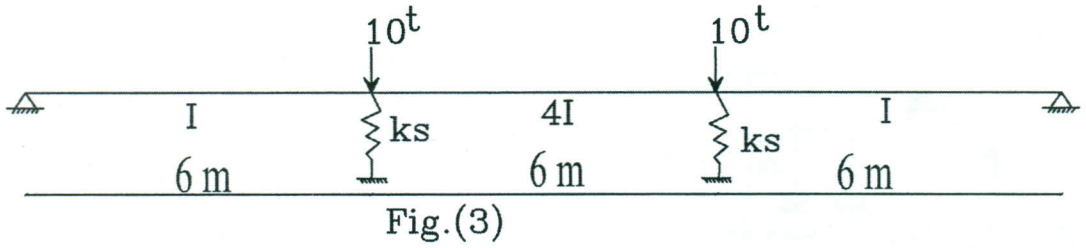


Fig.(3)

E = 2000 t/cm2 , I = 0.001 m4 , and ks = 5000 t/m

For the beam shown in Fig.(3), give a complete analysis using stiffness method.

Question 4: 20 Points.

The stiffness matrix for truss element in global is given as :

$$[K] = EA/L \begin{bmatrix} c_x^2 & cc_{xy} & -c_x^2 & -cc_{xy} \\ cc_{xy} & c_y^2 & -cc_{xy} & -c_y^2 \\ -c_x^2 & -cc_{xy} & c_x^2 & cc_{xy} \\ -cc_{xy} & -c_y^2 & cc_{xy} & c_y^2 \end{bmatrix}$$