Benha University
Civil Engineering Department
January 2009

Faculty of Engineering (Shoubra)
Fourth Year Civil – Public Works Div.
January Examination

ELECTIVE COURSE - COMPUTER APPLICATIONS

Time all. = 3.00 Hrs **Total Marks = 70**

Systematic arrangement of calculations and clear neat drawings are essential. Any data not given can be reasonably assumed according to the Egyptian Code of Practice.

Question (1): (10%)

(a) Use clear sketch to show the use of end-offset and state its importance.

(b) How the frame element can be used to analyze the trusses in **SAP2000** program.

(c) Consider that the following types of problems are needed to model using **SAP2000** program:

(1) **Plane Frame** (2) **2D-Truss** (in one plane) (3) **Raft** on springs

For each of the above cases explain (using sketches when appropriate) the following:

- Default plane (or planes) of work and available degrees of freedom.
- Types of elements involved.
- Data blocks or items that have to be defined to complete the analysis.

Question (2) : (25%)

It is required for the overhanging steel beam (**defgh**) which supported on three steel link members (**A, B** & **C**) as shown in Figure (1):

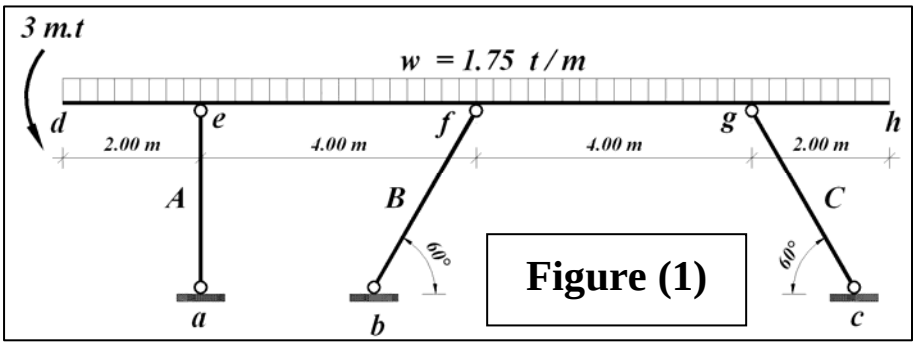

Figure (1)

(1) Write the steps to explaining how to complete the modelling of the structure using **SAP2000** program.

(2) Calculate the forces in the three link members **A, B** and **C**.

(3) If the allowable stress for the steel link members is ($\sigma_{all.} = 0.60\ t/cm^2$) and the cross-section is **IPE-160** ($Area_{sec.} = 20.10\ cm^2$). Check the safety of the three steel links members.

Question (3) : (25%)

It is required for the structure shown in Figure (2):

(a) Write the steps to explaining how to complete the modelling of the structure using **SAP2000** program.

(b) Draw the Bending Moment, Shear Force and Normal Force diagrams.

(c) Investigate the cross-section (**I - I**) is able to carry the external bending moment.

Note: The materials properties are, f_{cu} = 25 N/mm^2, f_y = 360 N/mm^2, f_y (stirrup) = 240 N/mm^2.

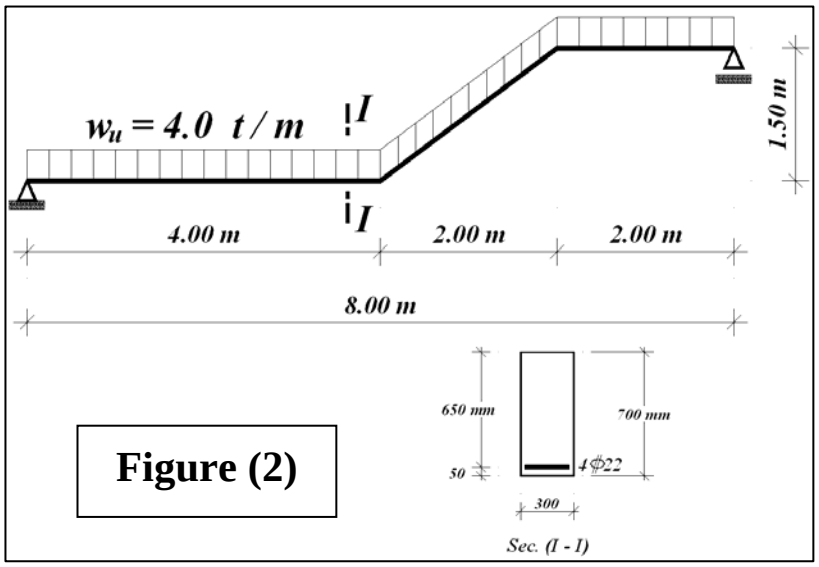

Figure (2)

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Question (3): (40%)

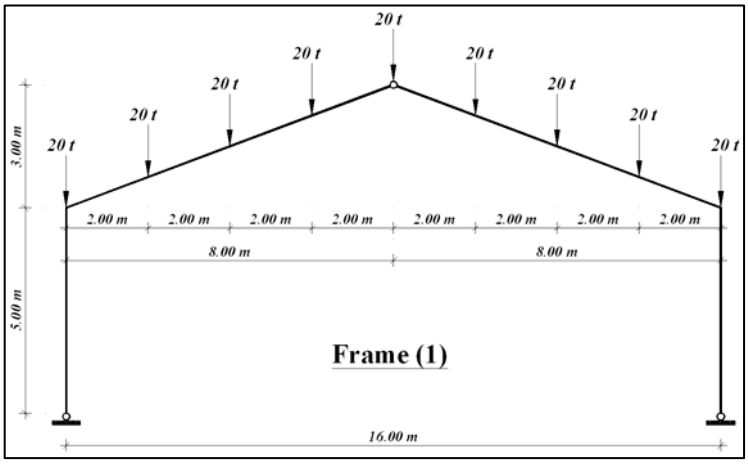
Figure (3) shows a vertical cross section in one of a series of three hinged frames spaced at 6.0m and supporting a roof covering an area ($16.0m \times 42.0m$) of a factory. There are three hinged frames suggested to be used.

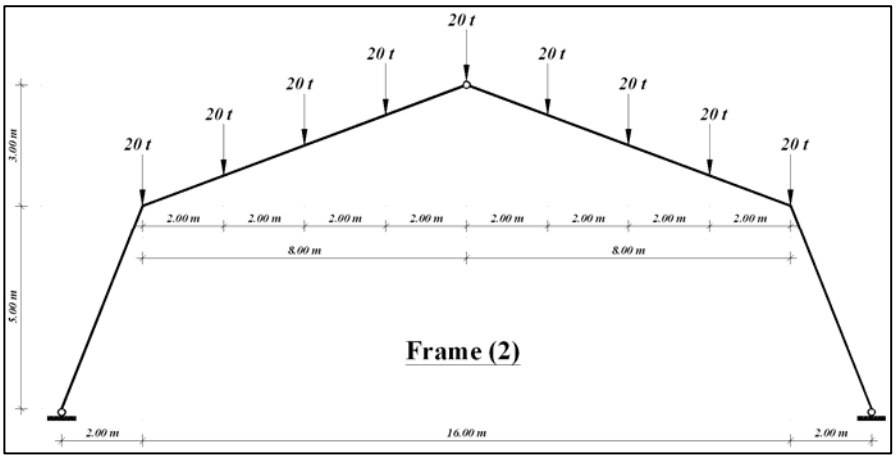
It is required for the shown frames in Figure (3):

(1) Write the main steps to complete the modelling for one frame only using **SAP2000** program.

(2) Draw the Bending Moment, Shear Force and Normal Force diagrams for the three hinged frames.

(3) Choose a suitable frame to be used to cover the factory area. Explain the reasons for choice of the suitable frame based on the above calculations and show the differences between all frames.





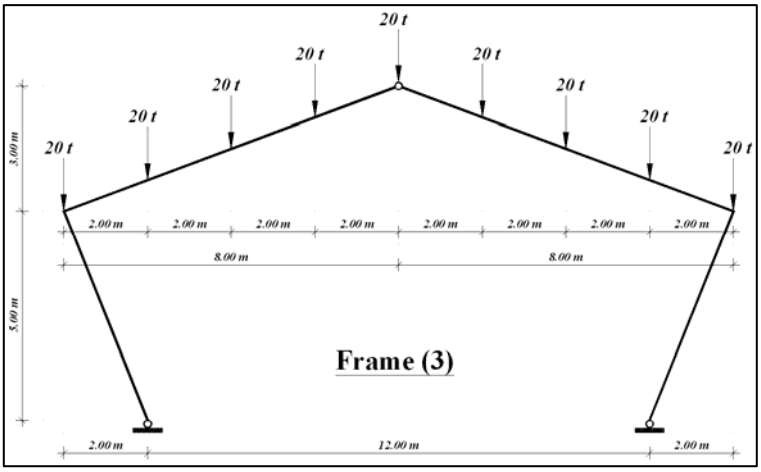


Figure (3)