Question IV (10 Marks)

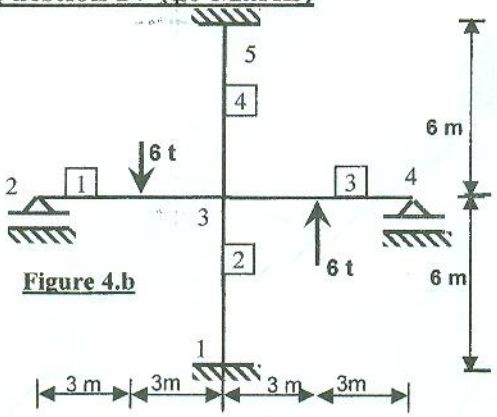


Figure 4.b

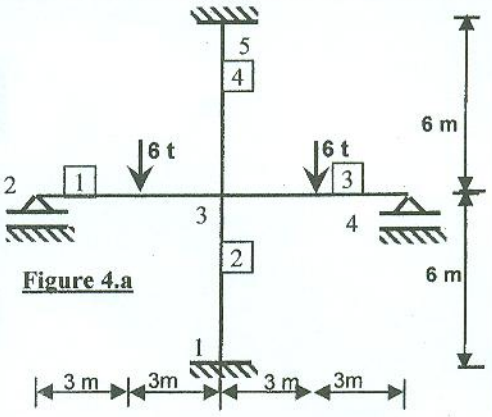


Figure 4.a

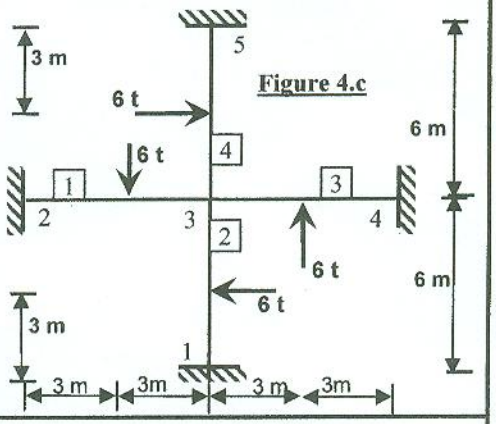


Figure 4.c

Figure 4 shows three frames are subjected to concentrated loads (EI = 3000 t.m^2 and EA = 8000 t for all members).

It is required to:

1. Use symmetry and anti-symmetry to simplify the shown frames in figures 4.a, 4.b and 4.c.
2. Using the stiffness matrix method, draw the bending moment diagrams of the frames shown in Figures 4.a and 4.c.

Question V (6 Marks)

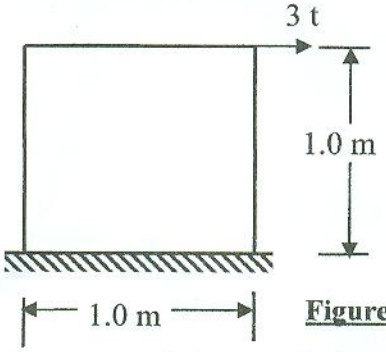


Figure 5.a

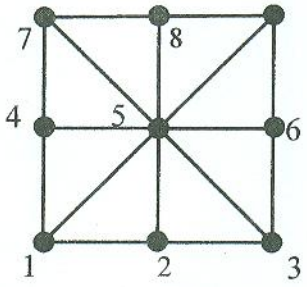


Figure 5.b

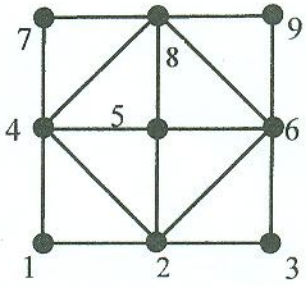


Figure 5.c

Fig. 5a shows a 1×1 m steel plate with a thickness of 10cm. The plate is fixed against a rigid floor. The plate needs to be analyzed to calculate deformations and stresses using the 2D finite element mesh shown in Fig. 5b or in Fig. 5c. The mesh consists of 8 elements

It is required to:

a. Mention the type of analysis required for obtaining the required results (plane stress or plane strain)? Explain your answer.

b. Sketch the mesh shown in Fig. 5b showing the appropriate boundary conditions at all nodes.

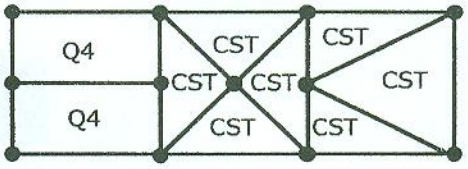
c. Explain which mesh in Fig. 5b or Fig. 5c gives more accurate results.

d. If the 2D-wall shown in Figure 5.a is modeled three times using the same number of square plane elements but with variable element dimensions L*9L, 3L*3L, and 2L*4.5L. What is the most accurate case? Why?

Question VI (2 Marks)

Identify two problems with the mesh shown in Figure 6. Explain your answer in detail.

Figure 6



Hit:

Q4 is a four nodes square 2D element
CST is a three nodes triangle 2D element

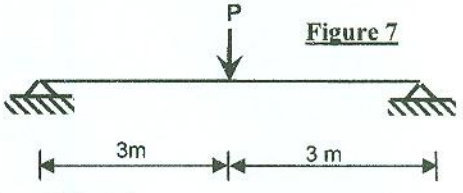
Question VII(4 Marks)

a. Transformation is not necessary in beams; right or wrong and why?

b. For the shown beam in Figure 7, suggest the type of analysis and the type of element to find out the maximum stresses and strains if the beam cross section (B*D) is:

i. 25*60 cm. ii. 40* 300 cm iii. 300*300cm

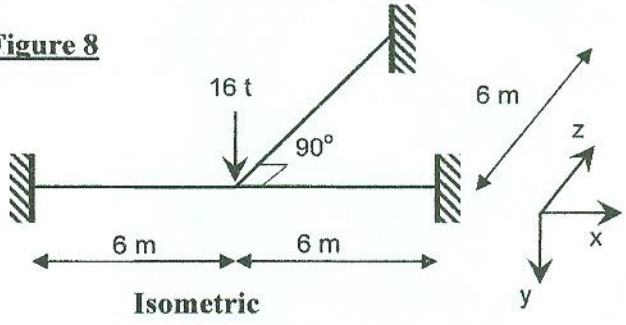
Figure 7



Question VIII (10 Marks)

For the grid shown in figure 8, it is required to draw the distribution of torsion and bending moments. ***EI = 3000 t.m^2 and GJ = 450 t.m^2 for all members.***

Figure 8



Isometric

The Global Stiffness Matrix for a Grid Element

$$K = \begin{bmatrix} a_1 & a_2 & a_3 & a_4 & -a_5 & -a_3 \\ & a_6 & -a_7 & -a_5 & a_8 & a_7 \\ & & a_9 & a_3 & -a_7 & a_9 \\ & & & a_1 & a_2 & -a_3 \\ & & & & a_6 & -a_7 \\ & & & & & a_9 \end{bmatrix}$$

where

$$a_1 = (GJ/L)\,c^2 + (4EI/L)\,s^2$$
$$a_2 = (GJ/L - 4EI/L)\,cs$$
$$a_3 = (6EI/L^2)\,s$$
$$a_4 = (-GJ/L)\,c^2 + (2EI/L)\,s^2$$
$$a_5 = (GJ/L + 2EI/L)\,cs$$
$$a_6 = (GJ/L)\,s^2 - (4EI/L)\,c^2$$
$$a_{7=} (6EI/L^2)\,c$$
$$a_{8=} (-GJ/L)\,s^2 + (2EI/L)\,c^2$$
$$a_9 = 12EI/L^3$$

$c = \cos\theta$ *and* $s = \sin\theta$

The Global Stiffness Matrix of a Truss Element

$$K = \frac{EA}{L}\begin{bmatrix} c^2 & cs & -c^2 & -cs \\ cs & s^2 & -cs & -s^2 \\ -c^2 & -cs & c^2 & cs \\ -cs & -s^2 & cs & s^2 \end{bmatrix}$$

$c = \cos\theta \quad and \quad s = \sin\theta$

The Global Stiffness Matrix of a Fixed-Fixed Frame Element

$$K = \begin{bmatrix} a_1 & a_2 & -a_3 & -a_1 & -a_2 & -a_3 \\ & a_4 & a_5 & -a_2 & -a_4 & a_5 \\ & & a_6 & a_3 & -a_5 & a_6/2 \\ & & & a_1 & a_2 & a_3 \\ & & & & a_4 & -a_5 \\ & & & & & a_6 \end{bmatrix}$$

where

$$a_1 = (EA/L)\,c^2 + (12EI/L^3)\,s^2$$
$$a_2 = (EA/L - 12EI/L^3)\,cs$$
$$a_3 = (6EI/L^2)\,s$$
$$a_4 = (EA/L)\,s^2 + (12EI/L^3)\,c^2$$
$$a_5 = (6EI/L^2)\,c$$
$$a_6 = 4EI/L$$

$c = \cos\theta \quad and \quad s = \sin\theta$

The Local Stiffness Matrix for a Fixed-Fixed Beam Element

$$k = \begin{bmatrix} \frac{12EI}{L^3} & \frac{6EI}{L^2} & \frac{-12EI}{L^3} & \frac{6EI}{L^2} \\ \frac{6EI}{L^2} & \frac{4EI}{L} & \frac{-6EI}{L^2} & \frac{2EI}{L} \\ \frac{-12EI}{L^3} & \frac{-6EI}{L^2} & \frac{12EI}{L^3} & \frac{-6EI}{L^2} \\ \frac{6EI}{L^2} & \frac{2EI}{L} & \frac{-6EI}{L^2} & \frac{4EI}{L} \end{bmatrix}$$

The Global Stiffness Matrix for Fixed-Hinged Frame Element

$$K = \begin{bmatrix} a_1 & a_2 & -a_3 & -a_1 & -a_2 \\ & a_4 & a_5 & -a_2 & a_4 \\ & & a_6 & a_3 & -a_5 \\ & & & a_1 & a_2 \\ & & & & a_4 \end{bmatrix}$$

where

$$a_1 = (EA/L)\,c^2 + (3EI/L^3)\,s^2$$
$$a_2 = (EA/L - 3EI/L^3)\,cs$$
$$a_3 = (3EI/L^2)\,s$$
$$a_4 = (EA/L)\,s^2 + (3EI/L^3)\,c^2$$
$$a_5 = (3EI/L^2)\,c$$
$$a_6 = 3EI/L$$

TANTA UNIVERSITY

FACULTY OF ENGINNERIN

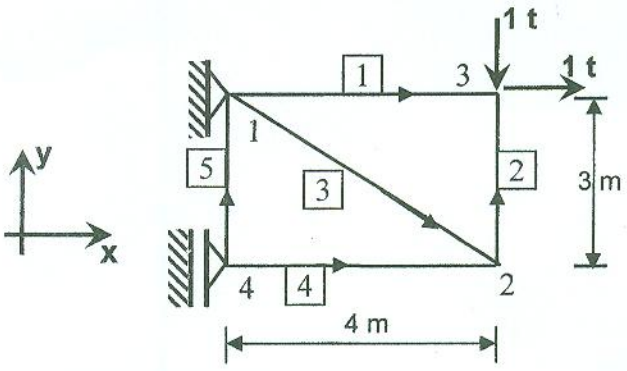
Computerized Structural Analysis | **Course Code: CSE4245**
Fourth Year 2010-2011 | **June 2011 (Second Term)**
Allowed time: 3 hrs | **Total Marks: 60 Marks** | **No. of Pages: (3)**

Question I (10 Marks)

Using the stiffness matrix method, set up the structural overall stiffness matrix as well as the load vector for the plane frame shown in figure 1 with applying the boundary conditions. Using the given nodal displacement of nodes 2, 3 and 4, find the internal forces in the members 2, 4 and 5.

Nodal Displacements

$dx_2 = 0.005$ m $dy_2 = -0.021$ m
$dx_3 = 0.004$ m $dy_3 = -0.024$ m
$dy_4 = 0.0$ m



EA= 1000t
For all members

Figure 1

Question II (10 Marks)

For the beam shown in figure 2, carry out a complete stiffness analysis to draw the shearing force and bending moment diagrams.

For member ab: EI = 60 000 t.m^2.
For member bd: EI = 30 000 t.m^2

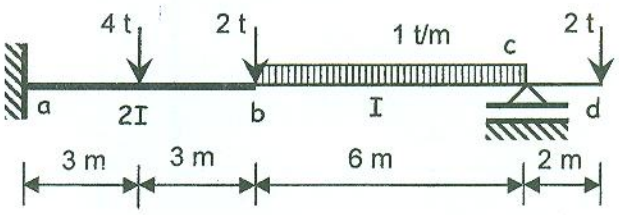


Figure 2

Question III (10Marks)

Figure 3 shows a frame with an intermediate hinge at Joint d. It is required to:

1. Carry out a complete stiffness analysis to find the horizontal and vertical displacements of Joint d.
2. Draw the bending moment diagram.

EI = 3000 t.m^2 and EA = 15000 t for all members.

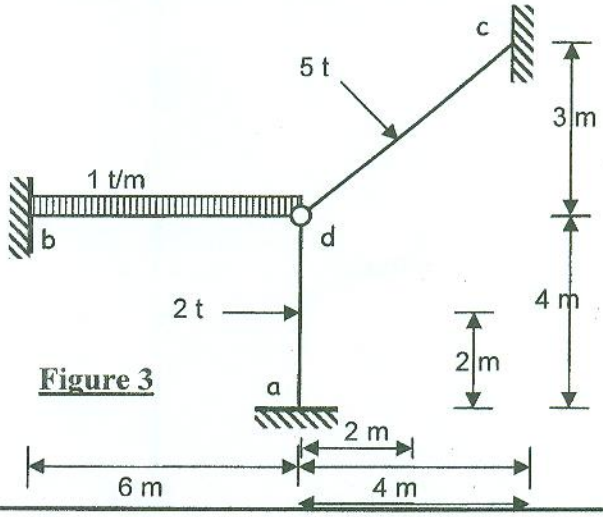
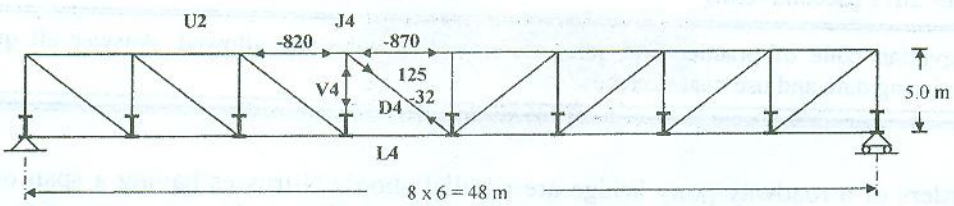
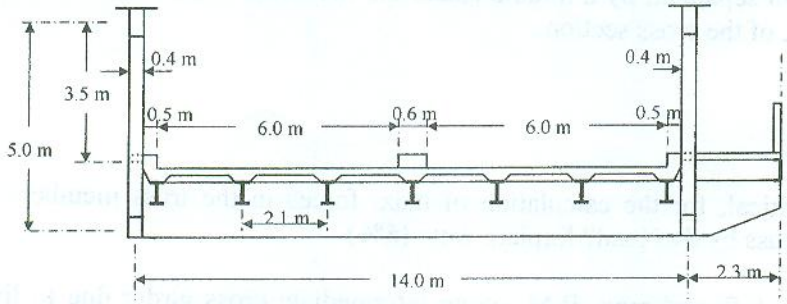
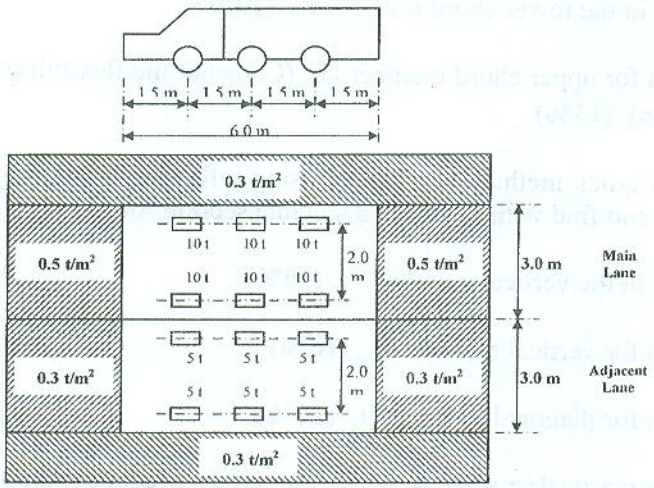


Figure 3







Course Examination Committee

Prof. Mohamed Dabaon — Assoc. Prof. Mahmoud El-Boghdadi

Associate Prof. Ehab Ellobody — Dr. Nashwa Youssef

Course Coordinators: Assoc. Prof. Mahmoud El-Boghdadi and Assoc. Prof. Ehab Ellobody

Course Title: Design of Steel Bridges (b)	Course Code:CSE4238	Year: 4th
Date: 15th of June 2011 (Second term)	Allowed time: 4 hrs	No. of Pages: (2)

Remarks: Egyptian code of practice and steel cross-section tables are allowed. Answer all questions. Assume any missing data and use neat sketches.

The main girders of a roadway pony bridge are parallel chords N-trusses having a span of 48 ms divided into 8 equal panels 6 ms each and a depth of 5.0 ms. The roadway consists of two traffic lanes in either direction separated by a middle island 0.6 ms wide. The bridge has an overhanging end only on the R.H.S. of the cross section.

REQUIRED:

1. Which is more critical, for the calculation of max. forces in the truss members, to load the L.H.S. or R.H.S. truss by live load? Explain why. **(5%)**
2. Calculate the max. S.F. and max. B.M. on an intermediate cross girder due to live load plus impact only. (middle island to be left unloaded). **(13%)**
3. Calculate the max. force in the lower chord member L_4. **(13%)**
4. Design a suitable section for upper chord member U_4. (Consider the flexibility of the U-frame at mid-span $\delta = 0.20$ cm/ton). **(13%)**
5. Find using an intelligent quick method (and not by using influence lines) the max. force in the upper chord member U_2 and find without check a suitable section for it. **(6%)**
6. Calculate the max. force in the vertical member V_4. **(10%)**
7. Design a suitable section for vertical member V_4. **(10%)**
8. Design a suitable section for diagonal member D_4. **(10%)**
9. Design and draw with a reasonable scale joint J4. Use High Strength Friction resistance bolts M24 having P_s=5.55 ton. Consider the same the cross-section of upper chord member U4 to be continued for upper chord member U3. **(20%)**

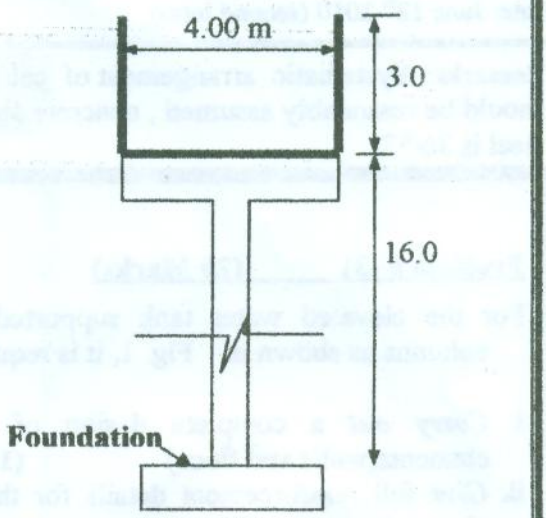
Problem # (3) **(20 Marks)**

For the elevated conduit supported on frames composed of central column with double cantilevers as shown in Fig. 3, assume 5.0 m frame's spacing it is required to:

i. ***Carry out*** complete design of the conduit elements (walls and floor) **(8 Marks)**

ii. ***Give*** full reinforcement details in plan and cross sections. **(8 Marks)**

iii. ***Give*** concrete dimensions for the shown foundation to assure tank stability. **(4 Marks)**



Problem # (4) **(20 Marks)**

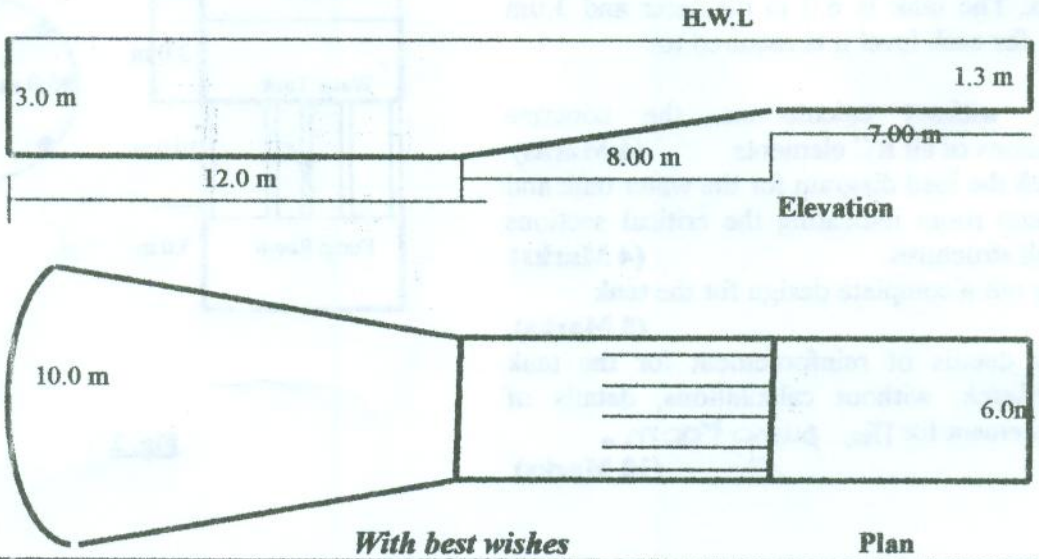
For the shown swimming pool on very stiff clay soil with net bearing pressure equals to 150 kN/m^2, it is required to:

i. ***Sketch*** the possible cases of loading and state the critical situation for both wall and floor design. **(4 Marks)**

ii. ***Specify*** the earth pressure coefficient for each case. **(2 Marks)**

iii. Carry out complete ***design*** of critical sections. **(8 Marks)**

iv. ***Draw*** details of reinforcement on plan (scale 1:100) and sectional elevation (scale 1:50) **(6 Marks)**



With best wishes

Course Examination Committee:

Prof. Tarek Mohamed Fawzy

Dr. Nsreen Kassem **Dr. Mohamed Hussein**

Tanta University

Department: Structural Engineering
Total Marks: 85 Marks

Faculty of Engineering

Course Title: Reinforced Concrete Design (3)-b	Course Code: CSE 4237	Year: 4th
Date: June 12th 2010 (second term)	Allowed time: 4 hrs	No. of Pages: (2)

Remarks: Systematic arrangement of calculations and neat drawings are essential, any missing data should be reasonably assumed , concrete characteristic strength f_{cu} = 25 MPa, and grade of reinforcing steel is 36/52

Problem # (3) **(20 Marks)**

For the elevated water tank supported on four columns as shown in Fig. 1, it is required to:

i. ***Carry out*** a complete design of the tank elements(walls and floor) **(10 Marks)**
ii. ***Give*** full reinforcement details for the tank in plan and cross sections. **(10 Marks)**

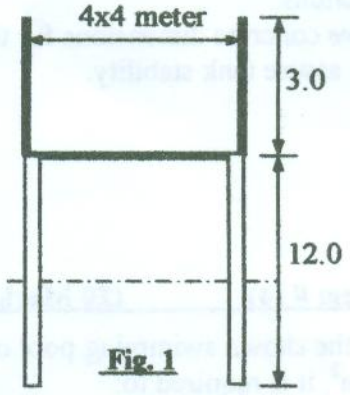


Fig. 1

Problem # (2) **(26 Marks)**

Figure 2 shows a sectional elevation of a circular water tank and pump room constructed at two levels. The tank is 6.0 m diameter and 3.0m high, for each level it is required to:

i. ***Draw***, without calculations, the concrete dimensions of all RC elements. **(4 Marks)**
ii. ***Sketch*** the load diagram for the water tank and the pump room indicating the critical sections for both structures. **(4 Marks)**
iii. Carry out a complete design for the tank **(8 Marks)**
iv. ***Draw*** details of reinforcement for the tank and, ***Sketch***, without calculations, details of reinforcement for the pump room. **(10 Marks)**

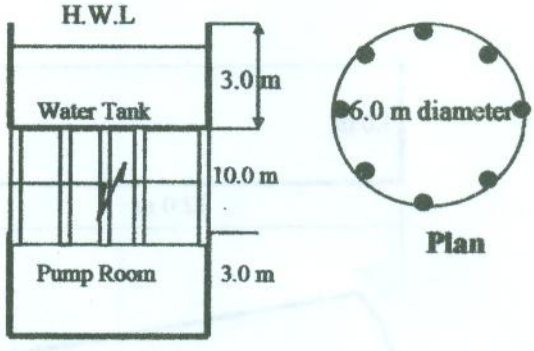


Fig. 2

Third Question (50 marks)

For the given concrete gravity dam
Consider water height= 105 ms
Soil foundation is almost rock fractions

Static analysis (20 marks)

Use hand calculation to find

Find at height = 50 ms from the base

- The stress distribution
- The stability against overturning,
- Tthe stability against sliding
- The stability against overstresses
- The soil stability at dam foundation against overstresses

Dynamic analysis (25 marks)

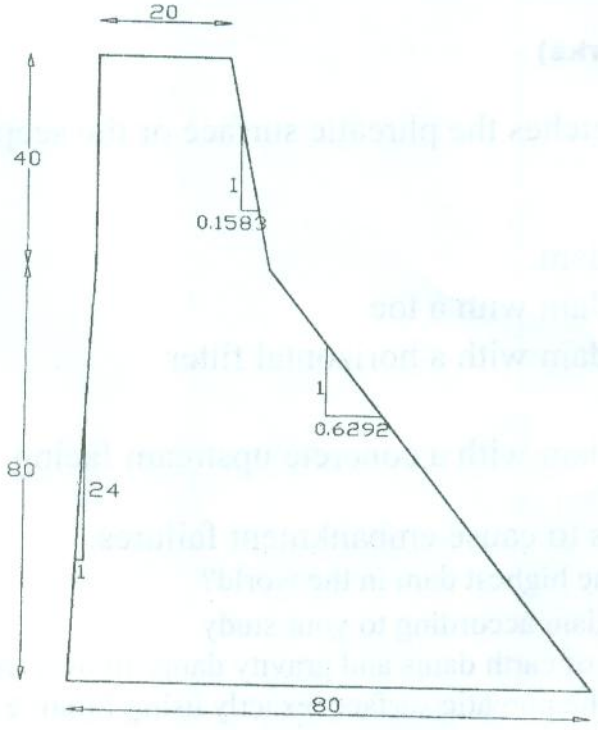
The dam is subjected to El centro earthquake.

Use hand calculation to find at the base

1- the stability against overturning due to seismic loads.
2- the stability against sliding due to seismic loads.
3- the stability against overstresses due to seismic loads.
4- the soil stability at dam foundation against overstresses due to seismic loads.

SAP calculations (5 marks)

1- Discuss how to analyze the above cases using quasi-static procedure (simplified method)
2- Discuss how to analyze the above cases using response spectrum method (exact method)



Subject:Final Term Exam 26 June 2011

Time allowed 3 hours

Assume any missing data

First Question: (15 marks)

A: What is a reservoir? What is a dam? What is the main differences between a gravity dam and an embankment dam?

B: Define for Reservoirs

- Purpose
- Site selection
- Sedimentation
- Effect of raised Water Table

C: Discuss the following:

- Discuss the methods of rock grouting for a gravity dam.
- Discuss the temperature control of mass concrete for dams.
- Discuss concreting procedure for gravity dams.
- State instrumentations in concrete gravity dams.

D: Using empirical dimensions, draw to scale 1:100 a cross section of a gravity dam if the height of the dam 50 ms with a vertical upstream and downstream side slope is 2hz:3vl.

Second Question: (10 marks)

A-Locate with neat sketches the phreatic surface or the seepage surface in the following cases:

- Homogenous dam
- Homogenous dam with a toe
- Homogenous dam with a horizontal filter
- Zoned dam
- Homogenous dam with a concrete upstream facing

B-Discuss main factors to cause embankment failures.

C- What is the height of the highest dam in the world?

D-Describe High Aswan dam according to your study

E- What is the percentage of earth dams and gravity dams all over the world?

F- Discuss how to locate the phreatic surface exactly using Finite Element Method.

Figure 1 Plan of the excavation

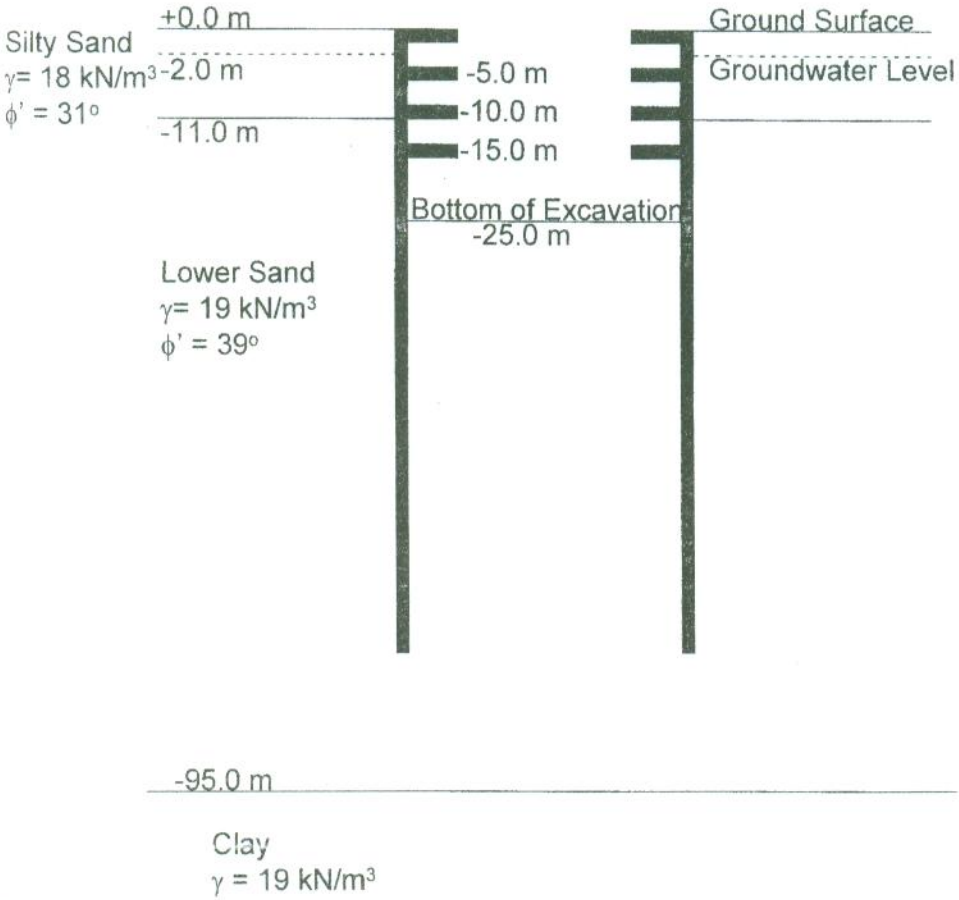


Figure 2 Cross section of the excavation

Question 3 (12 Points)

A tunnel is constructed with the cut and cover technique in an urban area. Figure 4 shows a cross section of the 14.5-m deep excavation for tunnel construction. The excavation support system consists of soldier piles (3m spacing) and lagging (EI = 130000 kN m/m'), 4 levels of wales and struts. The struts are spaced 3 m apart in the horizontal direction.

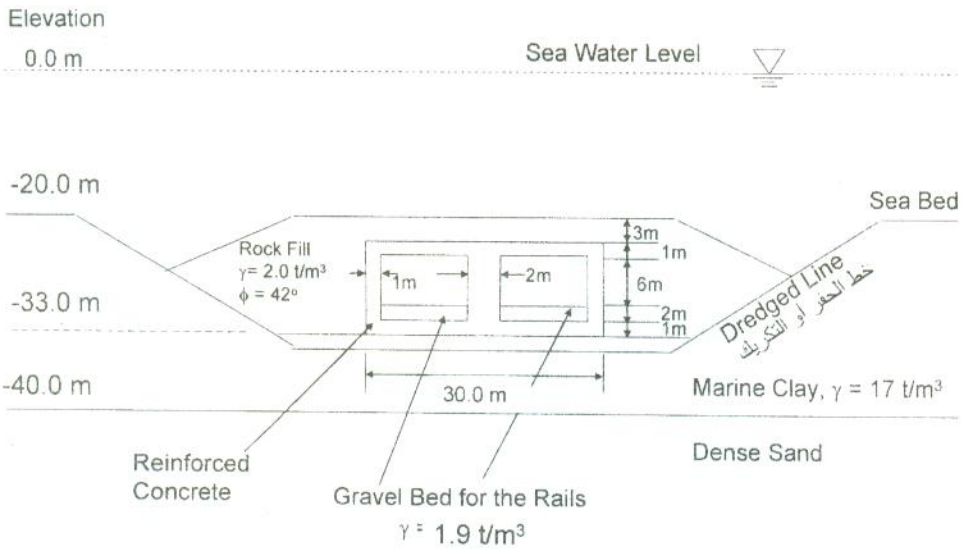


Figure 5

Question 5 (15 Points)

A 26 m deep (to springline) circular tunnel with a diameter of 8 m is excavated in dense sand (Fig. 6). The ground loss around the tunnel due to shield tunneling operations is estimated as 5 cm in annulus. (*Hint: use* $\beta_d = 21^o$) **Estimate**:

a) Volume of losses
b) Width of settlement trough (show in sketch)
c) Ground surface settlement above centerline of the tunnel.
d) Maximum lateral displacement at the ground surface.

For a 4-story brick-bearing wall structure that is 18 m in width and its edge is located 6 m from centerline of the tunnel (Fig. 6), **Estimate**:

a) Sketch and label the apparent earth pressure.

Calculate

b) The maximum moment on the soldier piles,
c) The maximum moment on the wood lagging.
d) The maximum load on the strut at level (C).

A 3-story adjacent building is 2m away from the edge of the excavation.

e) Calculate the factor of safety against basal failure.
f) Estimate the horizontal displacement of the soldier pile wall.
g) Calculate the differential settlement between the two edges (A & B) of the building.

h) What is the minimum vertical spacing of the horizontal supports if the maximum settlement allowed at Point A is limited to 2.5 cm.

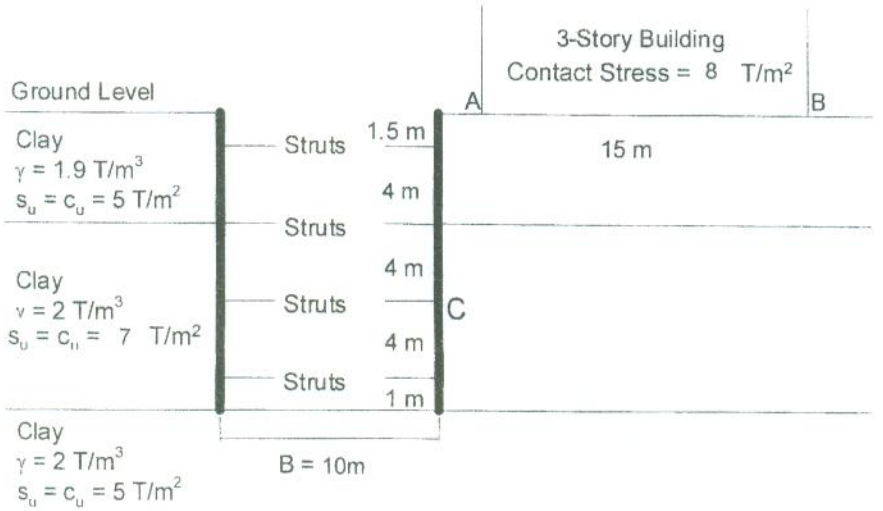


Figure 4

Question 4 (15 Points)

A 2 vent immersed rail road tunnel is constructed underwater. The sea bed shall be dredged or excavated to construct the tunnel as shown in Figure (5) . The final shape of the tunnel cross section is shown in Figure (5).

(I) Sketch and label the values of the pressure distribution around the tunnel to be used for analysis to estimate the straining actions on the tunnel. Use initial thickness of the reinforced concrete as shown in Figure (5).

(II) Calculate the factor of safety against uplift of the shown final shape of the tunnel (using dead weights concept).

(III) Comment on the factor of safety against up lift suggesting appropriate means of stabilization measures

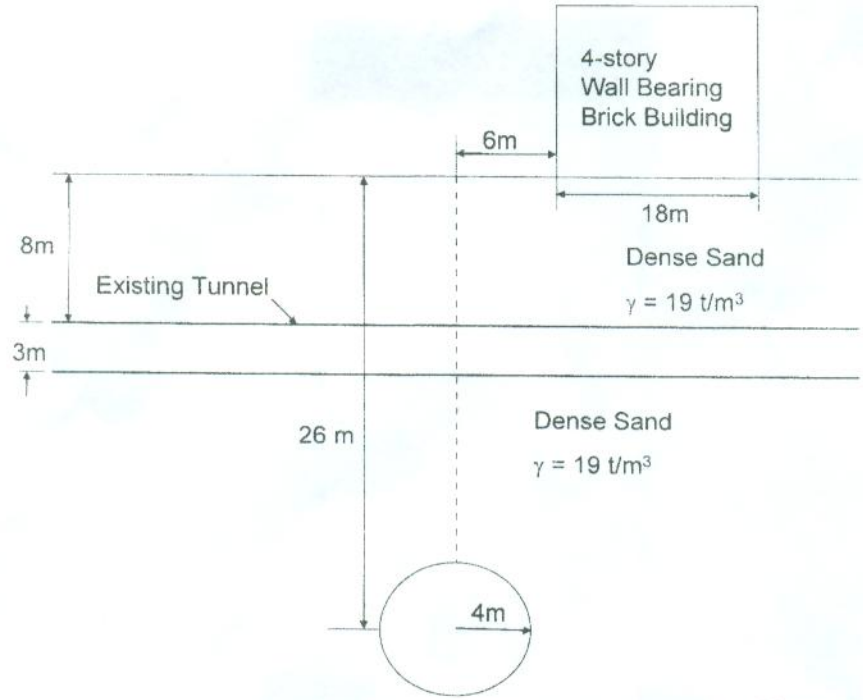


Figure 6

e) Settlement at both edges of the structure

For the 3m diameter existing tunnel,

f) **Compute and sketch** the settlement trough at the invert level of the existing tunnel due to tunnelling the 8m diameter tunnel.

For the 4-story building, **estimate**

g) Settlement at both edges of the structure if a second tunnel (same depth and same diameter) is excavated 12m away from the first tunnel as shown on Figure 7.

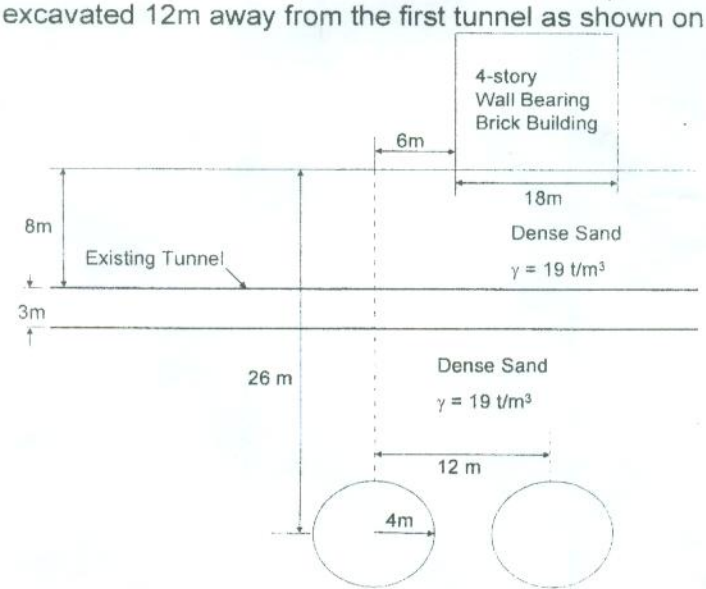


Figure 7

>>> BEST WISHES <<<

University of Tanta
Faculty of Engineering
Structural Engineering Department

4th year - Tunnels and Underground Structures
Final Exam
Spring 2011

>>>OPEN BOOK EXAM<<<

Question 1 (13 Points)

a) State the three major concerns of geotechnical engineer in relation to tunneling operations.
b) A sub-way (Metro) tunnel is to be excavated using Tunnel Boring Machine. The tunnel is five kilometer in length. The project includes the construction of 4 stations and sinking of a large shaft. **Outline and breifly explain the soil investigation Program for the project.**
c) What is dilapidation survey? Why it is needed?
d) **Breifly Discuss** the role of instrumentations and monitoring in deep excavations.
e) **Sketch and discuss** the advantages and the disadvantages of using (I) diagphram walls , (II) Soldier piles and wood lagging walls.
f) Define stability number in tunnel boring.

Question 2 (15 Points)

An excavation is to be excavated to rescue a tunnel boring machine. Figure 1 shows the plan of the excavation. Figure 2 shows cross section of the excavation during construction. The ground water level is 2 m below the ground surface. Diaphragm wall (100cm in thickness) around the perimeter of the excavation shall be embedded in the ground as shown in Figures 1 and 2. During excavation, there is a need to support the surrounding walls at 4 levels as shown in Figure 2. The depth of the wall in the ground shall be determined by the engineer. There are two options

Option 1: To extend the wall to a depth Ds below bottom of excavation with a grouted plug with thickness t.
(الإختيار الأول: مد الحائط الخرساني بعمق لابد من حسابه أسفل قاع الحفر مع تركيب سدادة من الحقن بسمك t)

Option 2: To extend the wall in the clay layer .
(الإختيار الثاني : مد الحائط الخرساني داخل طبقة الطين)

1) **Calculate the thicknesses t and Ds in case of Option 1 in Figure 2**
2) **Calculate the factor of safety against uplift at bottom of excavation in case of Option 1 in Figure 2**
3) **Comment on the need to execute Option 2**
4) **Calculate and sketch the pressure distribution along one side of the diaphragm wall.**
5) **Estimate the maximum moment in the walls**
6) **Calculate the loads at the fourth support at level -15.0m.**

Tanta University

Department: Structural Engineering
Total Marks: 70 Marks

Faculty of Engineering

Course Title: Elective Course: Special Topics of R.C. Structures | Course Code: CSE4247 | Year: 4th Structure.
Date: June. 2011 (Second term) | Allowed time: 3 hrs | No. of Pages: (2)

- Systematic arrangement of calculations and neat drawing are essential.
- Any missing data should be reasonably assumed.
- Concrete characteristic strength f_{cu}= 25 N/mm^2 & Grade of reinforcing steel is (360/520).

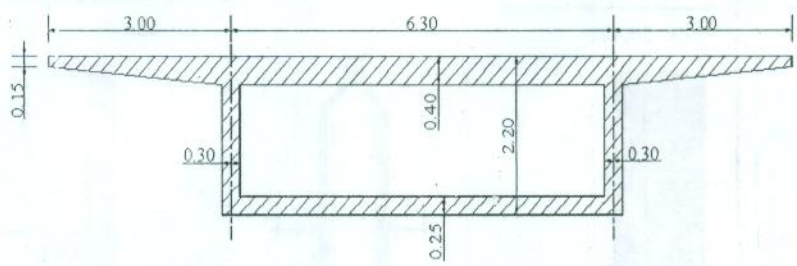
Problem # 1 (15 Marks)

(g) ***State*** with neat drawing the types of reinforced concrete bridges, then, define the maximum span that may be covered by each type. (2 Marks)
(h) ***What*** are the advantages of box girder bridges? (2 Marks).
(i) For a simply supported 2-lane box girder bridge with span 25 m. ***calculate*** the required concrete dimensions (total depth, top slab, bottom slab and webs). (3 Marks).
(j) ***Define*** the types of loads acting on roadway bridges. (2 Marks).
(k) ***What*** is the function of bearing of box girder, and then draw to reasonable scale the shape of neoprene bearing, steel bearing and pot bearing. (3 Marks).
(l) ***Define*** the types of expansion joints in box girder bridges, and then ***draw*** to reasonable scale the details of each type. (3 Marks).

Problem # 2 (16 Marks)

Fig. 1 shows the cross section of 29 m span simply supported Box Girder Bridge. It is required to carry out the following:

(e) ***Calculate*** and draw the distribution of dead load stresses acting on the section. (4 Marks).
(f) ***State*** without calculation the critical cases of loading acting on cross section in case of wheel loads. (4 Marks)



(g) If the maximum bending moment acting on the longitudinal direction of box girder= 3200m.kN ***calculate*** the required longitudinal main reinforcement of the bridge. (4 Marks)
(h) ***Draw*** the reinforcement details in both elevation and cross section. (4 Marks).

Problem # 3 (19 Marks)

c- Define with neat sketches the different modes of failure for beam-column joints. (4 Marks)
d- For the Type I beam column joint shown in figure1, it is required to check the joint capacity to resist the forces shown in the figure in both directions. (15 Marks)

Problem # 4 (25 Marks)

Fig. 2 shows the structural plan of multi-story residential building (12m×20m) located at Tanta city and constructed on raft. The center of the core locates at the center of the building. Widths of all walls are 0.3m. The lengths of the walls (W1), (W2), and (W3) are 4m, 4m, and 3m.
It is required to carry out the following:-
(g) ***Allocate*** the center of rigidity, neglecting the effect of columns. (5 Marks)
(h) Calculate the normal forces and the bending moments that can be carried by the shear walls due to earthquake loading taking into account the torsional moment effect. (5 Marks)
(i) ***Make*** complete design for the core and the critical shear walls. (5 Marks)

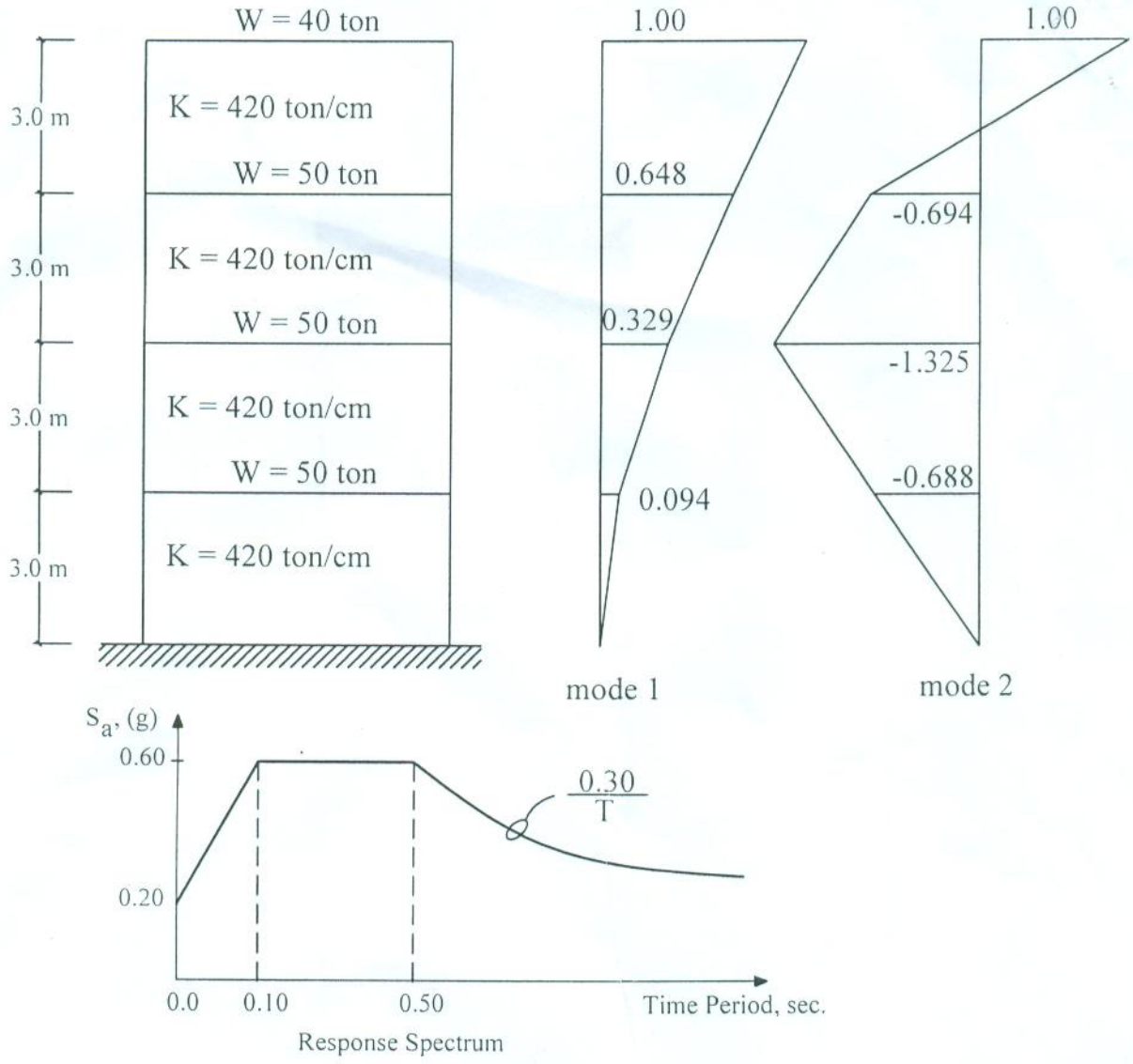
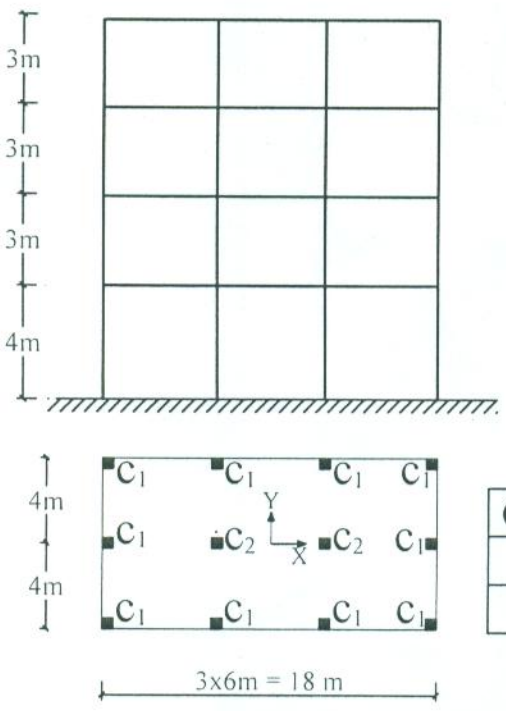


Fig. (1)

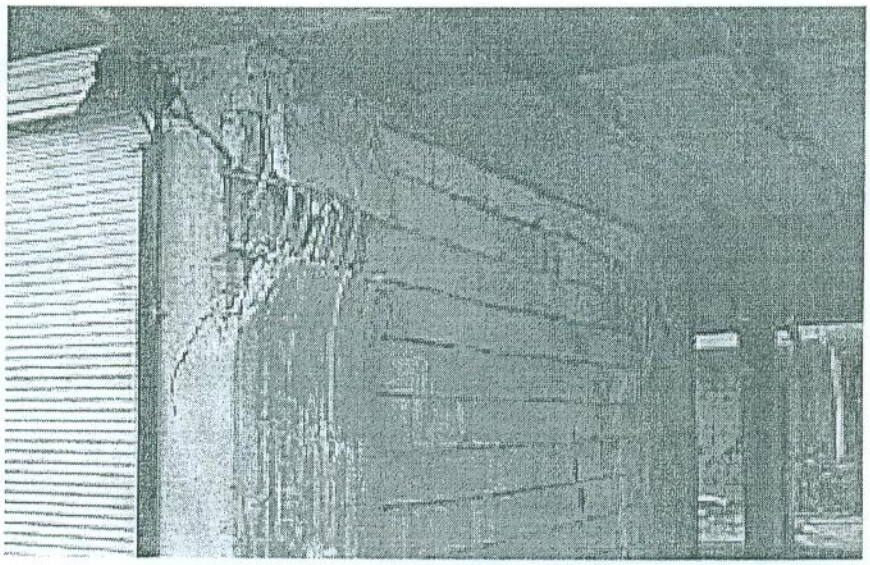


For each floor:
D.L = 800 Kg/m^2
L.L = 600 Kg/m^2

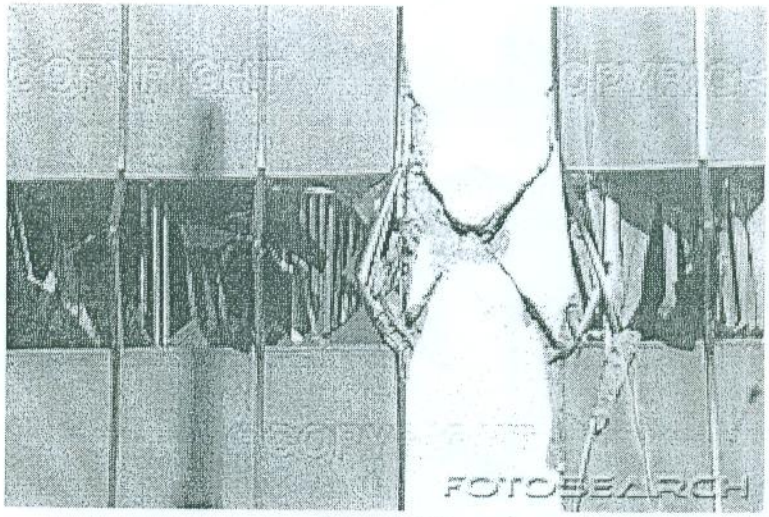
Col.	floor 1 & 2	floor 3 & 4
C 1	50x50	40x40
C 2	70x70	60x60

Fig. (2)

Case (a)



Case (b)



Case (C)

Fig (3)

إنتهت الأسئلة

TANTA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING
EXAMINATION (FOURTH YEAR) STUDENTS OF STRUCTURAL ENGINEERING

COURSE TITLE: Earthquake Engineering			COURSE CODE: CES4220
DATE:	TERM: SECOND	TOTAL ASSESSMENT MARKS: 70	TIME ALLOWED: 3 HOURS

Notes:
Systematic arrangement of calculations and clear neat drawings are essential.
Any data not given is to be assumed – Answer as many questions as you can.
Answer as brief as possible. الإمتحان مكون من 5 أسئلة فى ثلاث صفحات

1- The structure shown in Fig. (1) has four stories. The floors weights, stiffness, and the first two mode shapes are shown in the figure. The vibration properties of the structure are given in the following table

Mode number	1	2	3	4
Neutral period (sec)	1.418	0.226	0.083	0.048

Use the given response spectrum to find

- The floor forces.
- The story shear forces.
- The floor displacements.
- The story drifts.

USE ONLY THE FIRST TWO MODES OF VIBRATION.

Put your results in a tabulated form. Also calculate the modal weights of the two modes. Use the result to discuss if more modes should be included in the analysis.

2- For the structure shown in Fig. (2), use Equivalent Static Load method to calculate the base shear, base moment, story drift and total lateral displacement. Assume that that Young's modulus for concrete $2x10^6$ t/m^2, the soil is rock, the zone factor is 0.20 and The importance factor is 1. (Make your analysis in the X-direction)

3- Using clear sketches, give definition for the following:

1- Lead Rubber Bearings
2- FPS system
3- P-waves
4- Liquefaction
5- Tsunami
6- Dip-slip faults

4- Explain the idea of the following

1- Active control
2- Seismic isolation
3- Seismic energy dissipation

5- Three cases of structural failures during earthquakes are shown in Fig. (3). Discus the possible reason of failure for each case and give your recommendation to prevent such failure.