Question 4 (13 marks)

The following table gives plan for construction of one kilometer of a pipeline. Each activity will be done using a separate crew. The project consists of 20 similar kilometers.

Code	Activities	Duration (weeks)	Predecessors
LC	Locate and Clear	1	--
ET	Excavate Trench	3	LC
SP	String Pipe	1	LC
LP	Lay Pipe	4	ET,SP
PT	Pressure Test	1	LP
BF	Backfill	2	PT

Construct the project summary diagram using the precedence notation. State clearly the critical activities.

Question 5 (20 marks)

Complete the following sentences. Underline your answers:

1. The existence of a realistic cost estimate against which tenders can be compared is necessary because _____.
2. In a selective tender, the tender list is usually _____ compared with that of an open tender.
3. Main disadvantage of the traditional approach of project organizational structure is _____.
4. The contractor should be required to carry only those risks that he can reasonably be expected to foresee at the time of bidding because _____.
5. Main roles of the construction contract documents are: _____, _____, and _____.
6. The following services may be offered by the management contractor and not by the Engineer in the traditional approach: _____, _____, and _____.
7. The performance bond with a construction contract covers: _____ and _____.
8. Maximum flexibility for introducing design changes during construction can be achieved using the following type of contract: _____.
9. An important risk of using lump sum contract for a high-risk project is that of _____.
10. In a cost-plus contract, a contractor is reimbursed for actual site costs plus a specified fee for _____.
11. FIDIC conditions of contract are _____.
12. If liquidated damages are not specified in the conditions of construction contract, the client may become entitled to _____.
13. The tender period is usually short when compared with the design period of a project. The objective of this situation is _____.
14. Economic feasibility of a project aims at _____ while financial feasibility of the project aims at _____.

Best Wishes

Examiner:
Prof. Dr. Adel I. Eldosouky

TANTA UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENGINEERING DEPARTMENT
3rd Year Students of Structural Engineering Section

Course: Construction Project Management (1) **Course Code: CSE3231**
Final Exam **Date: 10 June 2012** **Full Marks: 85** **Time Allowed : 3 Hours**

Question 1 (15 marks)

The following table gives a group of sequential activities forming a certain contract together with their estimated quantities, durations and total direct costs. Contract indirect cost and markup is LE 575000.

Code	Activities	Estimated quantities	Unit	Duration (months)	Total direct cost (LE'000s)
C	Common excavation	500000	M_3	4	475
R	Rock excavation	200000	M_3	4	2400
F	Fill	750000	M_3	4	1000

a. Develop a balanced bid. (5 marks)
b. If you, as a contractor, have a reason to think that rock excavation quantities are considerably less than estimated while common excavation is higher, develop an unbalanced bid to maximize profit.
c. Compare cash flow curves for the two cases of balanced and unbalanced bids. (5 marks)

Question 2 (15 marks)

Draw a LOB diagram for the construction of 12 units in 38 days. Each unit is represented by the plan given in table below. Assume that optimum crew size for each activity is equal to one and buffer time between the activities is equal to zero.

Activity	Predecessors	Duration (days)
A	-	8
B	A	12
E	B	3
F	E	1
G	F	3

Question 3 (22 marks)

A bridge pier foundation is to be constructed in a cofferdam. The work is planned according to the network given below. Each activity requires the continuous use of a derrick crane. Because of space restrictions, only two such cranes can be made available for the work. What is the minimum contract duration assuming that once an activity is started it must be completed without a break?

Activity	i - j	Duration (days)
P	10 – 20	3
Q	20 – 50	8
R	50 – 80	6
S	80 – 90	3
T	10 – 30	4
U	30 – 60	5
V	60 – 90	4
W	10 – 40	6
X	40 – 60	2
Y	40 – 70	3
Z	70 – 90	8

P.T.O.

Tanta University
Faculty of Engineering
Structural Engineering Department
Final Term Exam 3rd str.Dept.

***Course Title:* Soil Improvement**	***Course Code: CSE 3233***	***Time allowed: 3.0 hours***
Total Marks: 85	***Date: 19/6/2012***	***No. of Pages: (2)***

Question No.4 ***(21 Marks)***

4-a) Write a brief critical note on : a-swelling soil b- collapsing soil, showing the main characteristics and types of each soil. ***(6 Marks)***

4-b) A site consists of a soft clay deposit 8 m thickness with an impermeable lower boundary (Rock). This site was improved by band shaped drains and preloading by construction an embankment over drains. The total vertical stress over clay was increased by 75kN/m^2. the clay properties are (Cv = 1.5x 10^{-7} m^2/sec, Ch =2.5x 10^{-7} m^2/sec, clay unit weight γ = 1.7 t/m3 and cc/1+eo = 0.1).

The properties of the band shaped drains (a = 57.8cm and b = 5cm).

The average degree of consolidation U = 86% was achieved at 4 month from the embankment. ***(15 Marks)***

It's required to:

a- Show with clear sketches the installation method of wick/ band drains in the field

b- Determine the spacing of square pattern band drains.

c- The expected clay settlement assuming water level at ground surface.

Question No.5 ***(24 Marks)***

5-a) Define the soil injection, showing the main importance of this technique in geotechnical engineering. **Also write** a brief about fracture grouting viewing its disadvantages. ***(4 Marks)***

5-b) What are the factors governing the choice of the chemical grouting? And state the available name of chemical grouting used in soil injection. ***(4 Marks)***

5-c) A suspension grout was used to improve a site with porosity 0.6. The viscosity ratio was found to be 1and the time obtained from march cone is 1.2 min. ($D_{15\ formation}$ = 0.4 mm, $D_{15\ grout}$ = 0.025 mm and g = 32 ft/sec^2) ***(6 Marks)***

Determine: 1- The grout ability ratio and comment on the results.

2 - The grout penetration depth.

5-d) Define what is meant by soil liquefaction, and mention the modern method of liquefaction mitigation. ***(4 Marks)***

5-e) A site consists of a layer of medium sand with unit weight of 18 kN/m^3, underlying by rock strata and the ground water level at the ground surface. The site is subjected to an earthquake with magnitude, M = 7.5 and the recorded maximum surface acceleration is 0.21g. The SPT test was carried out at depth 1.5m, and the penetration number at this depth is 18. It is required to determine:

1- The cyclic stress ratio and cyclic resistance ratio at depth 1.5m.

2- The factor of safety against liquefaction. ***(6Marks)***

Good Luck

Prof. Dr. Mohamed A. Sakr ***Dr. Ahmed M. Nasr*** ***Dr. Wasiem R. Azzam***

4- Problem (4) 15 Marks:

a-Find the plastic modulus for bending about the X and Y axes of the channel section shown in Fig. (4-a)

b- For the given continuous beam (ABCD) as shown in Fig. (4-b), each span has different section and thus plastic moment. Determine the collapse load P_c, and draw the **B.M.D.** at collapse

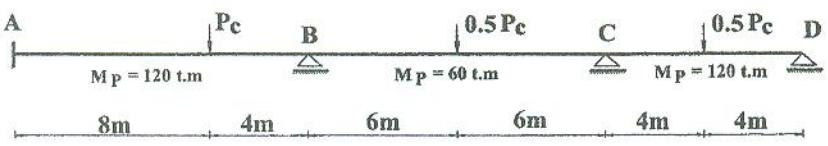


Fig.(4-b)

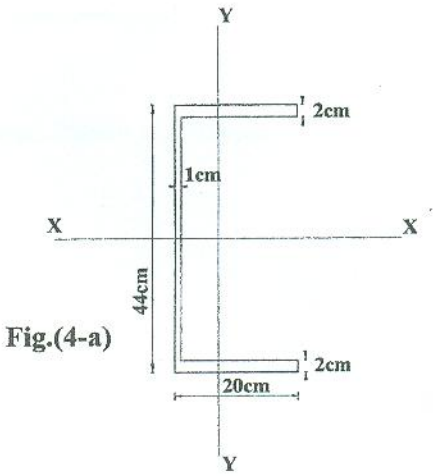


Fig.(4-a)

5- Problem (5) 12 Marks:

Calculate the collapse load factor for the given portal frame shown in Fig. (5), if the plastic moment M_p=**50 t.m** is constant for the beam and columns. Also draw the plastic B.M.D at collapse.

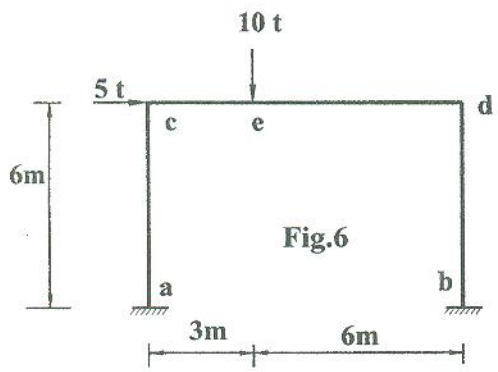


Fig.6

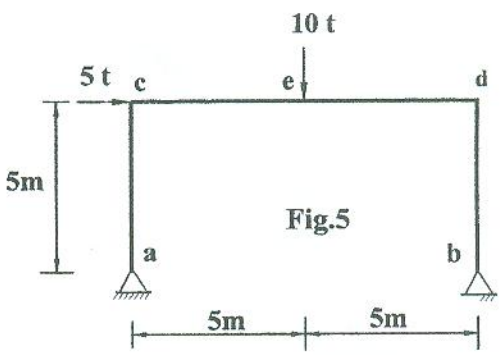


Fig.5

6- Problem (6) 14 Marks:

Determine the collapse load factor for the given portal frame shown in Fig. (6), and draw the plastic B.M.D if the plastic moment M_p is the same in all members.

With the best wishes

Course Examination Committee

Prof. Dr. Mohamed A. Kasem

Dr. Tarek Mohamady Khalifa

Tanta University

Department: Structural Engineering
Total Marks: 85 Marks

Faculty of Engineering

Course Title: Structure Analysis (3) (ب)	Course Code: CSE3122	Year: Third Year (هندسة إنشائية - لائحة جديدة)
Date: June, 2012 (Second term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: (answer the following questions… assume any missing data…)

1- Problem (1) 12 Marks:

Using the moment distribution method, draw the **B.M.D.** for the given frame of variable I shown in Fig. (1).

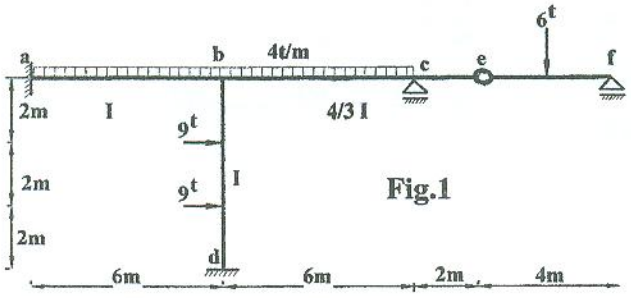


Fig.1

2 - Problem (2) 15 Marks

Using the moment distribution method, draw the **B.M.D.** for the given frame of variable I shown in Fig. (2).

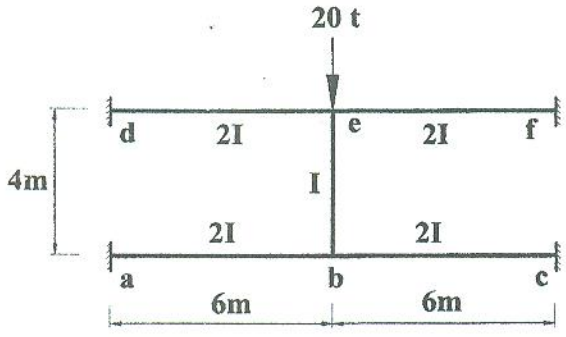


Fig. 2

3- Problem (3) 17 Marks:

For the given frame shown in Fig. (3), construct the influence lines for the reactions at **a** , **b** and **c**. Also construct the influence lines of the straining actions at sections **s-s** and **m-m**.

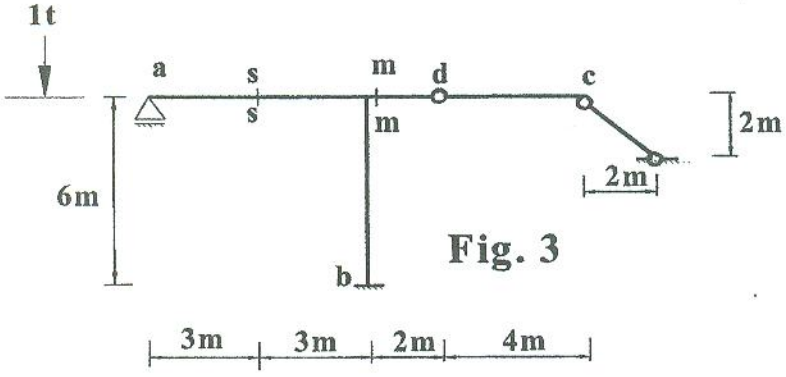
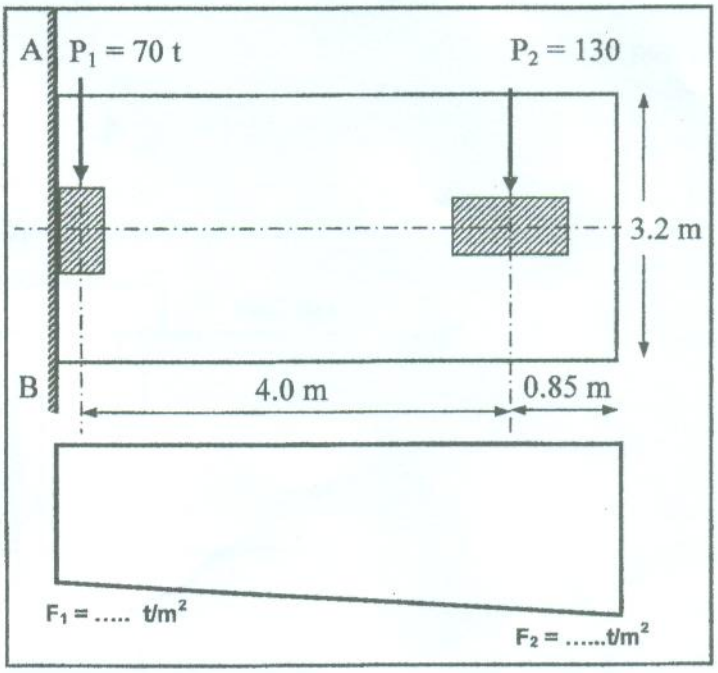


Fig. 3

P.T.O.

Question No. (3) (14 point)



The figure shows the plan of two adjacent columns. The left column is (30 x 60) cm and carries 70.0 t and the right column is (40 x 80) cm and carries 130.0 t. The distance center to center of columns is 4.0 m and the allowable net soil pressure is 1.70 kg/cm^2 and the thickness of plain concrete layer = 20 cm. Due to site conditions, the maximum projection of the combined footing is 0.85 m from the centerline of right column as shown in the figure. Assuming the thickness of the R.C footing = 80 cm, you are required to calculate the values of F_1 and F_2 and:

(i) Determine the maximum negative moment **(6 point)**

(ii) Check the shear stress adjacent to the left column **(4 point)**

(iii) Determine the reinforcement in the transfer direction **(4 point)**

Question No. (4) (15 point)

(a) Discuss the concept of negative skin friction of piles. **(4 point)**

(b) A rectangular column (30 x 100) cm carries vertical load = 215 t and bending moment, M=25 t.m . If the available piles are 50 cm in diameter and 17.0 m in length with safe pile load = 75 t. you are required to:

(i) Design the pile cap **(8 point)**

(ii) Give detailed drawing of the footing reinforcement **(3 point)**

Question No. (5) (12 point)

(a) Discuss by neat sketches the using of field tests in the design of the piles **(4 point)**

(b) A pile load test was performed on a pile with the following properties:

Pile length = 17.00 m Pile diameter = 0.60 m

Modulus of elasticity of pile material = 140 t/cm^2

The piles were designed to carry safe load = 100 t

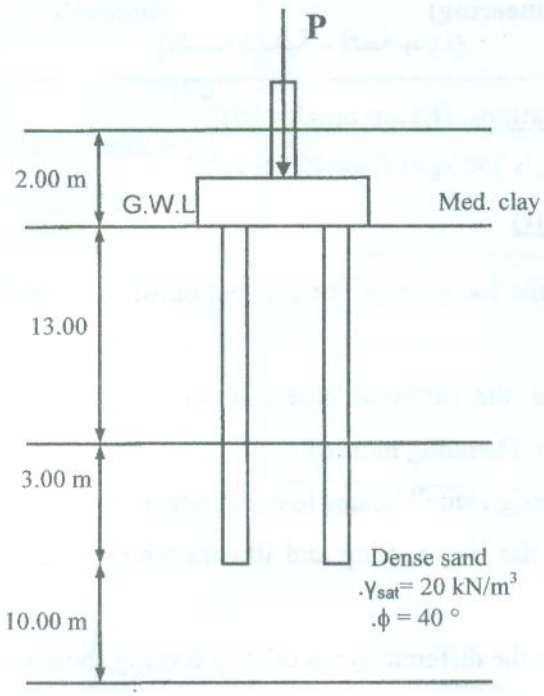
The results of the pile load test are given in the following table

Load, tons	0	25	50	75	100	120	150
Settlement , mm	0.0	0.25	0.66	0.90	1.50	2.08	2.85

Find out the safe pile load **(8 point)**

Question No. (6) (15 point)

(a) A square pile cap of four driven piles group carries a column load of (P) kN at ground level. The pile diameter is 50 cm, pile spacing (center to center) is 1.50 m and Nq = 150. Find the safe pile load **(8 point)**



(b) Using clear sketches show how to predict the settlement of pile group in different soil condisions. **(4 point)**

(c) Draw the details of strap beam connecting edge 2 piles cap with internal three piles cap, (the details of strap only) **(3 point)**

Best of luck أ.د.م: مصطفى الصواف - أ.د.م: أشـــرف نظـــير

Tanta University
Faculty of Engineering
Structural Engineering Department
3rd year Civil (structure Engineering)

Design of Foundations (1); CSE3232
Term Exam, June. 2012
Thursday 7/ 6 / 2012
Allowable time: 3 hours

(هندسة إنشائية – لائحة جديدة)

Answer all the following questions. (Exam mark =85)

For all the problems; consider F_{cu} is 250 kg/cm^2 and H.T.S 36/52.

Question No. (1) (15 point)

(a) Using clear sketch, show the location of critical section of moment for different types of wall footing. **(3 point)**

(b) Using clear sketch discus the different cases of stress distribution under isolated footing subjected to vertical load and bending moment. **(3 point)**

(c) Discuss in details how to design smell beams to resist lateral loads. **(3 point)**

(d) Using clear sketch define the ring footing and illustrate how to determine its dimensions and reinforcement. **(3 point)**

(e) Using clear sketch illustrate the different types of strip footing showing when each type is used. **(3 point)**

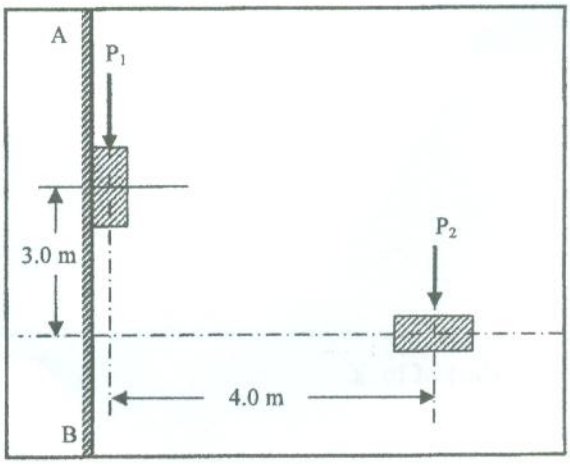
Question No. (2) (14 point)

(a) A square column (40 x 40) cm carries vertical load = 81.0 t and is subjected to M_y = 18.0 t m. The allowable net bearing capacity $q_{all\ net}$ = 1.40 kg/cm^2 and the thickness of the plain concrete is 50 cm. A square plain concrete footing (300 x 300) cm is suggested. You are required to:

(i) Check the stresses between the plain concrete footing and soil. **(4 point)**

(ii) Design the reinforced concrete footing. **(4 point)**

(b) The shown two columns are 40 x 70 cm. The line AB is the property line. The allowable net soil pressure is 1.35 kg/cm^2 and the thickness of plain concrete = 20 cm.



You are required to suggest the suitable footing and give the dimensions of suggested system (only length and width (don't design)) for the following two cases:

(i) p_1 = 90 t and p_2 = 135 t **(3 point)**

(ii) p_1 = 80 t and p_2 = 70 t **(3 point)**

C. Fig. 3 shows a structural plan and sectional elevation of stair case. The stair elements are strip footing, two walls W1 and W2 and beam B that supported on columns C1 and C2. The **slab thickness is 220mm** and the step dimensions are 300mm going and 150mm rise. It is required to carry out the following:

a. **Without any calculations,** sketch the B.M and the reinforcement details of the critical strips. **(5marks)**

b. Calculate the design loads of critical strips of the stair slabs; consider the flooring cover is 1.5kN/m^2. Calculate the walls loads W1 and W2. **(5 marks)**

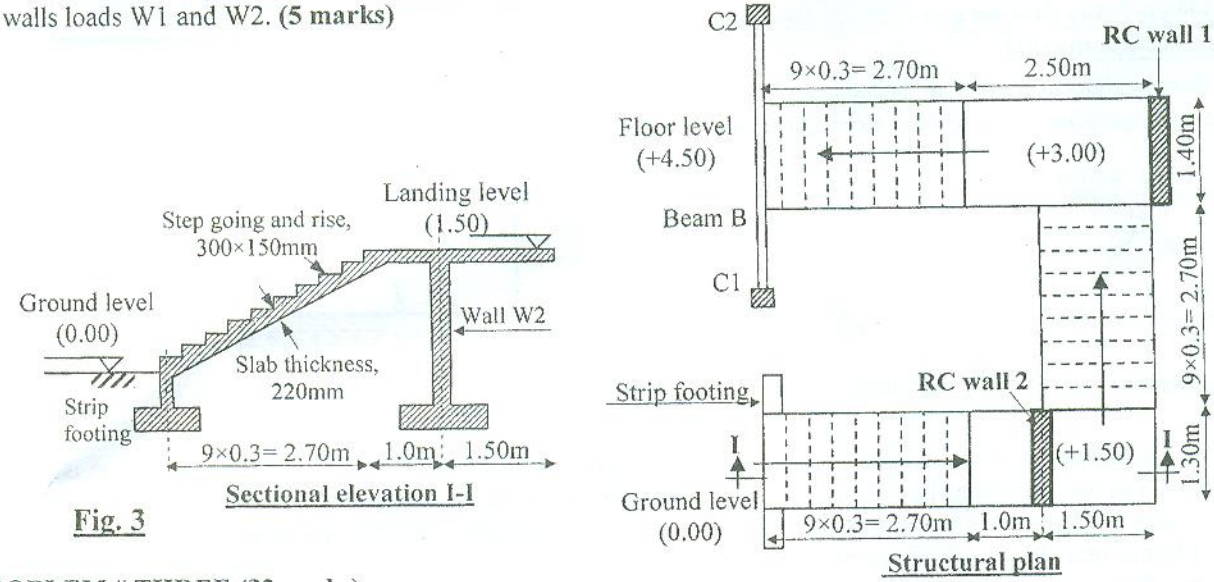


Fig. 3

PROBLEM # THREE (32marks)

Fig. 4 shows plan and sectional elevations of an industrial hall (L×42m). The columns are allowed only in the outer perimeter of the hall. There are five cases of a roofs may be used to covering this hall as shown in the sectional elevation I-I. It is required to carry out the following:

a. Suggest the **more economic** main supporting elements "MSE" (as possible as you can) that carry the given roofs. **(5marks)**

b. **For the three roofs of cases 1, 3 and 4 only: draw** to suitable scale the sectional elevations, showing the concrete dimensions of all necessary structural elements. Using diagrammatic sketches, **illustrate** the loads transfer up to the footings. **(12marks)**

c. **For the roof of case 5 only: design** the critical sections of **MSE** and its main elements, if the average ultimate total loads on the MSE are 18kN/m^2. The own weight of MSE may be estimated. **Draw** to convenient scale the sectional elevation of the MSE showing the reinforcement details of the MSE and its elements. **(15marks)**

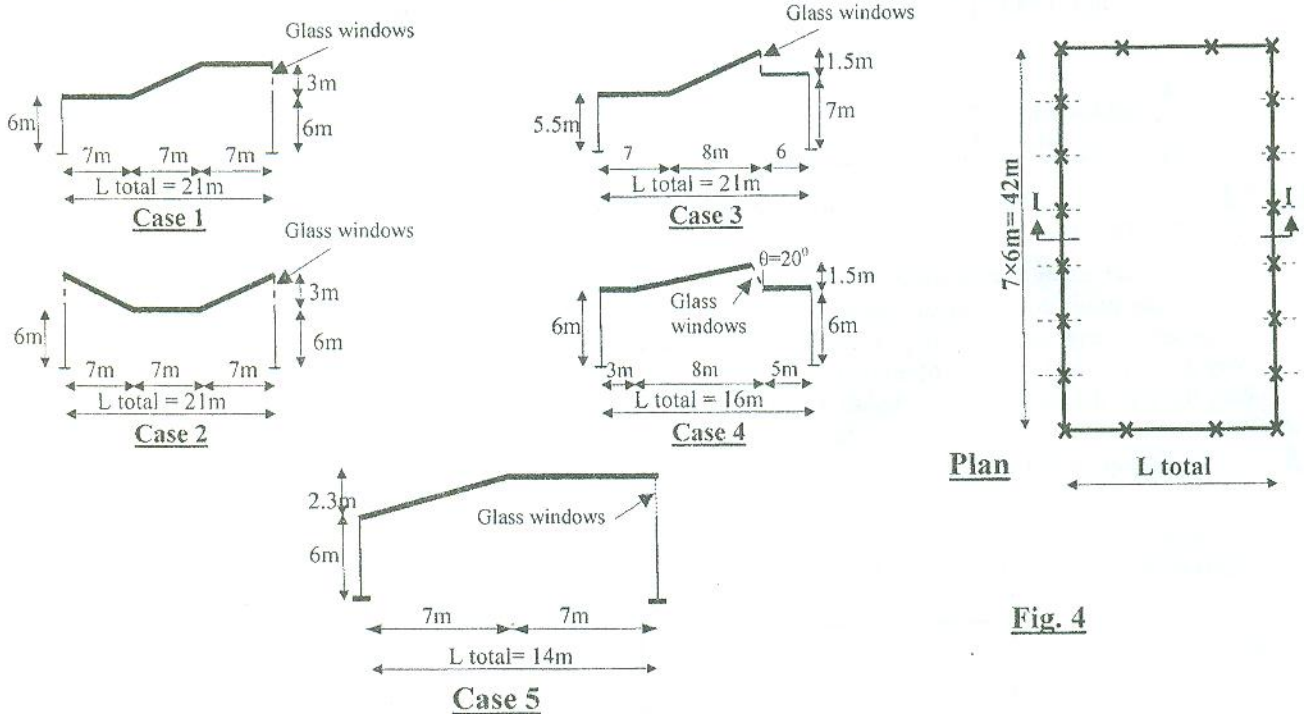


Fig. 4

Sectional Elevations I-I for five cases of a roofs

مع أطيب الأمنيات بالتوفيق

أ.د. محمد أحمد قاسم أ.د. طارق فوزى الشافعى

TANTA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF STRUCTURAL ENGINEERING مدنى وإنشاءات لائحة جديدة
EXAMINATION (THIRD YEAR) STUDENTS OF CIVIL AND STRUCTURAL ENGINEERING

COURSE TITLE: DESIGN OF REINFORCED CONCRETE STRUCTURES (2) b			COURSE CODE: CSE3210/3223
DATE: JUNE-2012	TERM: SECOND	TOTAL ASSESSMENT MARKS: 75	TIME ALLOWED: 4 HOURS

For all problems consider that: f_{cu}=30MPa, St.400/600

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

الإمتحان مكون من 3 أسئلة فى صفحتين

PROBLEM # ONE (28 marks)

A. Fig. (1-*a*) shows different frames under the given loads. It is required (**without any calculations**) to sketch the B.M.D and the corresponding main tension steel. **(6marks)**

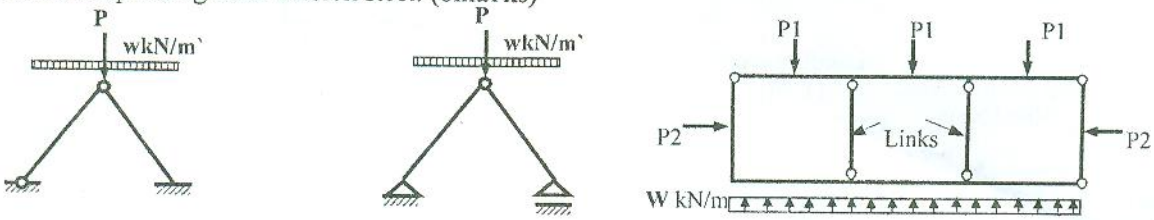


Fig. 1-*a*

B. Which is dangerous: opening corner joints or closing corner joints and why? Sketch crack pattern in each joint. **(4marks)**

C. Fig. (1-b) shows statical system of an intermediate frame ABCDEFG of a series frames spaced 5m. The frame is to be considered braced in two directions in-and-out of plane of the frame. The frame is hinged at A and a link support DC. It is required to make a complete ultimate strength design one of the intermediate frame having breadth 400mm and the slab thickness 120mm and the depth of the main girder 1.2m and depth of the cantilevers (0.6/0.8m) for the given ultimate loads including own weights and the vertical reaction at A equals (YA= 900kN). Determining the following:

a) B.M., S.F. and N.F. diagrams. **(6marks)**

b) Design the critical sections and check shear stresses of the frame. **(6marks)**

c) Draw to convenient scale the intermediate frame showing clearly the concrete dimensions and the reinforcement details in elevation and in cross sections. **(6marks)**

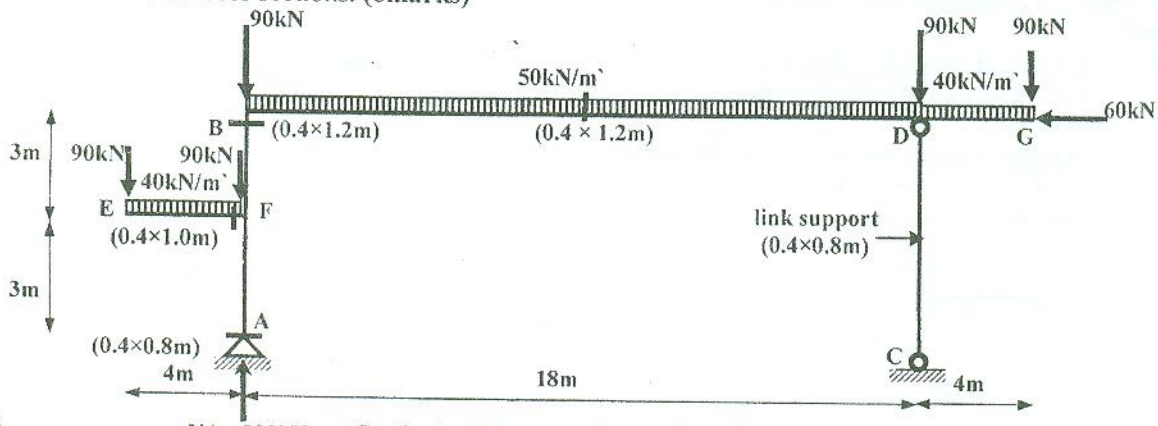


Fig. 1-b Statical system, ultimate loads and concrete dimensions

PROBLEM # TWO (32 marks)

A. *a-* What are the advantages and disadvantages of a tension and compression structures? **(4marks)**

b. What is the main condition to ensure coinciding line of pressure on the following main supporting elements: arched girder - triangular shed - trapezoidal shed. **(2marks)**

c. Why the horizontal reaction of arched slab is increased by 5% than that of arched girder? **(2mark)**

d. Why the foot thickness in arched slab is greater than that at crown? **(2marks)**

e. How do you ensure uniform distribution of light inside halls in a saw – tooth roof structures? **(1mark)**

f. What will happen if the tie reinforcement splits in the arches? **(2mark)**

B. Fig. 2 shows a Vierendeel girder of span 20m. It is required to carry out the following: Draw B.M., S.F. and N.F. diagrams of the V.G under the given loads. Draw the shape of reinforcement of the part marked (A). **(9 marks)**

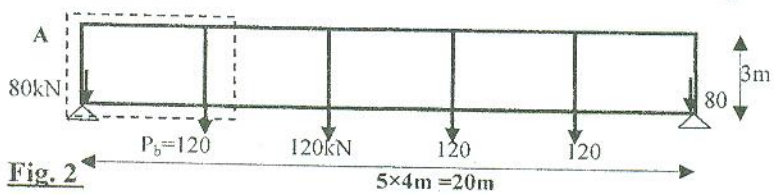


Fig. 2

Please Turn Over ⟶

a- Draw to scale 1:100 full plan, elevation and side view showing the bracing system. **(15 %)**

b- Calculate the applied loads assuming 2.0 meters between each two purlins. **(3 %)**

c- Tabulate the **factored** design **normal force, shearing force** and **bending moment** for the critical sections at a and b. **(15 %)**

d- Design a hinged base at support (a) which can carry a maximum load N_u = 20t and shearing force of 12 t. Draw to scale 1: 10 the different details of the base. **(10 %)**

Note: Live load and wind load are to be taken according to Egyptian Code

Question 3:

a. Design the beam column (a-c) of the frame shown in Fig. (3). The straining actions **neglecting the effect of wind** loads are as follows: **(15 %)**

- At section (a) $M_u = 0$, P_u = 12 t compression, and Q_u = 3.5 t
- At section (c) M_u = 20 t.m P_u = 12 t compression, and Q_u = 3.5 t
- (second order effect is already included)

- Use the end relative stiffness of the columns as: G_a = 10 (hinge) and G_c =1.85 to calculate the effective buckling length.

- Try cross section of the column is initially assumed HEB300mm.
- Use St52 (F_y = 3.6 t/cm^2 and F_u = 5.2 t/cm^2)

b. For the typical beam - column connection at (c) designed as **Category C** and subjected to: **(25 %)**

M_u = 20 t.m.
P_u = 3.5 t. (comp.)
$Q_u = V_u$= 12 t,

It is required the following:

1- Number of used high strength bolts of type **10.9**.
2- Check of weld between the end plate and the rafter of the frame.
3- Thickness of end plate connecting the rafter and the frame column.
4- Check of panel-zone web shear (Refer to page 10-7, 10-8 and 10.9) of ECP2008 LRFD, first edition.
5- Do you need additional stiffeners at the corner? (Refer to page 10-10 and 10.11 of ECP2008 LRFD, first edition)
6- **Draw** the part enclosed by dotted rectangle to scale **1:10.**

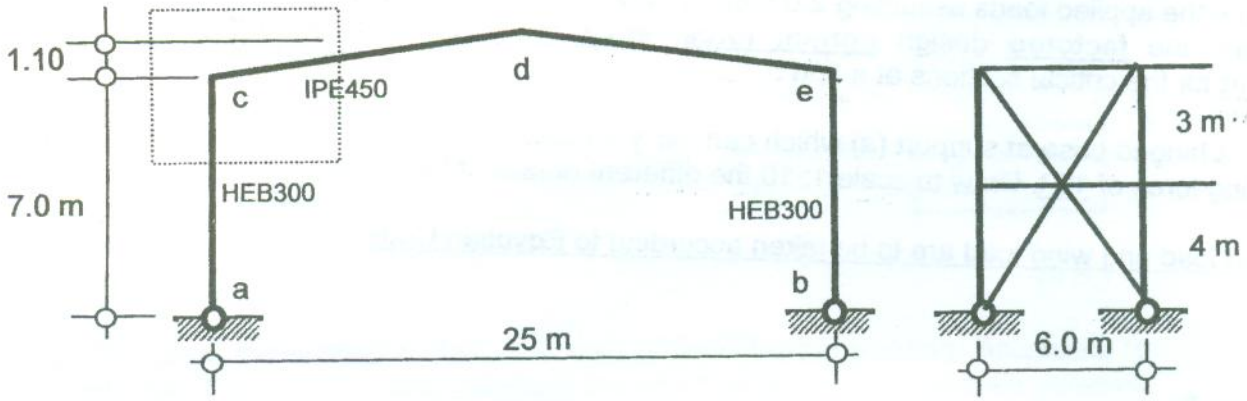


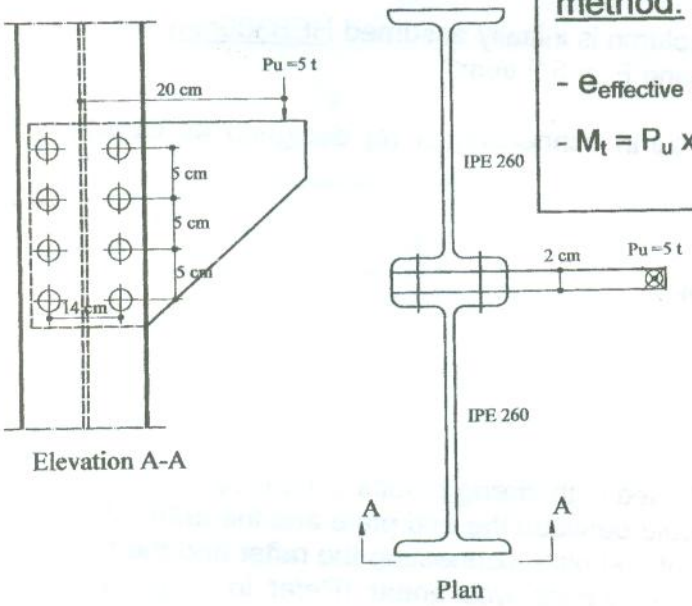
Fig. (3)

Question 4: (12 %)

Check the stresses for the bolts in the following bracket by using high strength bolts of grade 10.9 as bearing type (ϕ = 16 mm) and use steel plate of grade St 52.

Use reduced eccentricity method:

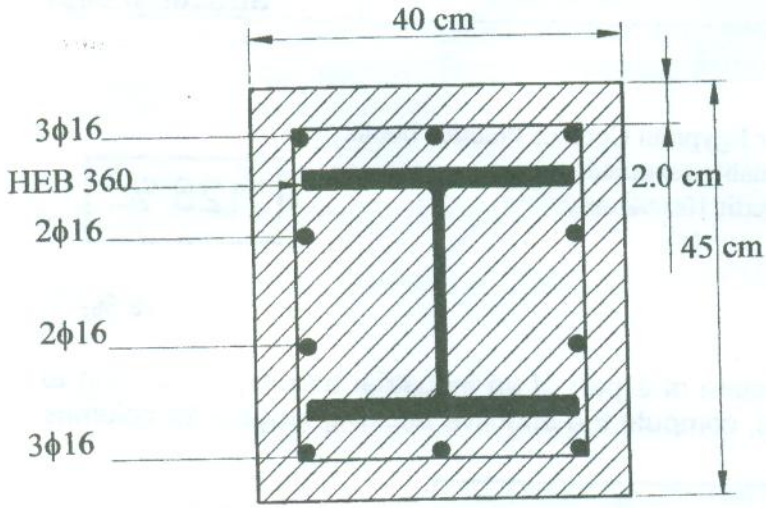
- $e_{effective} = e_{actual} - \frac{1+n}{2}$
- $M_t = P_u \times e_{effective}$



Question 5:

5.a) Discuss briefly with neat sketches the different types of composite columns and its advantages against reinforced concrete ones. **(05%)**

5. b) If the calculated design ultimate axial load (P_u) and ultimate moment (M_{ux}) about the major axis are 550 t and 10 t.m, respectively. Check the given cross-section of composite column (concrete encased section). **(9% & 8%)**



Given data:

- Steel grade ST52 (F_u = 52 kN/cm^2 and F_y = 36 kN/cm^2)
- Steel reinforcement of grade 36/52
- F_{cu} of concrete is 4.0 kN/cm^2
- Column effective length in both sides is (5.0 m)
- Full shear connection between the steel column and the concrete is assumed by means of using stud shear connectors of diameter 25 mm and 140 kN capacity for each.
  - Use the following equations for axial effect

$P_u = \phi_c P_n$ .....

$= \phi_c A_s F_{cr}$ .....

For inelastic buckling, $\lambda_m \leq 1.1$ $F_{cr}=(1- 0.348\ \lambda_m^2)\ F_{ym}$

For elastic buckling, $\lambda_m \geq 1.1$ $F_c = 0.648\ F_{ym}/\ \lambda_m^2$

Where:

$F_{ym} = F_y + c_1 F_{yr} (A_r/A_s) + c_2 F_{cu} (A_c/A_s)$ .....

$E_m = E_s + c_3 E_c (A_c/A_s)$ .....

λ_m = *Slenderness parameter* = $L_b(F_{ym}/E_m)^{1/2} / \pi r_m$ .....

- Use the following equations for bending and combined effect

For $P_u/((\phi_c P_n) \geq 0.20$

$P_u/(\phi_c P_n) + (8/9) \{ M_{ux}/(\phi_b M_{nx}) + M_{uy}/(\phi_b M_{ny}) \} \leq 1.0$

For $P_u/(\phi_c P_n) < 0.20$

$P_u/(2\phi_c P_n) + \{ M_{ux}/(\phi_b M_{nx}) + M_{uy}/(\phi_b M_{ny}) \} \leq 1.0$

Best wishes

Prof. Dr. Mohamed A. Dabaon + Exam. committee

Dept.: Structural Engrg.	Faculty: Engineering	University : Tanta
Time allowed: 3 hr. Date: June 2012	Course: Design of steel structures (b)	Course code: Civil : and Structural Dept[s].

Note:

- Open book examination.
- It is allowed to use any tables or Egyptian Code of Practice books.
- Any missing data may be reasonably assumed.
- Attempt all questions. Max. Credit 100 % only.
- Number of examination pages: (4).

125 %

Question 1: (8 %)

Fig. (1) shows the statical system of a part of an industrial building. According to the Egyptian Code of Practice, compute the effective buckling lengths for columns 1-2, 3-4, 5-6 and 6-7.

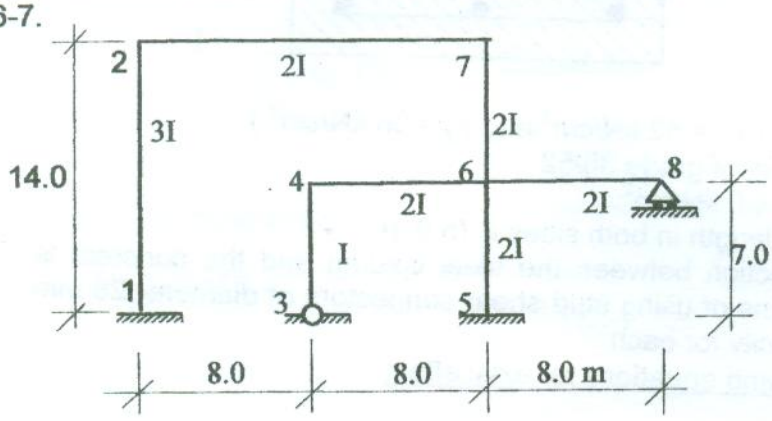


Fig. (1)

Question 2:

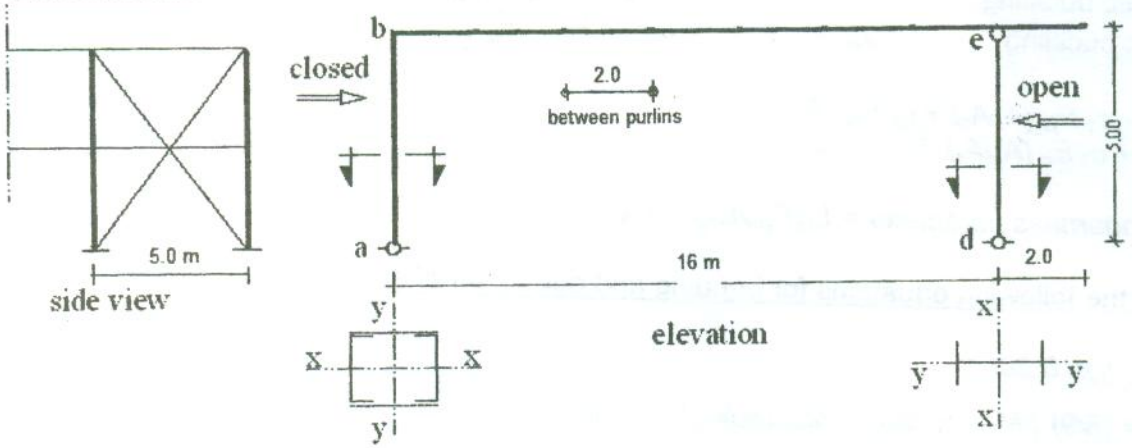


Fig. (2) Statical system of an intermediate frame

Fig. (2) shows an intermediate main system of a covered area 18m x 25m. The weight of the steel sheet cover is assumed to be **8 kg/m^2**. For the shown intermediate main system of Fig.(2), it is required the following:

Tanta University
Faculty of Engineering
Structural Engineering Department
Final Term Exam 3rd str.Dept.

Course Title: **Soil Improvement** | ***Course Code: CSE 3233*** | ***Time allowed: 3.0 hours***
Total Marks: 85 | ***Date: 19/6/2012*** | ***No. of Pages: (2)***

Any Missing Data to be Reasonably Assumed.
(ملاحظة: إجابة كل سؤال في ورقة منفصلة و الاستعانة بالرسم الواضح كلما أمكن)

Question No. 1 ***(15 Marks)***

1-a) What are the factors to be considered in the selection of additives? ***(5 Marks)***

1-b) Put true or false in front of the following sentences and corrects the mistakes: ***(5 Marks)***

(1) Granular soil-cements do not appear susceptible to sulfate.
(2) The use of sulfate-resistance cement may improve the resistance of clay-bearing soils.
(3) Clay with sodium better to be stabilized by cement.
(4) The ratio between lime, cement and fly ash mixture should be 1:3:4 respectively.
(5) Asphalt stabilization can improve durability characteristics.

1-c) Complete the following sentences: (Do not complete with Arabic) ***(5 Marks)***

(1) Using chemical stabilization can substantially increase the ..... and .....
(2) The percentage of cement required for stabilization sandy soil is ..... %
(3) The type of bitumen to be used in stabilization depends on ..... and .....
(4) Three types of dynamic compaction for deeper layers of soil are ....., ..., and .....
(5) Lyman law (1942) stated that .....
(6) Absorption and chemical binding of moisture will facilitate.....

Question No. 2 ***(12 Marks)***

Design a 6.0 m high geogrid-reinforced wall **(Fig. 1)**, where the reinforcement maximum spacing must be at 1.0 m. $C_r = 0.8$, $C_i = 0.75$, and $T_a = T_{design} = 26$ kN/m. The other details are given in the figure.

Question No. 3 ***(13 Marks)***

A section of a retaining wall with the backfill reinforced with metal strips is shown in figure 2. The backfill surface is subjected to a limited surcharge of 30 kN/m^2. Given: b = 100 mm, t = 5 mm, f_a = 143.7 MPa, $F_S = 1.5$, F_S (steel) = 1.67, s = 0.5 m, and h = 0.5 m. **Note**: use equal spacing.

Required: **(a) Complete** design for strip number 4.
(b) Check the maximum tension in the critical strip.

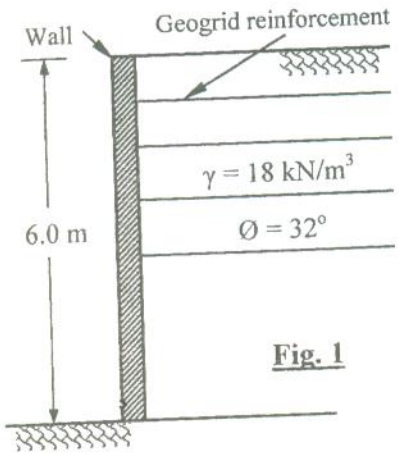


Fig. 1

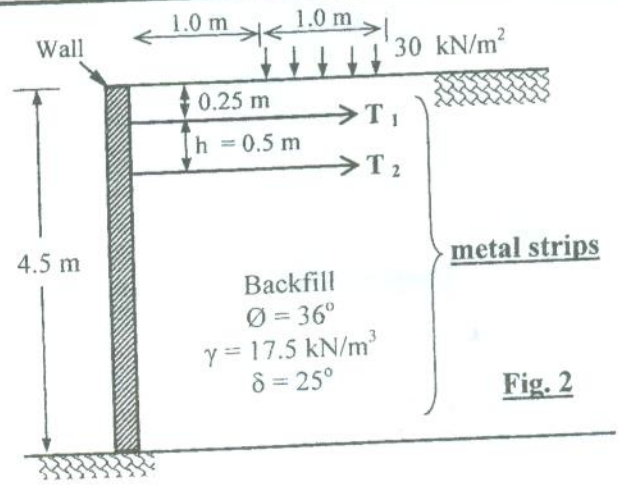
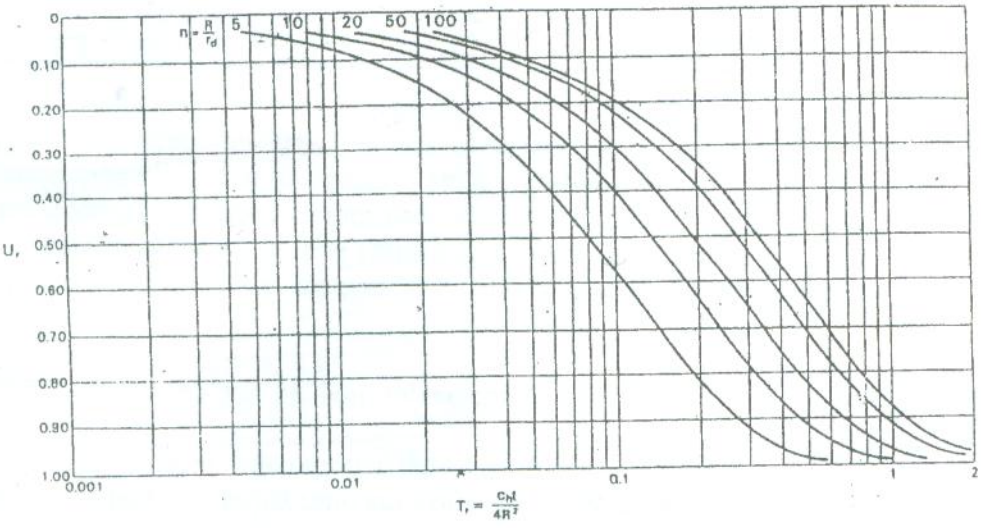


Fig. 2



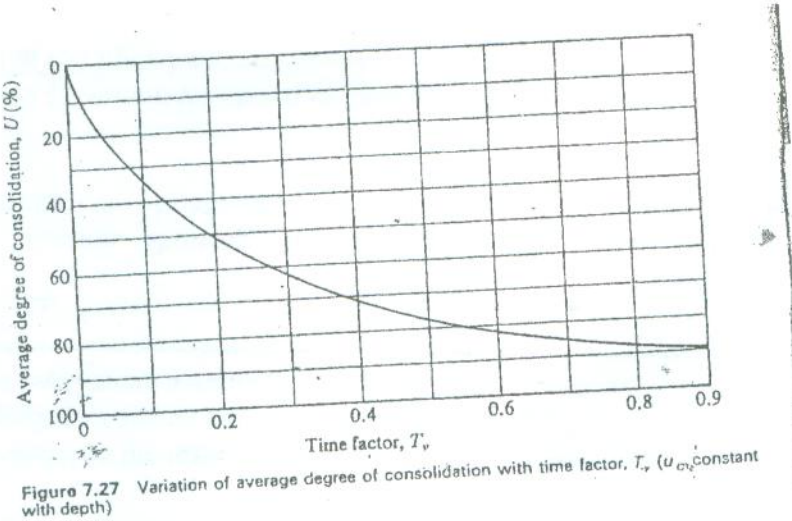
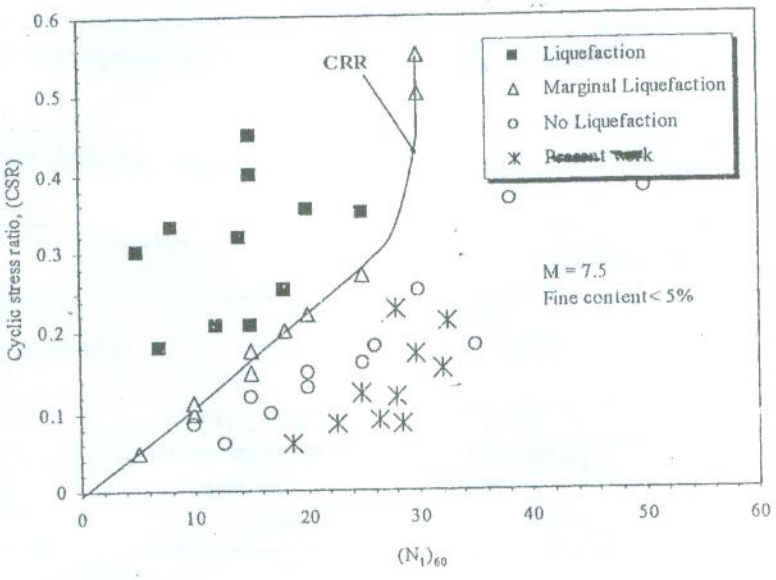


Figure 7.27 Variation of average degree of consolidation with time factor, T_v (u_{cv} constant with depth)



i-The maximum dynamic shear force in column **ef**.

ii-The maximum dynamic normal stresses in column **ab**.

iii-The amplitude of harmonic load (Fo sin 6.5 t) t acting at the level of girder that gives the same displacement at point (b) due to the ground motion.

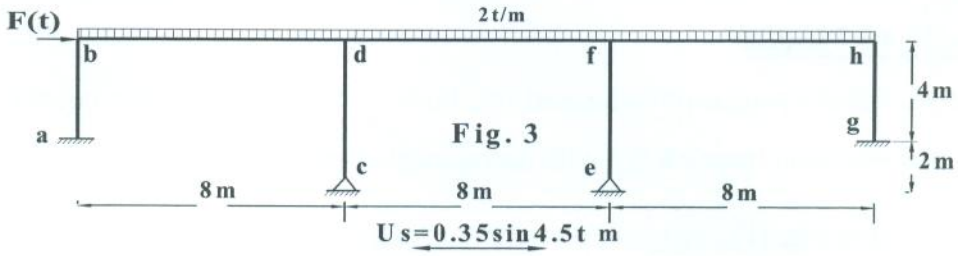


Fig. 3

4- Problem (4) 20 Marks:

The water tank shown in Fig. (4-a), is subjected to the blast loading shown in Fig. (4-b). If the stiffness of the column ab k= 800 t/cm, determine:

i- The lateral displacement of the tank after (0.8 sec).

ii- The maximum shear force in column **ab**.

iii- The amplitude of sinusoidal ground motion (uo sin 5.2 t) cm that gives the same maximum displacement of the tank due to the blast loading.

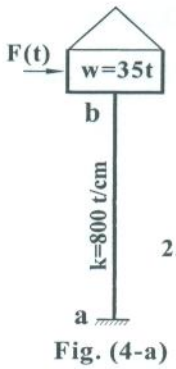


Fig. (4-a)

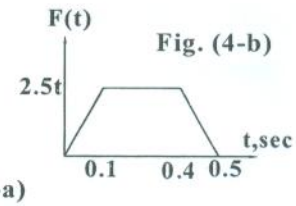


Fig. (4-b)

5- Problem (5) 18 Marks:

a. Draw the free body diagram and mathematical model for three story shear building and obtain the equation of motion.

b. For the two story shear building shown in Fig. (5). If E = 200t/cm^2 ,and I = 0.001 m^4 , determine:

i- The natural frequencies

ii- The modal shapes.

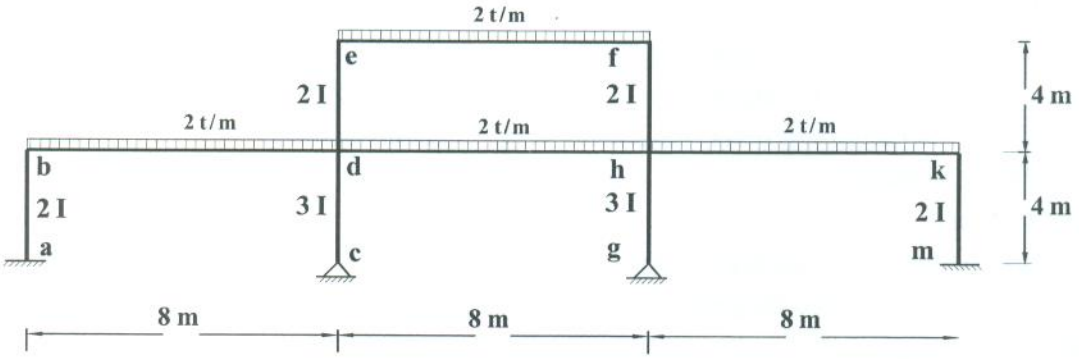


Fig. (5)

With the best wishes

Course Examination Committee

Prof. Dr. Saher Raaft Elkhoreby

Dr. Tarek Mohamady Khalifa

Remarks: (answer the following questions… assume any missing data…)

1- Problem (1) 15 Marks:

a. Write the differential equation of undamped free body motion and solve this equation to find the undamped free vibration response (u) with initial displacement u_0 and velocity v_0

b. The beam shown in Fig. (1) , supports a machine which exerts vertical harmonic loading F(t) =(7.5 sin 5.5t) t. The cross section of the beam is (30x60 cm) and the modulus of Elasticity of the beam, E=200t/cm^2. The machine supported on two springs. The stiffness of each spring is 10t/cm. The weight of the machine W=5.0t and the damping ratio =4%. Draw the mathematical model and determine:

i- The natural frequency and time period of vibration.

ii- The maximum dynamic normal stresses in the beam.

iii- What would be the frequency of the harmonic loading required to give the same steady state amplitude if the beam becomes hinged – hinged end supports

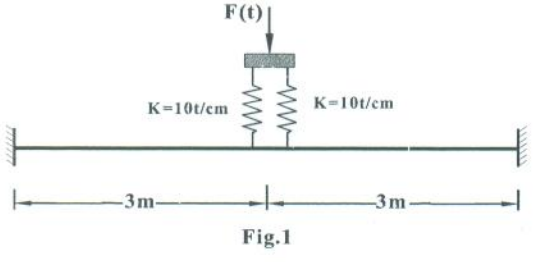


Fig.1

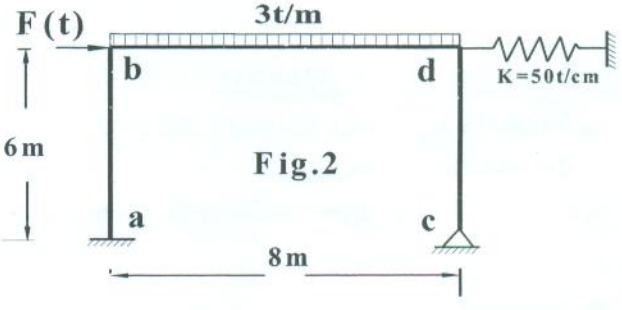


Fig.2

2- Problem (2) 17 Marks:

a. Define the critically damped system and obtain the critical damping value c_{cr}

b. The frame shown in Fig. (2), is subjected to horizontal dynamic force at the girder level F(t)=(15sin 10t) t, with damping ratio = 5% if the cross section of columns are (40x100 cm) and E=200t/cm^2 determine:

i- The steady state amplitude.

ii- The maximum dynamic normal stresses in column **ab** and **cd**

iii- The maximum dynamic force transmitted to foundation.

3- Problem (3) 16 Marks:

For the frame shown in Fig. (3), the columns section are (40x100 cm) and the modulus of elasticity, E=200t/cm^2. If the frame is subjected to the shown harmonic ground motion and assuming damping ratio = 5% determine:

P.T.O.