	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 – 2023	TERM: SECOND	TOTAL ASSESSMENT MARKS: 75	TIME ALLOWED: 4 HOURS

Systematic arrangement of calculations and clear neat drawings are essential. Assume any data not given. Consider for all problems, f_{cu}= 30MPa and f_y= 400MPa. The exam consists of three problems in two pages. Answer many questions as you can.

Problem # 1 (27 Marks)

A. i. An arched girder carries a horizontal roof at the level of the tie. A cut has occurred in the reinforcing steel of one of the hangers, either due to corrosion or due to the incorrect the reinforcement details of the hanger with the structural elements connected to it. It is required to:

a) Draw the correct reinforcement details for the hanger with the structural elements connected to it? **(2Marks)**

b) What will happen to the structural elements because of cutting the reinforcement of the mentioned hanger? **(2Marks)**

ii. What are the selection criteria of an efficient structural system? **(1Mark)**

iii. Compare between the following items: Arches with and without tie - Arches with and without hangers - Tension and compression structures. **(3Marks)**

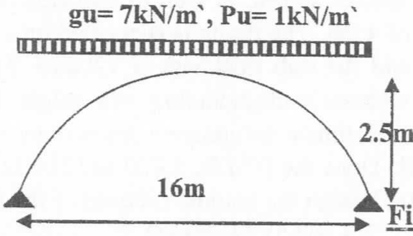


Fig. 1

B. Figure 1 shows one meter strip of the arched slab of span 16m carries an ultimate dead and live loads **(gu and Pu)** shown in the figure. The following data are considered: Column spacing **S= 6m**, ultimate own weight of the vertical and horizontal beams= **5 and 8kN/m`**, respectively, ultimate load of the stiffener, $w_{u,stif}$= **6kN/m`**. **It is required to** ***determine*** the loads and straining actions on all components of the structure. ***Make a complete design*** (design + drawing details) of the **arched slab** and the **tie. (12Marks)**

C. Figure 2 shows a Vierendeel girder of span 25m. It is required to ***draw*** the B.M.D, S.F.D and N.F.D diagrams of the **V.G** under the given loads and design the marked member **(A). (7Marks)**

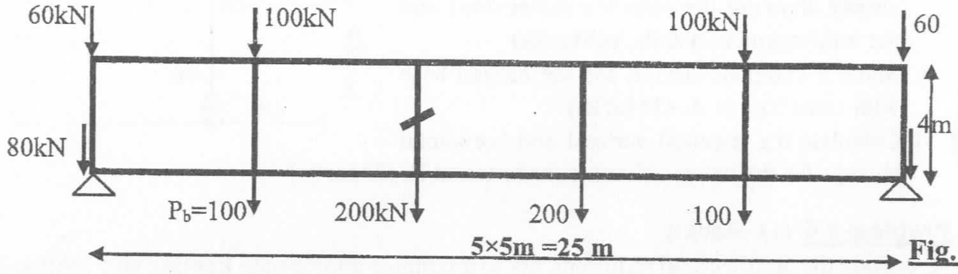
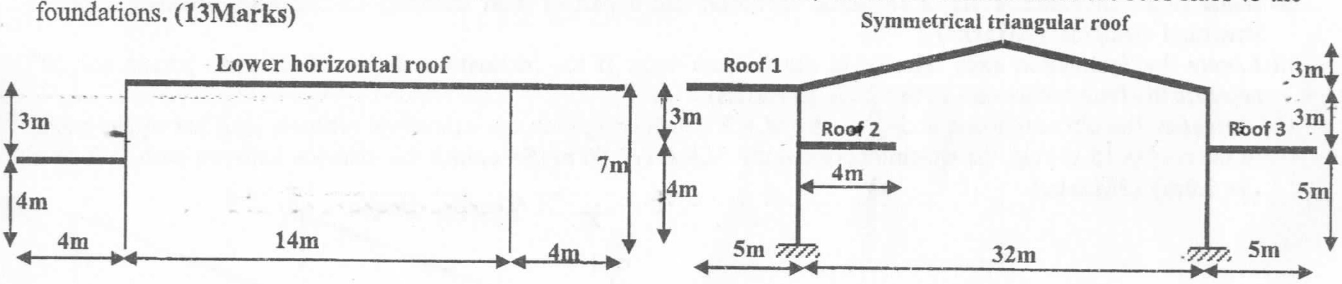


Fig. 2

Problem # 2 (25 Marks)

Figure 3 shows general layout of architectural sectional elevations of covering industrial halls using two different roofs, as shown in **cases 1 and 2**. The supported columns of spacing, **S= 7m** are only allowed on the outer perimeter of the halls. It is required to carry out the following:

i- **For the roofs of cases 1 and 2:** ***Suggest*** more economic main supporting elements **(MSE)** to carry all slabs of each roof and ***draw*** to a suitable scale structural sectional elevation, showing concrete dimensions of all necessary needed elements. ***Using diagrammatic sketches, illustrate*** without calculations, the loads transfer from the roof slabs to the foundations. **(13Marks)**



Case 1 Fig. 3 Case 2

ii- **For the roof of the case 1:** ***Make a complete design*** (design and reinforcement details) for the suggested MSE and its components. Consider the average total ultimate loads from the roof and its elements on the MSE is **20kN/m²** not included own weight of the MSE. **(4Marks)**

iii- **For the roof of the case 2**: ***without calculations, draw*** of shape of the B.M.D and the main reinforcement of the triangular roof slabs. ***Determine*** the straining actions of the suggested **MSE** of the triangular roof if average total ultimate loads from the roof and its elements on the MSE is **20kN/m²** not included own weight of the MSE. **(8Marks)**

PLEASE TURN OVER →

Problem # 3 (24 Marks)

(a) Sketch the possible shear cracks in opening and closing joints in RC frames. **(1Marks)**

(b) State the ECP recommendations for lab, mechanical and welded splices of the steel reinforcing bar. **(2Marks)**

(c) For each of the RC structures shown in **Figure 4**, it is required to ***draw*** shape of the B.M.D under the given uniform load. ***Sketch*** shape of the longitudinal reinforcement. ***Classify*** type of the joint (A). ***Sketch*** shape of the transversal reinforcement at joint (A). **(3Marks)**

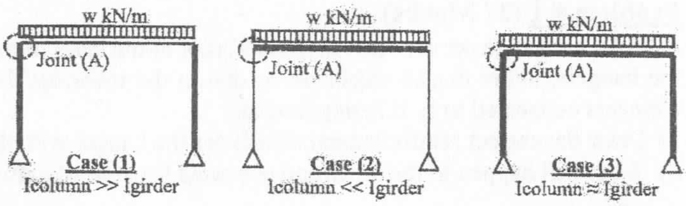


Fig. 4

(d) Figure 5 shows the statical system, ultimate loads, and dimensions of intermediate RC frame ABCDEFGH. The frame is used to cover a hall with a span of 16.0m, as well as two side parks with a span of 4.0m. The frame is supported on a hinged support at (A) and a link member at (DG). The frame is spaced at 5.0m and the slab thickness is 120mm. The frame has a constant cross section width of 400mm. The given loads are ultimate loads including own weight. Determine the following:

i. Estimate the concrete dimensions of the frame elements. **(2Marks)**

ii. Draw the B.M.D, S.F.D and N.F.D. **(3Marks)**

iii. Design the marked sections of the frame (1, 2, 3, 4 and 5). **(4Marks)**

iv. Draw to a convenient scale the intermediate frame in elevation and in cross sections clearly showing the concrete dimensions and the reinforcement details. **(4Marks)**

v. Make a complete design for the hinged base with cross bars at A. **(3Marks)**

vi. Calculate the required vertical and horizontal stirrups for the beam-column-connection at B. **(2Marks)**

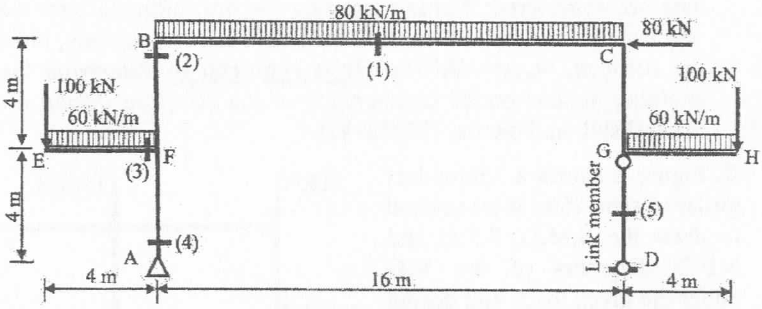


Fig. 5

Problem # 4 (14 Marks)

A. i- ***State*** the architectural requirements to guarantee appropriate lighting and ventilation in north-light roof structures? **(2Marks)**

ii- ***Define*** the following (using illustrative sketches): expansion, structural and settlement joints in reinforced concrete structures. **(2Marks)**

B. Figure 6 shows a sectional elevation of an industrial hall having **14m width and 40m length.** a north-light roof is required to cover this hall. The executed glass windows were vertical. It is required to:

i- ***Suggest*** a suitable main supporting element (M.S.E) to carry the shown north-light roof elements. **(2Marks)**

ii- ***Draw*** to a convenient scale; a sectional elevation and a part of plan showing all concrete dimensions of the structural elements. **(2Marks)**

iii-***Locate*** the foundation axes relative to the column axes. If the inclination angles of all glass panels are 20^0, ***relocate*** the foundation axes in this case. **(3Marks)**

iv- ***Calculate*** the ultimate loads acting on the ***M.S.E*** considering that; the equivalent ultimate load per square meter of the roof is 15 kN/m², the spacing between the ***M.S.E*** is 6.00 m **(S= 6.0m)**, the distance between posts is 2.00 m **(a= 2.0m)**. **(3Marks)**

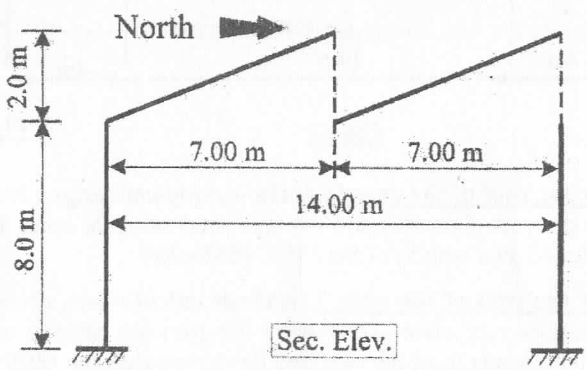


Fig. 6

All the best wishes

Prof. Dr. Tarek Fawzy El-Shafiey

Dr. Ali Hasan Abdel Mawgoud

Dr. Mohamed Ezat Ellithy

Tanta University	Structural Engineering Department Final Exam of Academic Year 2022/2023 Second term	Faculty of Engineering

Course Title:	**Structural Dynamics**	**Course Code:**	**CSE3235**	**Year :**	**3 rd Str.**
Date :	**7 June, 2023**	**Allowed Time:**	**3 hrs**	**Total Marks :**	**85 marks**

أجب عن الأسئلة الآتية - قم بفرض اى معلومات قد تراها غير معطاه - دعم دائما اجاباتك بالرسومات التوضيحية

Question [1] (10 marks)

a - Using clear sketches, define the following:

i - The relationship between the time and displacement in both free undamped vibration and free damped vibration systems.

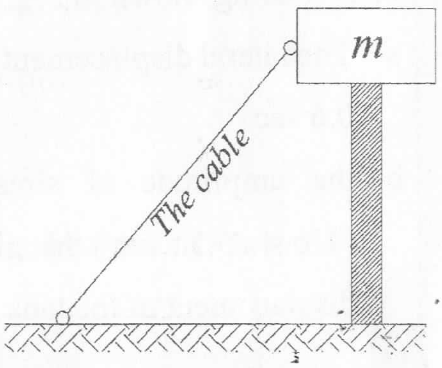
ii- The dynamic load factor (D.L.F).

iii - The assumptions that are considered for shear building.

b- Draw the free body diagram and mathematical model for a three stories shear building then obtain the equations of motion, the mass and stiffness matrices.

Question [2] (15 marks)

A free vibration test is conducted on an empty elevated water tank as shown in the figure. A cable attached to the tank applies a lateral horizontal force of 24 ton and pulls the tank horizontal by 4 cm. The cable is suddenly cut and the resulting free vibration is reordered at the end of four complete cycles, the time is 2 sec and the amplitude is 1.0 cm.



From these data compute the following:

a-The damping ratio   b- the stiffness   c- the weight

d- the damping coefficient

e- draw (to scale) four loops of the tank displacement in the X-direction in this case and compare it with the case of adding a damper to the system such that the damping ratio reaches 18%

Question [3] (15 marks)

The beam shown in Fig. 2 supports a machine which exerts vertical harmonic loading ($F_t = 1500 \sin 6.5t$) kg. The cross section of the beam is (25x50) cm and modulus of elasticity of the beam, E= 200 t/cm^2. The spring stiffness is 10 t/cm^2. the weight of the machine is 2 ton and the damping ratio = 5%,

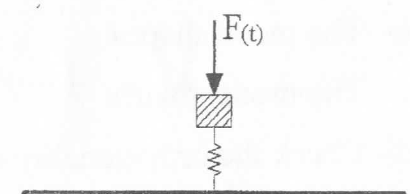
Determine:

a- the time period of the vibration

b- the maximum amplitude of vibration

c- the maximum dynamic normal stress in the beam

d- if the beam is fixed-fixed and the machine is supported directly on the beam without spring, what would be the depth of the beam that give the same steady state amplitude



Question [4]: (15 marks)

For the frame shown in Fig. 3, the columns section are (40 x 80 cm) and the modulus of elasticity, E= 200 t/cm^2. If the frame is subjected to the shown harmonic ground motion and assuming damping ratio = 4 % determine:

a- The maximum dynamic shear force in column ab.

b- The maximum dynamic normal stress in column ef.

c- The amplitude of a harmonic load (F_o sin 6.25 t) ton acting at the level of girder that gives the same max. displacement at point (b) due to the previous ground motion.

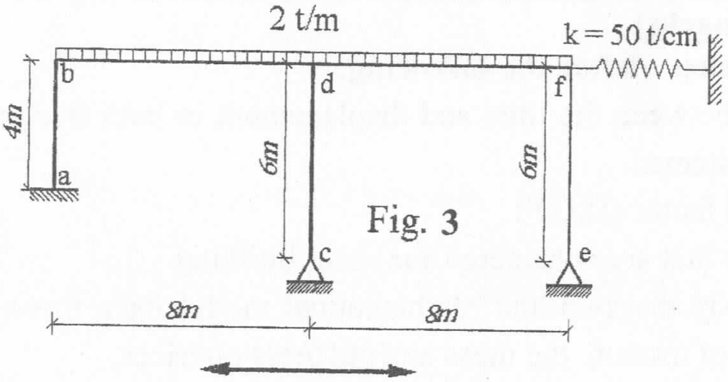


Fig. 3

U_g= (0.35 sin 4.5 t) cm

Question [5]: (15 marks)

The water tank shown in Fig 4.a, is subjected to the blast loading shown in Fig. 4.b. determine

a- The lateral displacement of the frame girder after 0.6 sec.

b- the amplitude of sinusoidal ground motion (Uo sin 5.5 t. cm) that gives the same maximum displacement of the tank due to the blast loading

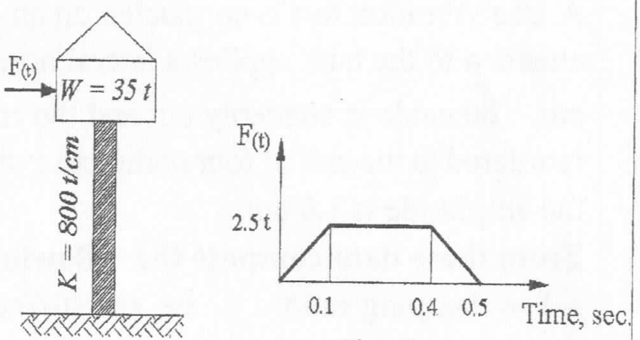


Fig. 4.a

Fig. 4.b

Question [6]: (15 marks)

For the two stories shear building shown in Fig.5.

E = 2000 t/ cm^2 and I = 0.002 m^4, determine:

a- The natural frequencies

b- The mode shapes.

c- The modal matrix

d- Check the orthogonality condition.

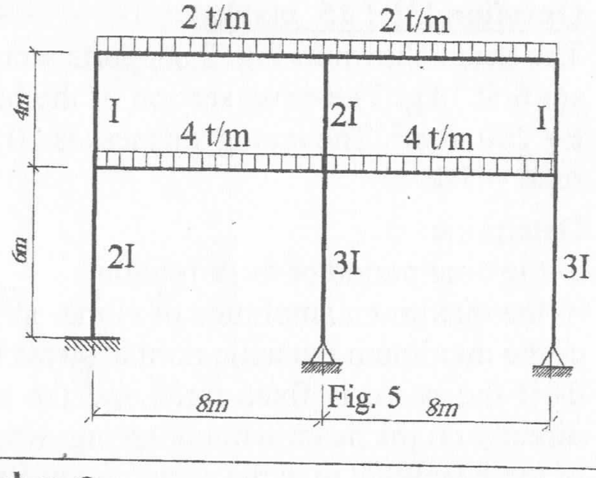


Fig. 5

☺ **With the best wishes** ☺

Course Examination Committee :

Dr. Tamer M. El Korany

Tanta University
Faculty of Engineering
Structural Engineering Department
Final Term Exam

Course Title: Soil-Structure Interaction *Course Code: CSE3127* *Time allowed: 3.0 hours*
Total Marks: 85 *Date: June 2023* *No. of Pages: (4)*

Any Missing Data to be Reasonably Assumed

Question No. 1 *(15 Marks)*

1-a) Discuss with details how to determine the subgrad reaction of soils in the filed **mention** to factors affecting their values . Also show the correction for subgrad reaction of square footing in clay and sand soils. **(5 Marks)**

1-b) What are the main difference between scant modulus and constrained modulus mention to determination methods . **(5 Marks)**

1-c) Explain the fallowing filed tests : cross hole and dawn hole test, state its impotents in soil structural interaction problems **(5 Marks)**

Question No.2 *(20 Marks)*

2-a) Give details for the simplest soil rheological model spring element or hooken model and Newtonian model - Also illustrate the element of ***composite model***. **(10 Marks)**

2-b) A machine foundation with an area of 1.5 x 2m^2, modeled **as mass-spring dashpot** in sandy soil with poison's ratio 0.25 and unit weight of 18 kN/m^3. The spring constant = 15000 kN/m. **(10 Marks)**

1- Determine the shear modulus of the supporting soil
2- Determine the **Damping** coefficient.
3- What will be the increase in the damping coefficient if the soil is replaced with other having a maximum unit weight of 20 kN/m^3?

Question No. 3 *(15 Marks)*

3-a) Define the contact stress (contact pressure) and **illustrate** the factors affecting on it. **Compare** with neat drawing between the rigid and flexible foundation for clay and sand soil showing the induced contact pressure and settlement. **(5 Marks)**

3-b) Determine the bending moment diagram as a beam on elastic foundation for the footing shown in Figure 1. The available data are: (Kp = 1.7 kg/cm^3, L = 5 m and t = 80 cm and E_f = 2 x10^6 t/m^2) . **(10 Marks)**

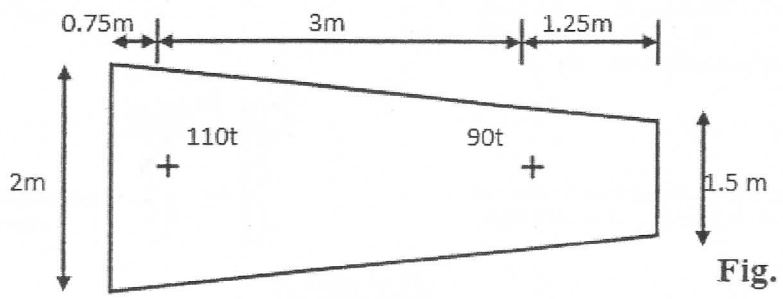


Fig. 1

Tanta University
Faculty of Engineering
Structural Engineering Department
Final Term Exam

Course Title: Soil-Structure Interaction *Course Code: CSE3127* *Time allowed: 3.0 hours*
Total Marks: 85 *Date: June 2023* *No. of Pages: (4)*

Question No. 4 *(15 Marks)*

4-a) Define the types of settlement. **Illustrate** with neat drawing the three phases of settlement for fine-grained soils as a function of time. **(3 Marks)**

4-b) **Demonstrate** the general precautions to avoid settlement of foundations. **(3 Marks)**

4-c) **Illustrate** with neat sketches the zone of influence in shallow foundation for square, rectangular and strip footing. **(3 Marks)**

4-d) A structure is to be supported on a reinforced concrete mat foundation whose dimensions are 20 m by 50 m. The load on the mat is to be uniformly distributed; its magnitude is 65 kPa. The mat rests on a deep saturated deposit of saturated clay for which the average undrained Young's modulus is approximately 40 MPa. **Estimate the immediate settlement** at the center and corner of the mat.

1. For flexible mat, $I_{p(Flexible)}$ = **1.63 at the center** and $I_{p(Flexible)}$ = **0.81 at the corner** **(3 Marks)**
2. For rigid footing, $I_{p(Rigid)}$ = **1.25** **(3 Marks)**

Question No. 5 *(20 Marks)*

5-a) Illustrate the sources of lateral and inclined loads on piles showing with neat sketches how to improve the lateral capacity of the piles. **(5 Marks)**

5-b) A reinforced concrete raft is supported on 98 reinforced concrete bored piles as shown in figure 2. The pile diameter, pile spacing, and the yield stress of pile material are 60 cm, 180 cm and 30000 kN/m^2 respectively. Modulus of elasticity of the pile $E_p = 2x10^7$ kN/m^2. **Determine the horizontal load capacity of this raft.** **(15 Marks)**

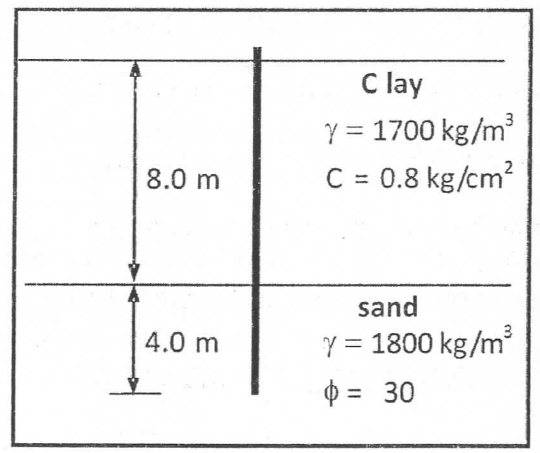
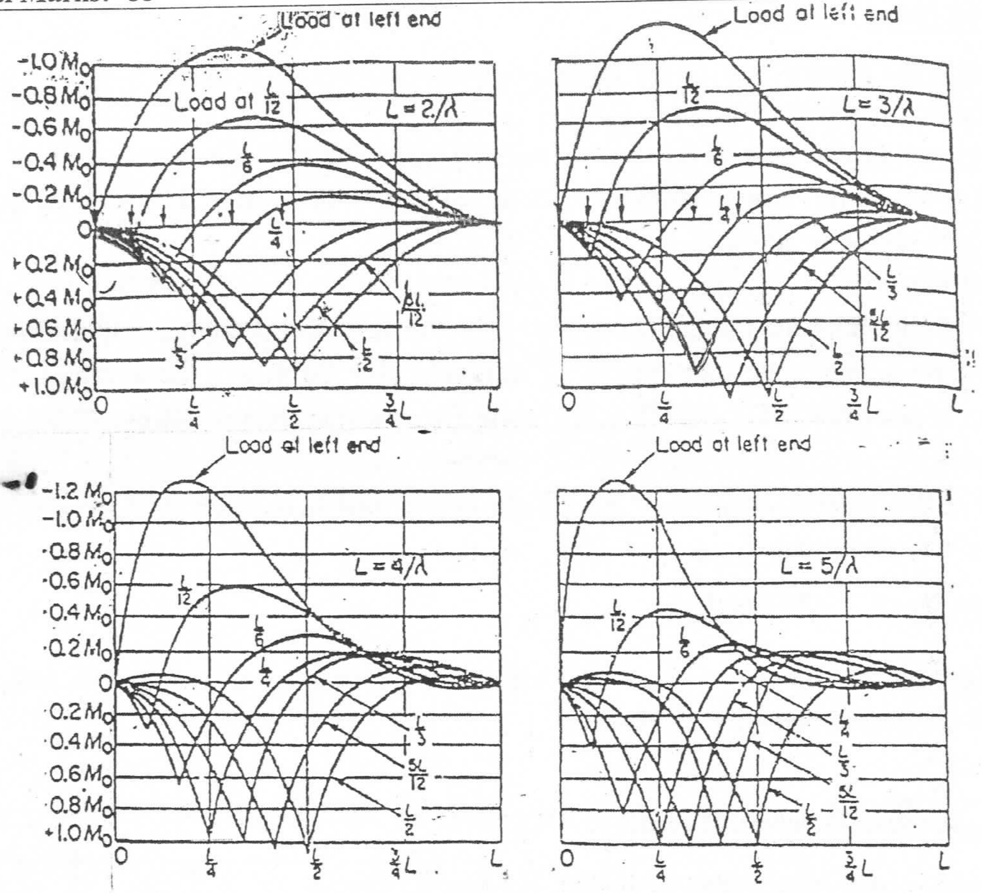


Fig. 2



Elastic lines for footings of finite length acted by a concentrated load, Seely and Smith

VALUES OF COEFFICIENTS n_1 AND n_2 FOR COHESIVE SOILS	
Unconfined Compressive Strength, q_u, (kPa)	n_1
Less than 48 kPa	0.32
48 to 191 kPa	0.36
More than 191 kPa	0.40
Pile Material	n_2
Steel	1.00
Concrete	1.15
Wood	1.30

VALUES OF K_h FOR COHESIONLESS SOILS		
	K_h, (kN/m³)	
Soil Density	Above Ground Water	Below Ground Water
Loose	1900	1086
Medium	8143	5429
Dense	17644	10857

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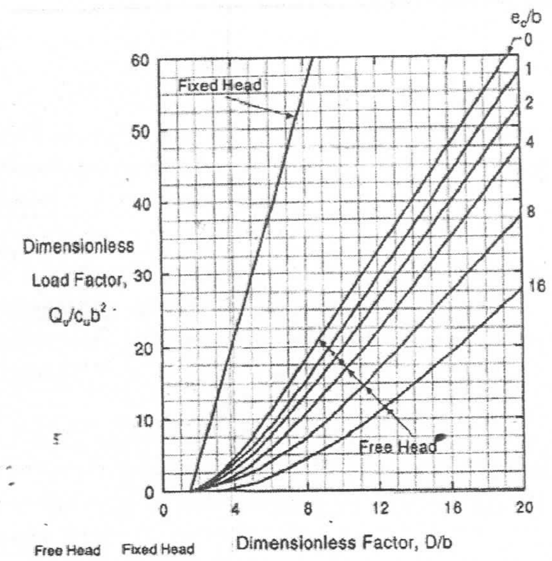
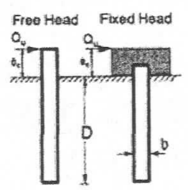
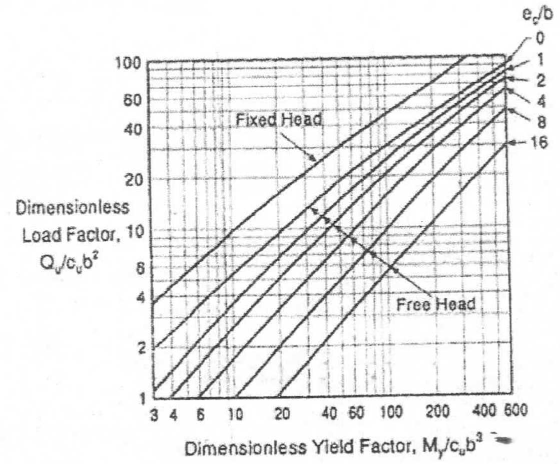
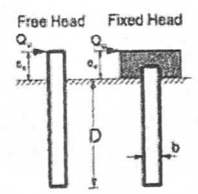


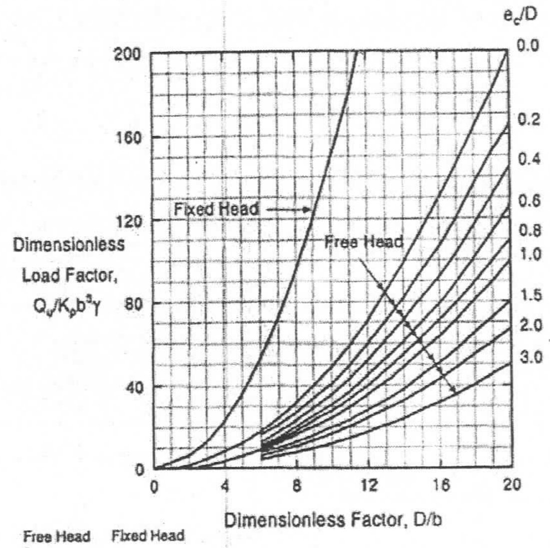


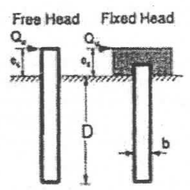
Ultimate Lateral Load Capacity of Short Piles in Cohesive Soils



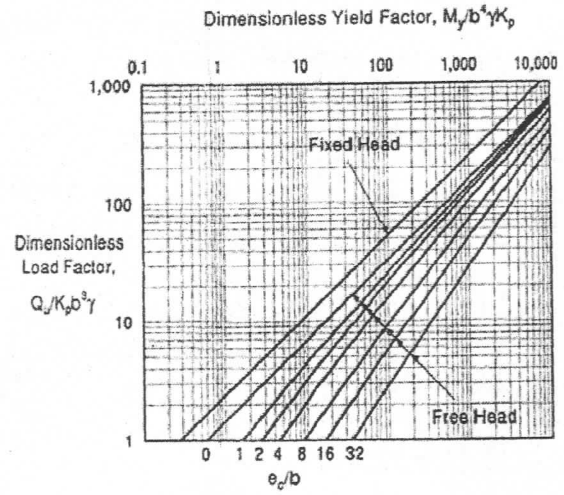


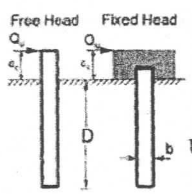
Ultimate Lateral Load Capacity of Long Piles in Cohesive Soils





Ultimate Lateral Load Capacity of Short Piles in Cohesionless Soils





Ultimate Lateral Load Capacity of Long Piles in Cohesionless Soils

Best wishes

Prof. Dr. Ahmed M. Nasr , *Prof. Dr. Wasiem R. Azzam* and **Dr. Ahmed F. Sallam**

Tanta University

Structural Engineering Department

Faculty of Engineering

Course Title	Design of Steel Structures (b)	Academic Year 2022/2023 Second- Semester Exam	Course Code	CSE3124 (Str.)
Year/ Level	Third			
Date	11-6-2023	No. of Pages (6)	Allowed time	3 hrs

Remarks:

- **The exam consists of five questions in three pages,**
- **Any missing data may be reasonably assumed,**
- **The code of practice and the tables of the steel sections are not allowed to use**

Question Number (1) (15%)

An industrial area 36x72 ms to be covered using the shown main system. The covered area is located in Alexandria. The used covering system is replicated double span steel frames with spacing (S = 6.0 m). The roof cover is RC slab with thickness 10 cm and the side covering is steel corrugated sheets with O.W 7 kg/m^2.

From Fig. (1) It is required to:

1. Calculate the different loads acting on the shown system (Dead, live and wind loads) showing the distribution of each load on the shown structure. **(10%)**

   Consider that:

   W_s = 30 kg/m^2 - Basic wind speed V = 36m/sec - Inaccessible roof with L.L = 100 kg/m^2

2. Explain the function of "bracing systems" of steel structures and the bracing types that could be used in typical coverage of factories (use 3-D sketches if necessary). **(5%)**

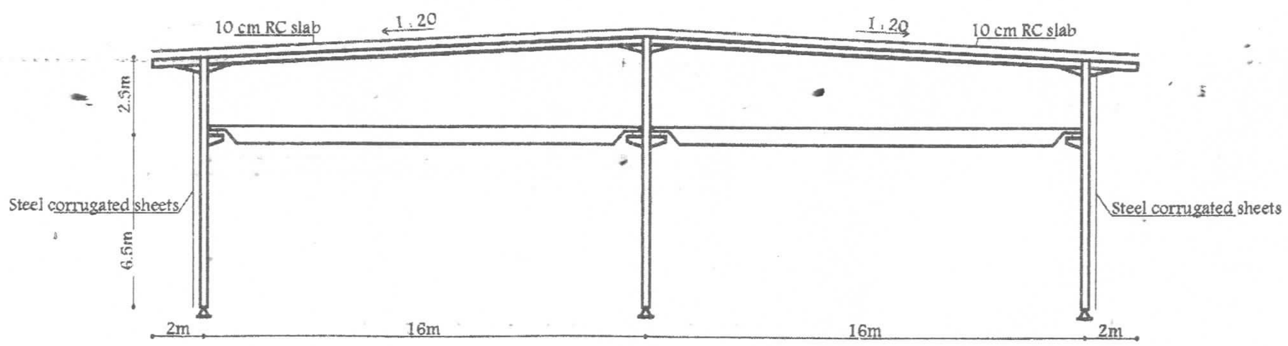


Fig. (1)

Question Number (2) (30%)

The steel system shown in **Fig. (2)** is used as a cantilever shed (fixed-free system). The steel column is made of HEB400 and laterally braced using the shown bracing system. Using steel material ST44 (F_y = 2.8 t/cm^2 – F_u = 4.4 t/cm^2),

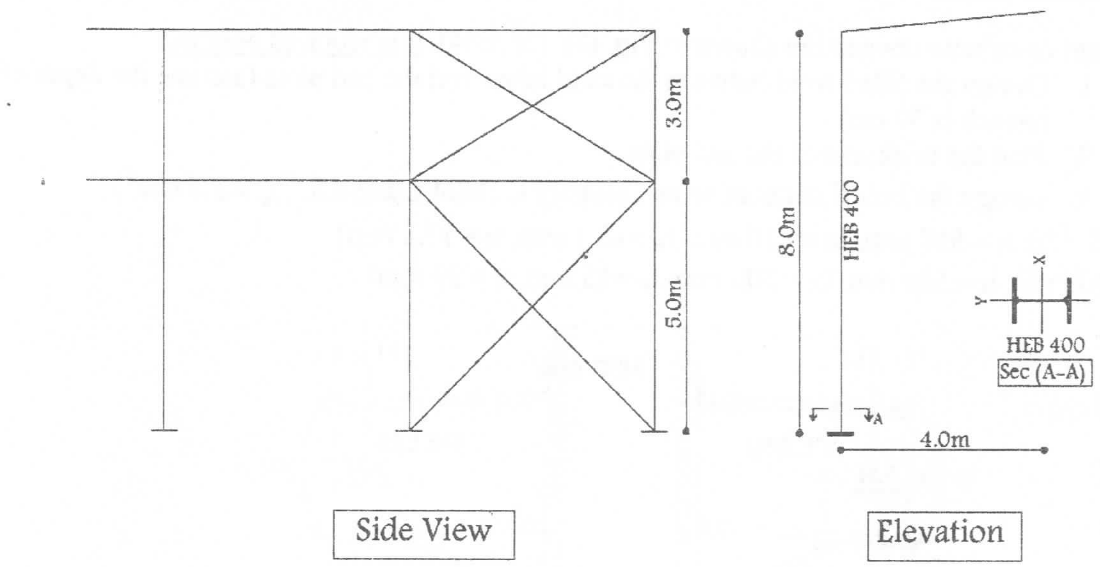
it is required to:

1. Calculate the buckling length (in plane and out-of-plane) of the steel column. **(3%)**
2. Check the safety of the shown column if the ultimate straining actions at the base are:

   - $M_u = 23$ *t.m* - $N_u = -35$ *t (compression)* - $V_u = 15$ *t* **(12%)**

3. Design the fixed base and draw to scale 1:10 elevation and plan to show the detail of the base. (F_{cu} = 300 kg/cm^2, M27 of Grade 10.9, $A_s = 4.59 cm^2$) **(15%)**

(UPN 300: h = 300 mm, b_f = 100 mm, t_w =10 mm, t_f = 16 mm)



Properties of section (HEB400)			
b (mm) =	300	t (mm) =	24
h (mm) =	400	s (mm) =	13.5
r (mm) =	27	c (mm) =	51
h-2c (mm) =	298	A (cm^2) =	198
I_x (cm^4) =	57680	I_y (cm^4) =	10820
S_x (cm^3) =	2880	S_y (cm^3) =	721
r_x (cm) =	17.1	r_y (cm) =	7.4

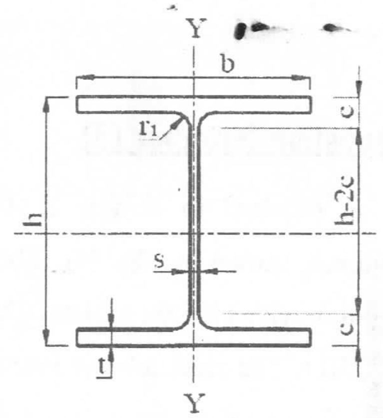


Fig (2)

Question Number (3) (20%)

For crane track girder supporting electrically operating crane capacity 12 t, the girder supported two wheels of maximum value of 10 t and spaced 4.5 m. The spacing between frame is 5 m. steel used is St. 37 (F_y = 2.4 t/cm2 – F_u = 3.7 t/cm^2)

Required:

1. Find **M_{L+I} and Q_{L+I}** due to life loads only (neglect Dead loads)
2. Check safety of **bending strength** for HEA 400 given that (HEA 400: h_w = 390 mm, b_f = 300 mm, t_w =11 mm, t_f = 19 mm, S_x = 2310 cm^3, i_x = 16.80 cm, S_y =571 cm^3, i_y = 7.34 cm and r_t = 8.273 cm)
3. Check **fatigue stress**, knowing that f_{sr} = 1.68 t/cm^2
4. **Check local yield** under wheels, knowing that the area of the web to resist concentrated load = (2.5 k + N) * t_w and Ø = 0.95

Question Number (4) (20%)

For the beam-to-column connection shown in **Fig. (3)** (of St44), it is required only to:

1. Design the filled weld between the steel beam and the end plate (assume the depth of haunch is 30 cm).
2. Find the thickness of the end plate.
3. Design the bolted connection as Category C (M24 grade 8.8, $A_s = 3.53 cm^2$).

(IPE 550: h = 550 mm, b_f = 210 mm, t_w =11.1 mm, t_f = 17.2 mm)
(HEB 550: h = 550 mm, b_f = 300 mm, t_w =15 mm, t_f = 29 mm)

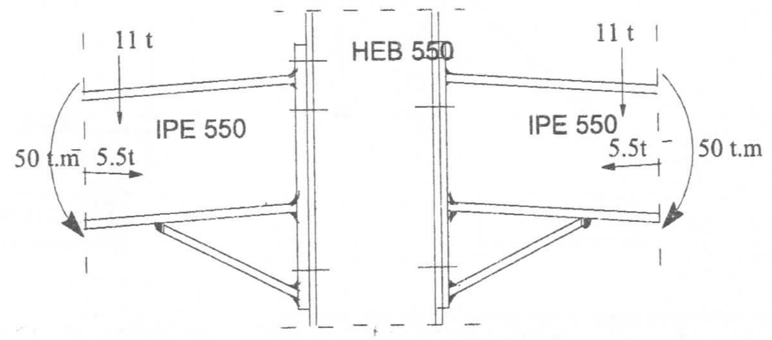


Fig. (3)

Question Number (5) (15%)

It is required to design a concrete-filled square tubular column, shown in **Fig. (4)**. The column is a hinged-hinged column with a height of 4ms. The design force of the column is 250 t. The steel tube is formed of St.37 and the concrete cubic strength is $300 kg/cm^2$. Use 4Φ12mm as minimum longitudinal reinforcement.

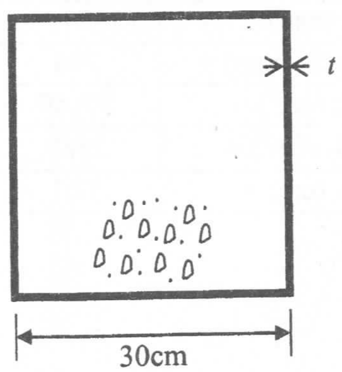


Fig. (4)