Tanta University
Faculty of Engineering
Public Works Engineering Dept.

First Term Exam
12 Jan. 2023
Time: 3 hrs.

4th Year Civil Engineering
Sanitary Engineering
CPW4105

Answer the following questions and assume any missing data
Maximum marks :85 **No. of pages: 2** **Date: 12 Jan. 2023**

Question (1) (17 points)

1-a) - Discuss the conditions that should be considered when choosing the type and location of an intake for a city water supply system.
- Explain the preliminary studies which are required for water supply. (4 points)

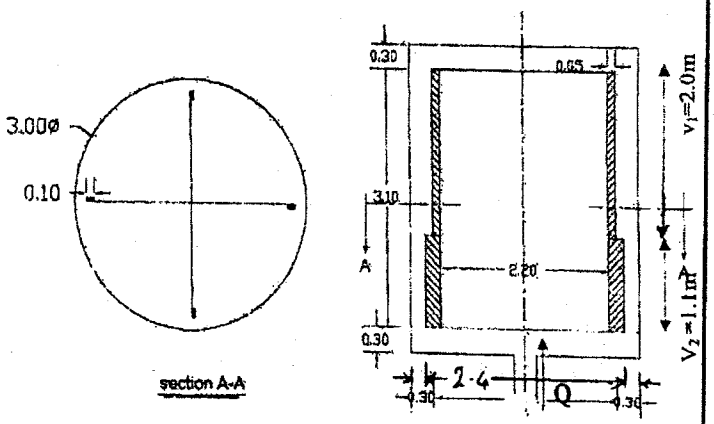
1-b) Design the collection works for a city with population of 195,000 and 152,000 for the years 2016 and 2006 respectively. The water source to the city is a the River Nile, H.W.L. at (8.50), L.W.L. at (7.00), Bed level at (1.00), G.L. at (10.50), Road level at (11.50), The intake about 3000 meters away from the city, and water level in the rapid mixing tank at (25.00). The water treatment plant collection works for the city is designed to serve the year 2075 Considering geometric growth rate of increase and water consumption of 220 L/cap./day. It is required to :

a- Determine the future population and average discharge at year 2075. (4 points)
b- Choose and design a suitable type of intake and delivery pipes taking into consideration :
- Pumps works 16 hrs at a day
- Number of delivery pipes = 1 , with velocity 1.60 m/s (7 points)
c- Draw a neat sketch (not to scale) showing the main elements of the intake (2 points)

Question (2) (16 points)

2-a) - Write short notes describing the following :
Jar test , Tapered flocculation.
- Explain the different zones in sedimentation tank for water treatment plant. (4 points)

2-b) A flocculator basin illustrated in figure is rotated through water with an angular velocity of 3.75 rev/min . How much power is dissipated into water, if the flow is 7,100 m3/d. Determine the G values. (7 points)



2-c) For the discharge in b, its required to determine:-
- The dimension and power required for circular cross section rapid mixing tank if (d = 2.5 m, T = 60 sec, G =900 sec^{-1}, and $\mu = 1.02 \times 10^{-3}$ N.S/m^3)
- The required amount of Alum kg/day.
- The required capacity of the Alum solution tank sufficient for one day if Alum concentration in solution equal 10%. (5 points)

Question (3) (15 points)

3-a) Discuss briefly the operation steps of rapid sand filter. Draw sectional elevation of the filter showing all pipe and valves. (4 points)

3-b) Design a horizontal flow baffled channel flocculator which serve a rectangular sedimentation tank if the common wall shared between flocculator and sedimentation tank have 11.0 m width, with design flow of 55,000 m^3/d. The flocculation basin is to be divided into three sections of equal volume, each section having constant G of 40, 35, 30 S^{-1} respectively. The total flocculation time is 45 min. and the baffles roughness coefficient of 0.3, , with a depth of 2.0 m is considered. (7 points)

3-c) A rapid sand filters used for filtering 55,000 m3/d , with average rate of filtration 6.0 m3/m2/h, and backwashed at a rate of 30 m3/m2/h for about 11 min. Calculate the number and dimension of the filter boxes, the quantity and percentage of backwash water used in washing per day. (4 points)

Question (4) (11 points)

4-a) Discuss briefly; The function and operation steps of elevated tank. And draw the sectional elevation of the tank showing all pipe and valves. (4points)

4-b) For a city of population 150,000 capita and average daily water consumption 220 L/cap./day. Design the ground and elevated storage tanks, if the working hours per day of the plant are 16 hours, (6 AM – 10 PM). The consumption characteristic data during the day are given as follows :- (7 points)

Time	Lit./2hr	Time	Lit./2hr
12 M.N - 2 A.M	3	12 N - 2 P.M	32
2 - 4	5	2 - 4	29
4 - 6	8	4 - 6	24
6 - 8	17	6 - 8	18
8 - 10	32	8 - 10	8
10 - 12 N	40	10 - 12 M.N	4

Question (5) (19 points)

5-a) - Draw a flow diagram for the primary treatment units briefly discussing the functions of each unit. (4 points)

5-b) Design and checks all dimensions of the following treatment units in wastewater treatment plant for a city of average flow 63,000 m^3/d and design maximum flow 128,000 m^3/d.

- The inlet(deceleration) chamber. (T = 40 sec, V = 0.9 m/s at maximum flow) (3 points)
- The approach channel.(V = 0.9 m/s at average flow) (3 points)
- The screen chambers. (S = 2.5 cm, a = 2.0 cm, b = 6.0 cm, $\Theta = 60^\circ$) (3 points)
- The grit removal tanks designed to remove particles with a diameter of 0.2 mm with settling velocity in grit chamber 0.022 m/s. A flow through velocity of 0.3 m/s will be maintained by a proportional weir, d = 1.5 W. (3 points)
- The primary sedimentation tank to remove approximately 65%, 35% of suspended solids and BOD respectively, with retention period of 2.75 hrs. (over flow rate = 0.0004 m/s at max. flow) (3 points)

Question (6) (14 points)

6-a) - What are the difference between the Conventional and Extended aeration activated sludge system. (3 points)

6-b) Design a conventional Activated sludge system to to treat a waste flow of 26,000 m^3/d of municipal wastewater. With BOD_5 of 320 mg/l before primary treatment and it is desired to have not more than 20 mg/l of soluble BOD_5 in the effluent. A completely mixed reactor is to be used, and pilot plant analysis has established the following kinetic values Y= 0.5 kg/kg, K_d=0.05 d^{-1}. Assume a MLSS concentration of 2500 mg/l and an underflow concentration of 11,0 00 mg/l from secondary clarifier and Θ_c=10 day. Its required to determine: - Volume of the reactor – Volume of solids to be wasted daily – Mass of solids wasted – Sludge recycle ratio. – F/M ratio, volumetric loading. (9 points)

-Design the required secondary clarifiers (over flow rate = 24 m/d). (2 points)

End of questions.....

Hints:-

$V = 0.355\ C\ D^{.63}\ S^{0.54}$ $HP = \gamma\ Q\ H_t / 75\ \eta_1\eta_2$ $\eta_1\eta_2 = 0.7$ $P = G^2\mu V$ $P = C_d\ \rho_w\ A_p\ V_p^3/2$

$\rho_w = 999.1\ kg/m^3$ $\mu = 1.02 \times 10^{-3}\ N.s/m^2$ $V = \dfrac{QY\theta_c(S_o - S_e)}{X(1 + K_d\theta_c)}$

$n = \left\{\left(\dfrac{2\mu T}{\rho(1.44 + f)}\right)\left(\dfrac{H\ L\ G}{Q}\right)^2\right\}^{\frac{1}{3}}$ $Q_R = \dfrac{Q\,X - Q_W\,X_U}{X_U - X}$

Good luck and best regards, **Dr/ Abdelaziz El-sayed**

Course Title: Geodesy and Satellite Surveying	Academic Year 2022/2023 First Term Exam	Course Code: CPW4106
Year: Fourth		Total Marks: 70 Marks
Date: 24- January -2023	No. of Pages (2)	Allowed time: 3 hrs
Remarks: (answer all the following questions, and assume any missing data) (answer should be supported by sketches)		

السؤال الأول (٣٥ درجة)

أ- **اشرح باختصار ما يلي مع التوضيح بالرسومات الدقيقة والمعادلات كلما أمكن ذلك:** **(١٥ درجة)**

١. طريقة التقاطع العكسي (بالرسم والمعادلات).

٢. الفرق بين نظام GPS ونظام GNSS.

٣. قطاع التحكم ودوره في نظام GNSS.

٤. حالة توزيع هندسي جيد للأقمار الصناعية وحالة توزيع سيء، موضحا المقصود بمعامل دقة الأقمار DOP.

٥. طريقة الرصد المتحرك باللاسلكي RTK GNSS، موضحا مميزاتها وعيوبها.

ب- عند الرفع المساحي لموقع أحد المشاريع الهندسية تبين عدم وجود نقطة مرجعية قريبة من المشروع، والمطلوب توضيح كيفية رصد وتثبيت نقطة مرجعية عالية الدقة في موقع المشروع باستخدام جهاز GNSS أو GPS مع ذكر شروط اختيار مكان النقطة المرجعية وكذلك توضيح العلاقة بين دقة الإحداثيات المرصودة النقطة المرجعية وزمن الرصد. **(٤ درجات)**

ت- وضح المقصود بطريقة الرصد المتحرك المستمر Continuous RTK GNSS والرصد المتحرك المستمر الجوي مع شرح تطبيقات واستخدامات كل طريقة باختصار. **(٣ درجات)**

ث- اشرح باختصار مع التوضيح بالرسم خطأ تعدد المسار عند القياس بنظام GNSS موضحا كيفية التغلب عليه وكيفية تحديد إحداثيات النقط القريبة من العوائق بدقة عالية. **(٣ درجات)**

السؤال الثاني (٢٠ درجة)

أ- وضح بالرسم نظم الإحداثيات المستخدمة في المساحة الجيوديسية مع تعريف عناصر كل نظام إحداثيات. **(درجتان)**

ب- وضح بالرسم مع كتابة المعادلات العلاقة بين محاور الاحداثيات عند التحويل بين أي مرجعين جيوديسيين باستخدام نموذج عناصر التحويل السبعة. **(٣ درجات)**

ت- اذكر طرق إسقاط الخرائط من حيث سطح الإسقاط واذكر أهم خصائص إسقاط ميركاتور المستعرض مع توضيح طريقة تقسيم سطح الأرض في ميركاتور المستعرض العالمي (UTM) ثم حدد رقم الشريحة UTM التي تقع بها منطقة على خط الطول ٣١° ١٤′ شرقاً ودائرة عرض ٣٠° ٠٢′ شمالاً. **(٥ درجات)**

ث- إذا علمت أن الإحداثيات الجغرافية للنقطتين (أ) و (ب) الواقعتين على سطح الالبسويد المرجعي WGS 84 (نصف المحور الأكبر =٦٣٧٨١٣٧ متر ونسبة الانبعاج =١/٢٩٨,٢٥٧) هي كما يلي: **(١٠ درجات)**

النقطة	زاوية خط عرض			زاوية خط طول		
	"	′	°	"	′	°
أ	٠٠	٠٣	٣٠	٠٠	٣٠	٣١
ب	٠٠	٠٣	٣٠	٠٠	٢٠	٢٢

والمطلوب حساب الاتي:

١. الإحداثيات الكارتيزية للنقطة (أ) على سطح الالبسويد المرجعي WGS 84.

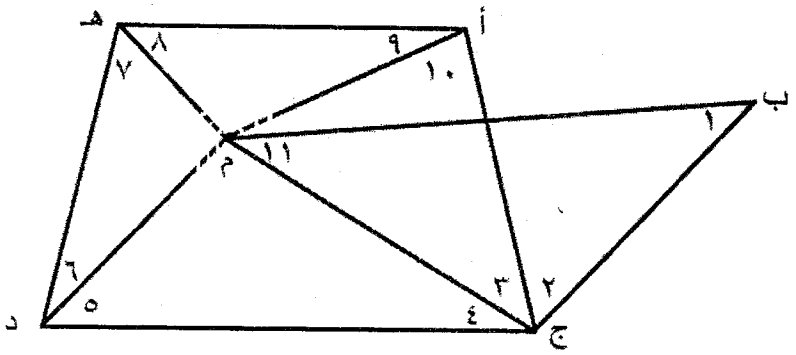
٢. الإحداثيات الجغرافية للنقطة (ب) على سطح الالبسويد المرجعي هلمرت ١٩٠٦ (نصف المحور الأكبر =٦٣٧٨٢٠٠ متر ونصف المحور الأصغر=٦٣٥٦٨١٨,١٧ متر) إذا كانت الإحداثيات الكارتيزية لنقطة (أ) على سطح البسويد هلمرت هي الإحداثي (X) = ٤٧١١٣٧٠,٩ متر، الإحداثي (Y) = ٢٨٨٦٩٤٧ متر الإحداثي (Z) = ٣١٧٥١٨٥,٦ متر (استخدم نموذج عناصر التحويل الثلاثة).

السؤال الثالث (٢٥ درجة)

أ- حدد مع التوضيح بالرسم أشكال شبكات المثلثات الجيوديسية المختلفة والاشتراطات الخارجية لها. **(درجتان)**

ب- تكلم عن شبكات المثلثات الجيوديسية في جمهورية مصر العربية. **(٣ درجات)**

ت- يوضح الشكل جزء من شبكة مثلثات جيوديسية والمطلوب ضبط الزوايا المرصودة وايجاد قيمها المصححة إذا علم أن قيم الزوايا المرصودة كالتالي: **(٢٠ درجة)**



رقم الزاوية	قيمة الزاوية		
	"	′	°
١	٢٢	٣٠	٥٠
٢	١٠	٤٢	٥٢
٣	٠٩	٢٧	٤٦
٤	٢٨	٥٧	٤٣
٥	٢٦	٣٣	٤٣
٦	٤٢	٥٢	٣٨
٧	٤٨	٥٥	٤٠
٨	٠٦	٠٢	٤٦
٩	١٨	٣٨	٤٨
١٠	١١	٣٣	٥١
١١	٣٠	٢٠	٣٠

انتهت الأسئلة مع أطيب الأمنيات بالتوفيق والنجاح

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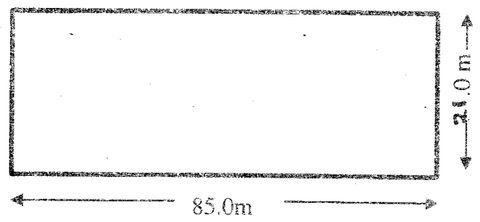
COURSE TITLE: DESIGN OF REINFORCED CONCRETE STRUCTURES (3)		CORSE CODE: CSE 4115
DATE: WEDNESDAY 10/1/ 2023	FINAL TERM EXAM	TIME ALLOWED: 4 HOURS

B. ***Fig. 4*** shows a plan of a rectangular hall of dimensions 21 m x 85 m covered by cylindrical shell system with edge beams. The clear height is 5.00 m. It is required to carry out the following:

1. ***Discus*** the main idea and the theory of analysis of cylindrical shell.
2. ***Choose*** the suitable statical system to achieve less needed numbers of columns.
3. ***Determine*** the concrete dimensions of all main members of the system choose the suitable total height of shell system = 2.5m or 3.0m or 3.5m.
4. ***Draw*** to convenient scale a structural plan and sectional elevation of the covering system.
5. ***Make compleic design*** for suggested roof system.
6. ***Provide*** full details of reinforcement in plan and cross section.

Fig. 4



Problem (4) (20%):

For the shown combined tank in ***Fig. 5*** which consists of two elevated water tanks 1 and 2 supported on columns at perimeter only, it is required to:

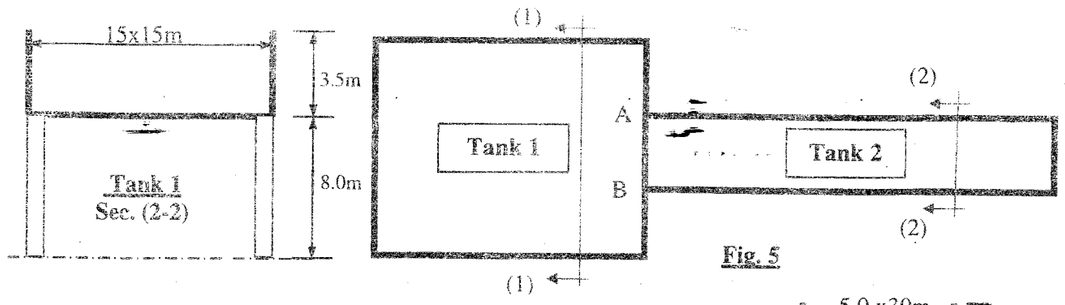
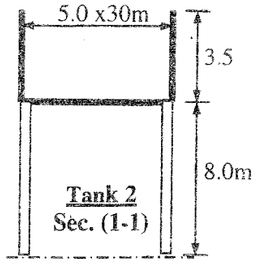


Fig. 5

1. ***Choose*** the suitable statical system for the combined tank and draw all required supporting members.
2. ***Calculate*** the load distribution for the combined tank.
3. ***Mention*** without calculation the steps of design of wall AB.
4. ***Sketch*** without any calculations the straining actions of tank 1.
5. ***Carry out*** complete design of the tank 2 elements (walls and floor).
6. ***Give*** full reinforcement details for the combined tank in plan and cross sections.



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Problem (5): (15%): Solve only one question

A. For the elevated rectangular tank in ***Fig. 6*** without top cover, with floor 6.0 m x 3.0 m and 6.0 m water depth, it is required to:
1. ***Choose*** the suitable statical system for the tank and draw sketches for all required supporting members.
2. ***Calculate*** the load on all critical strips.
3. ***Carry out*** complete design of the tank elements.
4. ***Draw*** full reinforcement details for the tank in plan and cross sections.

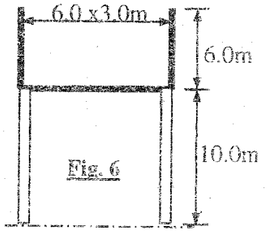

Fig. 6

B. For the elevated cylindrical tank shown in ***Fig. 7***, with floor diameter 10.0 m and 7.0 m water depth, it is required to:
1. ***Draw*** the straining action on the floor and the wall.
2. ***Make*** a complete design for the walls and the floor only.
3. ***Draw*** the details of reinforcement in both cross-sectional elevation and plan.

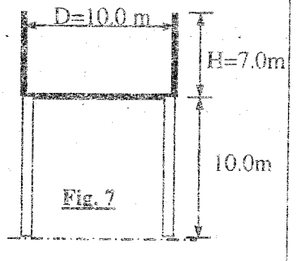

Fig. 7

C. For the shown swimming pool shown in ***Fig. 8*** on a clay soil with net bearing pressure equals to 120 kN/m^2, the pool width is 20 m. It is required to:

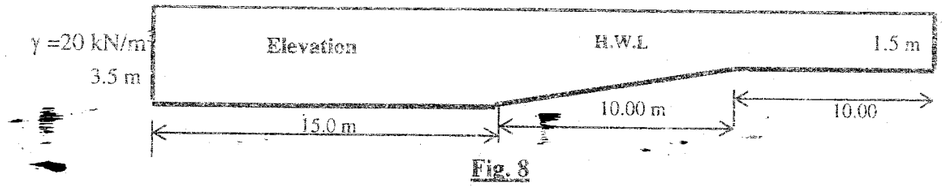

Fig. 8

1. ***Carry out*** a complete design for the critical wall side sections.
2. ***Draw*** to a reasonable scale detail of reinforcement on sectional elevation.
3. If the ground water level after the construction of the pool" was raised to the ground level, GL, ***give a detailed report*** concerning the safety of the pool for such case, and give your opinion about how can we face this problem.

End of questions **(Wishing you best of luck)**

Prof. Dr. Mohamed Hussein Mahmoud
Prof. Dr. Nesreen Mohmmed Kassem **Assis. Prof. Mahmoud Ahmed Abdel-Aziz**

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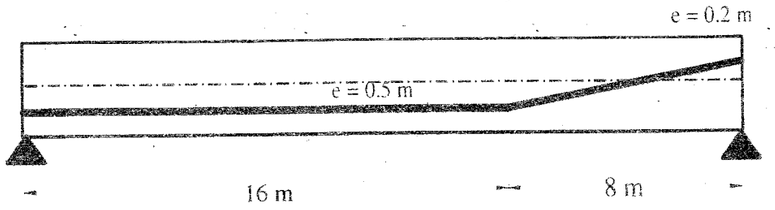
General notes and data: Systematic arrangement of calculations and neat sketches are essential. Any missing data should be reasonably assumed and unless otherwise specified, you may use; concrete characteristic strength f_{cu} for normal strength concrete 28 N/mm^2, grade of reinforcing steel is 400/600 N/mm^2, for shear reinforcement use grade 240/350 N/mm^2, concrete characteristic strength f_{cu} for prestressed concrete 45 N/mm^2, and low relaxation-stress relieved strands with f_{Py}=1600 MPa, f_{Pu}=1900 MPa.

Problem (1) (20 %):

For the shown pre-stressed concrete beam of 24 m span having rectangular cross-section of 350 mm x 1300 mm with the cable profile as depicted in ***Fig.1***, it is required to carry out the following:

Fig.1



1. ***Define*** the kern of the section and determine it.
2. ***Discuss*** the effect of the building classes on the design of the prestressing members.
3. ***Draw*** the N.F.D and the B.M.D due to pre-stressing only.
4. ***Calculate*** the equivalent loads due to pre-stressing only.
5. ***Calculate*** the maximum camber due to pre-stressing at the initial stage, Pi =950 kN, f_{cu} = 45 MPa.
6. ***Check the stresses*** at all critical sections at transfer and service stages (partial prestressing).
7. ***If the loads of the beam will be changed*** to be uniform load of 15 kN/m and one concentrated load at midspan of 220 kN, suggest the possible cable profiles and choose the suitable one and its type of prestressing.

Problem (2) (20%):

Fig. 2 shows a multi-story residential building located in center of Tanta. The building consisted of ground floor with height 3.5 m and eight typical floors with height 3.00 m for each story. The foundation level is located at (-1.5) m from the road level, the foundation consisted of 0.5 m plain concrete raft and 1.0 m reinforced concrete raft (soil type D). The soil was characterized as 8.0 m normal clay over 15 m loose sand. The finishing level of the ground floor is located at +0.45 m from the road level. The average working dead load for the structural and nonstructural elements is 15 kN/m^2. Assume that the average working live load is 2.5 kN/m^2.

You may use the simplified formula when calculating the earthquake moment. neglect the off-axis eccentricities, it is required to:

1. ***Classify*** the shear wall no. 6 according to Egyptian Code of Practice.
2. ***Calculate*** the total shear force due to wind load in Y-direction. ***Calculate*** the total overturning moment due to wind around axis y-y at the foundation level.
3. ***Calculate*** the total base shear and overturning moment due to earthquake load in X-direction (moment around axis y-y) at the foundation level.
4. ***Locate*** the center of mass and center of rigidity then, ***calculate*** the design eccentricities.
5. ***Calculate*** the ultimate design shear force and moment acting on wall no. 1.
6. **Design** wall no. 1 to resist all straining actions then, ***draw*** the reinforcement details in cross section.

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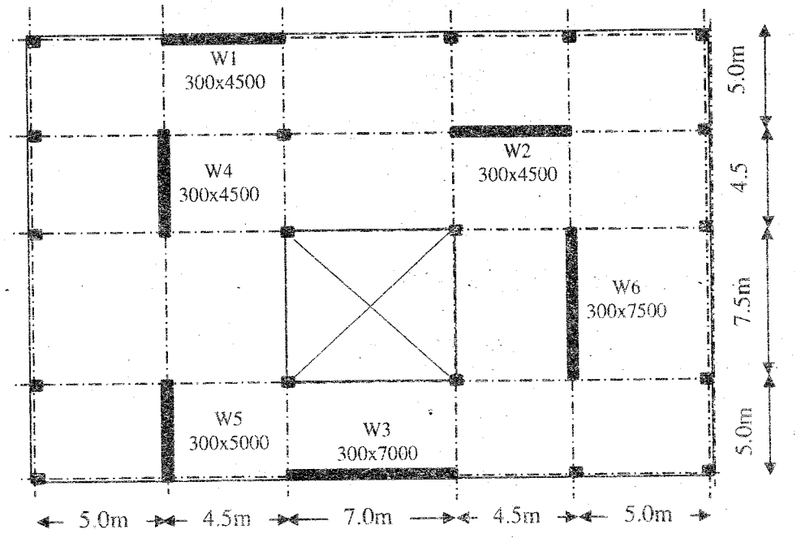
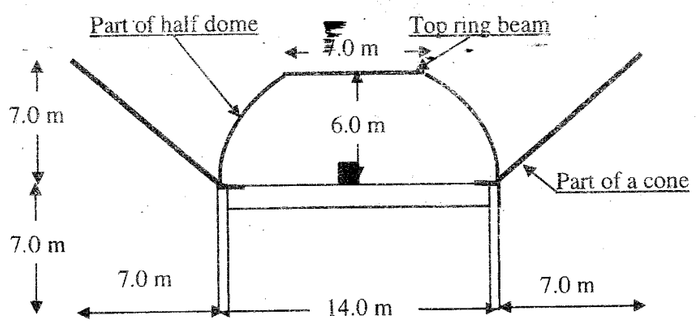
Fig. 2



Problem (3) (35%):

A. For the RC structural system of part of a dome and part of a cone covering circular area shown in ***Fig. 3*** it is required to carry out the following: (assume that the working distributed live load is 1.0 kN/m^2, flooring cover is 0.5 kN/m^2)

Fig. 3



1. ***Suppose*** all necessary beams and columns then, ***sketch*** to a convenient scale plan and sectional elevation showing all concrete dimensions of the covering system along with the necessary supporting elements.
2. ***Draw*** the internal force diagrams for the shown dome and cone (the ring force Nθ and the meridian force Nϕ).
3. ***Design*** the critical sections and ***draw*** the details of reinforcement, to a convention scale, on elevation and plan.

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Data sheet

Basic wind pressure KN/m²: $q = 0.5 \times 10^{-3}(\rho . v^2 . c_t . c_s)$, $P_e = C_e . k . q$

Subjected area	A	B	C
Roughness Hight (Z_o)	0.05	0.30	1.00
Hight in (m)		k	
0-10 m	1.00	1.00	1.00
10-20 m	1.15	1.00	1.00
20-30 m	1.40	1.00	1.00
30-50 m	1.60	1.05	1.00
50-80 m	1.85	1.30	1.00
80-120 m	2.10	1.50	1.15
120-160 m	2.30	1.70	1.35
160-240 m	2.50	1.85	1.55

Subsoil class	S	T_B	T_C	T_D
A	1.00	0.05	0.25	1.20
B	1.35	0.05	0.25	1.20
C	1.50	0.10	0.25	1.20
D	1.80	0.10	0.30	1.20
E	1.60	0.05	0.25	1.20

Fundamental building period:

$T_i = C_t . H^{3/4}$ where $c_t = 0.075$ for framing systems, 0.05 for other systems

Zone	a_g	Location
1	0.10 g	Luxor, Asyut, Edfu, Sohag, Menia
2	0.125 g	Alexandria, Dakahlia, Gharbiya, Matrouh
3	0.15 g	Ismailia, Fayoum, Port Said, Cairo
4	0.20 g	Safaga, Sinai, Ras Ghareb
5a	0.25 g	Sharm El-Shaikh, Hurghada
5b	0.30 g	Taba, Shidwan Island

Structural system	R
Ductile frames	7.00
Frames with Limited ductility	5.00
Shear walls	5.00
shear walls and ductile frames	6.00
shear walls and frames with limited ductility	5.00

Horizontal design spectrum

$0 \le T \le T_B$: $Sd(T) = a_g . Yi . S\ (2/3 + T/T_B(2.5/R - 2/3))$

$T_B \le T \le T_C$: $Sd(T) = a_g . Yi . S\ (2.5/R)$

$T_C \le T \le T_D$: $Sd(T) = a_g . Yi . S\ (2.5/R).(T_C/T) \ge (0.20)\ a_g . Yi$

$T_D \le T \le 4$ sec : $Sd(T) = a_g . Yi . S\ (2.5/R).(T_C . T_D/T^2) \ge (0.20)\ ag . Yi$

TANTAUNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF STRUCTURAL ENGINEERING
FINAL EXAM – FIRST SEMESTER 2022/2023
(STUDENTS OF CIVIL ENGINEERING)

COURSE TITLE: DESIGN OF REINFORCED CONCRETE STRUCTURES (3)		CORSE CODE: CSE 4115
DATE: WEDNESDAY 10/1/ 2023	FINAL TERM EXAM	TIME ALLOWED: 4 HOURS

Design aids

جدول (٤-١٣) الحد الأدنى لسمك الغطاء الخرساني

قسم تحرض سطح الشد	سمك الغطاء الخرساني * (مم)			
	عام لجميع العناصر عدا الحوائط والبلاطات المصمتة		للحوائط والبلاطات المصمتة	
	f_{cu} ** ≤ 25	f_{cu} ** > 25	f_{cu} ** ≤ 25	f_{cu} ** > 25
الأول	25	20	20	20
الثاني	30	25	25	20
الثالث	35	30	30	25
الرابع	45	40	40	35

* يجب ألا يقل سمك الغطاء الخرساني بأي حال عن قطر أكبر سيخ مستعمل في التسليح

** بوحدات ن/مم²

جدول (٤-١٦) قيم المعامل η_1

السمك الافتراضي للقطاع، t (مم)	المعامل η_1
t≤100	1.00
t≤200	1.20
t≤400	1.30
t≥600	1.40

جدول (٤-١٥) إجهادات تشغيل الصلب ومعاملات خفض إجهادات خضوع الصلب β_{11} التي تستوفي شروط حالة حد الشرخ للصلب عالي المقاومة ذي النتوءات

أسطح شد القسمين الثالث والرابع	أسطح شد القسم الثاني	أسطح شد القسم الأول	β_{11}		إجهاد تشغيل الصلب
قطر السيخ مم	قطر السيخ مم	قطر السيخ مم	صلب 420	صلب 350	ن/مم²
10	16	18	0.92	1.00	220
12	18	22	0.83	0.93	200
18	22	25	0.75	0.85	180
22	25	32	0.67	0.75	160
25	32		0.58	0.65	140
32	----	---	0.50	0.56	120

- Cylindrical walls = $C_3 . \gamma_w . H . R$
  where H is the tank height
  R is the tank radius.

H/R2	1.4	1.2	1.0	0.8	0.6	0.4	0.2	0.1	0.08	0.06	0.04	0.02	0.01
n	16.4	15.2	13.9	12.5	10.9	9.00	6..50	4.77	4.32	3.82	3.26	2.46	1.93
C1	7.40	7.44	7.49	7.55	7.65	7.82	8.22	8.80	9.04	9.4	10.1	11.7	14.4
C2	.118	.127	.138	.154	.175	.211	284	.375	.409	.455	.525	.646	.769
C3	.800	.895	.890	.882	.870	.852	.812	.756	.736	.708	.663	.570	.462

Solid Circular Plates Subjecteed To Uniform Load :-

$M = \text{coeff.} \times pR^2$

Positive sign indicates compression surface loaded

at point	0.00R	0.10R	0.20R	0.30R	0.40R	0.50R	0.60R	0.70R	0.80R	0.90R	1.00R
Mr	+.075	+.073	+.067	+.057	+.043	+.003	+.003	-.023	-.053	-.087	-.125
Mt	+.075	+.074	+.071	+.066	+.059	+.050	+.039	+.026	+.011	-.006	-.025

Table XIX : Stiffness of Circular Plate with Center Support

$k = \text{coeff.} \times Et^3/R$

c/D	0.05	0.10	0.15	0.20	0.25
Coeff.	0.290	0.309	0.332	0.358	0.387
Without Center Support : $k = 0.104\ Et^3/R$					

Table XX Stiffness of Cylindrical Wall, near edge hinged, far edge free :

$k = \text{coeff.} \times Et^3/H$

H^2/Dt	5	6	8	10	12	14	16	20
coeff.	.713	.783	.903	1.01	1.11	1.2	1.28	1.43

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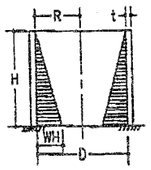
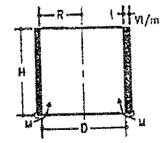
Table VII : Moments in cylindrical wall
Triangular Load
Fixed base, free top
Mom. = coeff. * wH^3
Positive sign indicates tension in the outside.



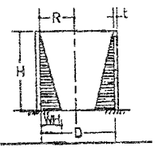
H^2 / Dt	Coefficients at point									
	0.1H	0.21H	0.3H	0.4H	0.5H	0.6H	0.7H	0.8H	0.9H	1.0H
0.4	+.0005	+.0014	+.0021	+.0007	-.0042	-.0150	-.0302	-.0529	-.0816	-.1205
0.8	+.0011	+.0037	+.0063	+.0080	+.0070	+.0023	-.0068	-.0224	-.0465	-.0795
1.2	+.0012	+.0042	+.0077	+.0103	+.0112	+.0090	+.0022	-.0108	-.0311	-.0602
1.6	+.0011	+.0041	+.0075	+.0107	+.0121	+.0111	+.0058	-.0051	-.0232	-.0505
2.0	+.0010	+.0035	+.0068	+.0099	+.0120	+.0115	+.0075	-.0021	-.0185	-.0436
3.0	+.0006	+.0024	+.0047	+.0071	+.0090	+.0097	+.0077	+.0012	-.0119	-.0333
4.0	+.0003	+.0015	+.0028	+.0047	+.0066	+.0077	+.0069	+.0023	-.0080	-.0268
5.0	+.0002	+.0008	+.0016	+.0029	+.0046	+.0059	+.0059	+.0028	-.0058	-.0222
6.0	+.0001	+.0003	+.0008	+.0019	+.0032	+.0046	+.0051	+.0029	-.0041	-.0187
8.0	.0000	+.0001	+.0002	+.0008	+.0016	+.0028	+.0038	+.0029	-.0022	-.0146
10.	.0000	.0000	+.0001	+.0004	+.0007	+.0019	+.0029	+.0028	-.0012	-.0122
12.	.0000	.0001	+.0001	+.0002	+.0003	+.0013	+.0023	+.0026	-.0005	-.0104
14.	.0000	.0000	.0000	.0000	+.0001	+.0008	+.0019	+.0023	-.0001	-.0090
16.	.0000	.0000	-.0001	-.0002	-.0001	+.0004	+.0013	+.0019	+.0001	-.0079

Table XI : Moments in cylindrical wall
Moment Per m, M, applied at base
Hinged base, free top
Mom. = coeff. * M
Positive sign indicates tension in outside



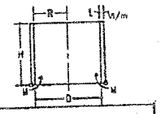
H^2 / Dt	Coefficients at point									
	0.1H	0.21H	0.3H	0.4H	0.5H	0.6H	0.7H	0.8H	0.9H	1.0H
0.4	+.013	+.051	+.109	+.196	+.296	+.414	+.547	+.692	+.843	1
0.8	+.009	+.040	+.090	+.164	+.253	+.375	+.503	+.659	+.824	1
1.2	+.006	+.027	+.063	+.125	+.206	+.316	+.454	+.616	+.802	1
1.6	+.003	+.011	+.035	+.078	+.152	+.253	+.393	+.570	+.775	1
2.0	-.002	-.002	+.012	+.034	+.096	+.193	+.340	+.519	+.748	1
3.0	-.007	-.022	-.030	-.029	+.010	+.087	+.227	+.426	+.692	1
4.0	-.008	-.026	-.044	-.051	-.034	+.023	+.150	+.354	+.645	1
5.0	-.007	-.024	-.045	-.061	-.057	-.015	+.095	+.296	+.606	1
6.0	-.005	-.018	-.040	-.058	-.065	-.037	+.057	+.252	+.572	1
8.0	-.001	-.009	-.022	-.044	-.068	-.062	+.002	+.178	+.515	1
10.	0	-.002	-.009	-.028	-.053	-0.067	-.031	+.123	+.467	1
12.	0	-.000	-.003	-.016	-.040	-.064	-.049	+.081	+.424	1
14.	0	0	0	-.008	-.029	-.059	-.060	+.048	+.387	1

Table I : Tension in circular rings
Triangular Load
Fixed base, free top
T = coeff. * wHR
Positive sign indicates tension



H^2 / Dt	Coefficients at point								
	0.0H	0.1H	0.2H	0.3H	0.4H	0.5H	0.6H	0.7H	0.8H	0.9H
0.4	+0.349	+0.334	+0.320	+0.305	+0.082	+0.066	+0.049	+0.029	+0.014	+0.004
0.8	+0.263	+0.259	+0.255	+0.190	+0.160	+0.130	+0.096	+0.063	+0.034	+0.010
1.2	+0.283	+0.271	+0.254	+0.234	+0.209	+0.180	+0.142	+0.099	+0.054	+0.016
1.6	+0.265	+0.258	+0.268	+0.266	+0.250	+0.226	+0.185	+0.134	+0.075	+0.023
2.0	+0.234	+0.251	+0.273	+0.285	+0.285	+0.274	+0.232	+0.172	+0.104	+0.031
3.0	+0.134	+0.203	+0.267	+0.323	+0.357	+0.362	+0.330	+0.262	+0.157	+0.052
4.0	+0.067	+0.164	+0.256	+0.335	+0.403	+0.429	+0.409	+0.334	+0.210	+0.073
5.0	+0.025	+0.137	+0.245	+0.346	+0.428	+0.477	+0.469	+0.398	+0.259	+0.092
6.0	+0.018	+0.119	+0.234	+0.344	+0.441	+0.504	+0.514	+0.447	+0.301	+0.112
8.0	-0.011	+0.104	+0.218	+0.335	+0.443	+0.534	+0.575	+0.530	+0.391	+0.151
10.	-0.011	-0.098	+0.208	+0.323	+0.437	+0.542	+0.608	+0.589	+0.440	+0.179
12.	-0.005	-0.097	+0.202	+0.312	+0.429	+0.543	+0.628	+0.633	+0.494	+0.211
14.	-0.002	+0.098	+0.200	+0.306	+0.420	+0.539	+0.639	+0.666	+0.541	+0.241
16.	0.000	+0.099	+0.199	+0.304	+0.412	+0.531	+0.641	+0.687	+0.582	+0.265

Table VI Tension in circular rings
Moment Per m,M, applied at base
Hinged base, free top
T = coff. * MR/H^2
Positive sign indicates tension



H^2 / Dt	Coefficients at point								
	0.0H	0.1H	0.2H	0.3H	0.4H	0.5H	0.6H	0.7H	0.8H	0.9H
0.4	+2.70	+2.50	+2.30	+2.12	+1.91	+1.69	+1.41	+1.13	+0.89	+0.44
0.8	+2.02	+2.06	+2.10	+2.14	+2.10	+2.02	+1.95	+1.75	+1.39	+0.80
1.2	+1.06	+1.42	+1.79	+2.03	+2.46	+2.65	+2.80	+2.60	+2.22	+1.37
1.6	+0.12	+0.79	+1.43	+2.04	+2.72	+3.25	+3.56	+3.59	+3.13	+2.01
2.0	-0.68	-0.22	+1.10	+2.02	+2.90	+3.69	+4.30	+4.54	+4.08	+2.75
3.0	-1.78	-0.71	+0.43	+1.60	+2.95	+4.29	+5.66	+6.58	+6.55	+4.73
4.0	-1.87	-1.09	-0.09	+1.04	+2.47	+4.31	+6.34	+8.19	+8.82	+6.81
5.0	-1.54	-1.03	-0.42	+0.45	+1.86	+3.93	+6.60	+9.41	+11.0	+9.02
6.0	-1.04	-0.86	-0.59	-0.05	+1.21	+3.34	+6.54	+10.2	+13.0	+11.4
8.0	-0.24	-0.53	-0.73	-0.67	-0.02	+2.05	+5.87	+11.3	+16.5	+16.06
10.	+0.21	-0.23	-0.64	-0.94	-0.73	+0.52	+4.79	+11.6	+19.4	+20.8
12.	+0.32	-0.05	-0.46	-0.96	-1.15	-0.18	+3.52	+11.2	+21.8	+25.7
14.	+0.26	+0.04	-0.28	-0.76	-1.29	-0.87	+2.29	+10.5	+23.5	+30.3
16.	+0.22	+0.07	-0.08	-0.64	-1.28	-1.30	+1.12	+9.67	+24.5	+34.6

Table XII : Shear at base of cylindrical wall

V = coef. * (wH^2 (triangular) ; pH (rectangular) ; M/H (mom. at base))

Positive sign indicates shear acting inward

H_2 / Dt	Triangular Load, fixed base	Rectangular Load, fixed base	Triangular or Rectangular Load, hinged base	Moment at edge
0.4	+ 0.436	+ 0.755	+ 0.245	- 1.58
0.8	+ 0.374	+ 0.552	+ 0.234	- 1.75
1.2	+ 0.339	+ 0.460	+ 0.220	- 2.00
1.6	+ 0.317	+ 0.407	+ 0.204	- 2.28
2.0	+ 0.299	+ 0.370	+ 0.189	- 2.57
3.0	+ 0.262	+ 0.310	+ 0.158	- 3.18
4.0	+ 0.236	+ 0.271	+ 0.137	- 3.68
5.0	+ 0.213	+ 0.243	+ 0.121	- 4.10
6.0	+ 0.197	+ 0.222	+ 0.110	- 4.49
8.0	+ 0.174	+ 0.193	+ 0.096	- 5.18
10	+ 0.158	+ 0.172	+ 0.087	- 5.81
12	+ 0.145	+ 0.158	+ 0.079	- 6.38
14	+ 0.135	+ 0.147	+ 0.073	- 6.88
16	+ 0.127	+ 0.137	+ 0.068	- 7.36

Prof. Dr. Mohamed Hussein Mahmoud
Prof. Dr. Nesreen Mohmmed Kassem
Assis. Prof. Mahmoud Ahmed Abdel-Aziz

Tanta University | Civil Engineering Department | Faculty of Engineering

Total Marks: 85 Marks

Course Title: Highway Engineering	Course Code:CPW4107	Year: 4th
Date: 15th January 2023	Allowed Time: 3 hrs	No of Pages: (3)

Remarks: (Answer all the following questions, assume any missing data), (Answers should be supported by sketches)

Problem (1): (15 Marks)

An asphalt mix specimen was removed from 6-lane free-way pavement surface. The extraction test indicated that the percent of asphalt content was 5.0%, expressed as a percentage of weight of mix, its bulk specific gravity was 2.239. The specific gravity of asphalt cement was 1.015. The bulk and effective specific gravities of the used aggregates were 2.705 and 2.731 respectively. It is required to:

1. **(3 Marks)** Draw the component diagram showing **all volumetric properties and mass quantities** of the tested specimen.
2. **(10 Marks)** Calculate: Air Voids Percentage, Effective Asphalt Content, **VMA, VFA**
3. **(2 Marks)** Is the asphalt mix air voids percent within specification or not?

Problem (2): (20 Marks)

1. **(10 Marks)** A vertical curve connecting upward grade +2% with other down-ward grade 4% passes through points D,E these points has station of (13 + 50) and (14 + 70) and elevation of (49.8)and (51.0) respectively knowing that the station of PVC is (12 + 80).
   a. **(5 Marks)** Find the length of the curve.
   b. **(3 Marks)** Determine the elevation of the highest point on it.
   c. **(2 Marks)** For that type of curve will a speed of 40 mph be safe, and why?
2. **(6 Marks)** Determine the AC, Base and Subbase layer thicknesses for the pavement system shown in the following figure for an ESAL of 20 x 106, R = 95%, So = 0.35, initial PSI =4.6 and terminal PSI =2.5

Surface, E_1 = 400,000 psi , a_1 = 0.42
Base, E_2 = 40,000 psi , a_2 = 0.17, m_2 = 1.2
Subbase, E_3 = 10,000 psi, a_3 = 0.07, m_3 = 1.1
CBR = 10% Subgrade,

3. **(4 Marks)** What are the possible reasons for the following pavement distresses:
   a) Transverse cracking b) Alligator cracking
   c) Rutting d) Bleeding of Asphalt pavement

Problem (3): (30 Marks)

1. **(12 Marks)** Define the following and explain briefly how to obtain their values (if any), and what are they used for:
   a. CBR b. M_R c. Stability
   d. Pen 60-70 e. VFB f. VMA
2. **(5 Marks)** write short notes about major road research projects and the main findings of each one
3. **(5 Marks)** Explain the types of composite pavements; draw a neat sketch.
4. **(3 Marks)** Why flexible pavements are generally built in layers with better materials on top?
5. **(5 Marks) (True or False):**
   a) One of the major AASHO findings was the effect of climate on pavement performance. ( )
   b) Pumping is a distress that only occurs rigid pavements due to the presence of water. ( )
   c) AC Fatigue cracking increases with an increase in the compressive strain at the bottom of the AC layer. ( )
   d) JPCP have fewer joints compared to JRCP ( )
   e) The granular base layer is used in both flexible and rigid pavements as a structural support layer ( )

Problem (4): (20 Marks)

1. **(8 Marks) Write short notes about the following:**
   a. Road functions and functional classification b. Traffic Lanes
   c. Widening of pavement on horizontal curves d. Importance of Medians for Highways
2. **(12 Marks) In the shown figure:**

For the given horizontal alignment of 4-lane undivided highway, PI of the first curve is located at station 25+00.00. The deflection angle at the PI is 55°. A 1200.00 ft radius curve will be fit between the tangents. Two consecutive curves are planned to join the first curve directly with 3°, 5°, degrees of curves and 30°, 60° deflection angles respectively.

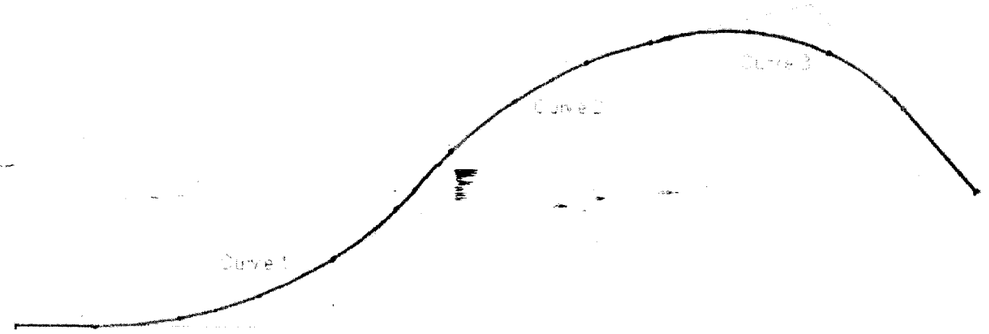


Figure 1: Highway Centerline Horizontal Alignment

Design Speed = 70mph
Lane width = 11 ft
- Side slopes (3:2) in fill sections & (4:1) in cut sections.
- Shoulder width = 8ft

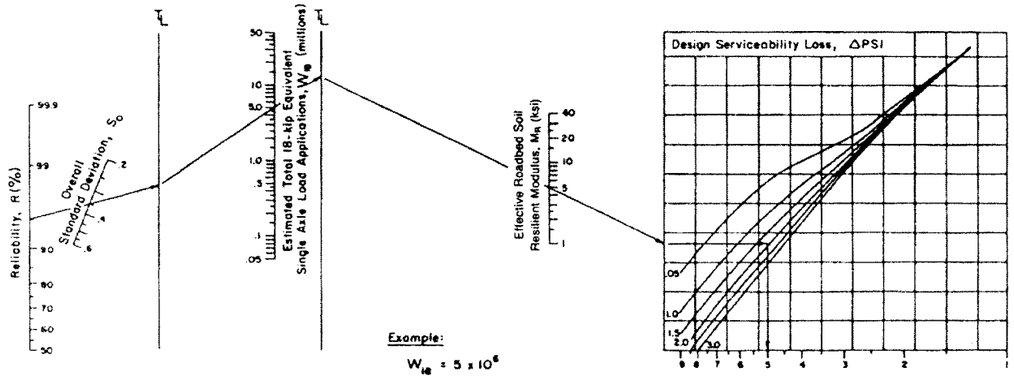
It is required to:

a. Draw a complete cross-section of this highway in a fill area showing all elements. **(3 Marks)**
b. Determine the stations of points A, B. **(6 Marks)**
c. If the maximum superelevation is 4%. Draw a superelevation diagram for the attainment of super elevation necessary for movements along the horizontal curve. **(3 Marks)**

Handouts

NOMOGRAPH SOLVES:

$$\log_{10} W_{18} = Z_R * S_o + 9.36 * \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 * \log_{10} M_R - 8.07$$



Example:

$W_{18} = 5 \times 10^6$

R = 95 %

$S_o = 0.35$

$M_R = 5000$ psi

ΔPSI = 1.9

Solution: SN = 5.0

Figure 3.1. Design Chart for Flexible Pavements Based on Using Mean Values for Each Input

مع خالص تمنياتي بالنجاح والتوفيق..... د. رجاء عبد الحكيم ولجنة الممتحنين

Course Title	Irrigation Works 2	Academic Year 2022/2023	Course Code	CIH4107
Year/ Level	4th Civil	First Semester Exam	Allowed time	3hrs
Date	17-1- 2023	No. of Pages (4)	Exam Marks	85
Remarks: *Solve as much as you can. Assume any missing Data. Short clear answers and neat drawings are required.*				

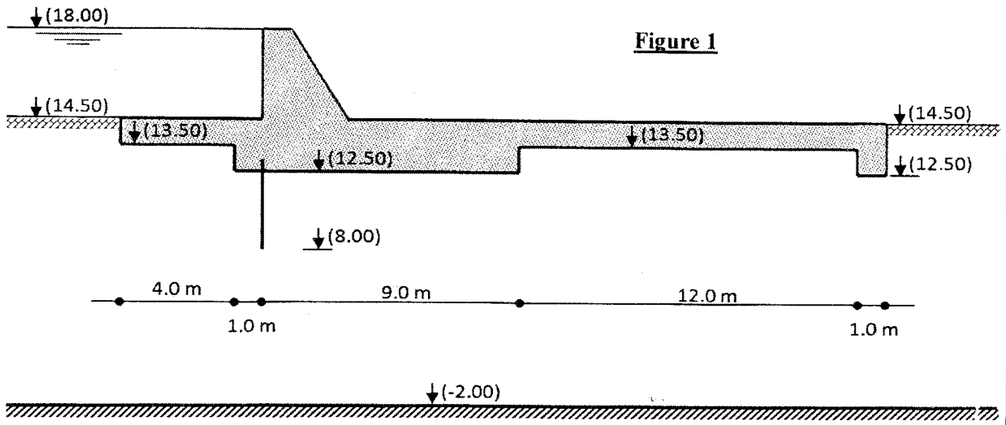
Question No:1: (10 marks)

For the shown weir in Fig. (1). It is required to determine the following:

a. The distribution of the uplift pressure along the floor base.

b. If the foundation soil is fine sand (C_B=12), check the floor lengths and thicknesses according to both Bligh's Method.

Figure 1



Question No: 2: (15 marks)

For the given R.C. abutment, shown in Figure (2), and for the following data:

i. For concrete γ= 2.50 t/m^3 Sand fill γ= 1.80 t/m^3 , Φ = 30, c=0

ii. Soil bearing capacity q_{all} = 2.20 kg/cm^2

iii. Concrete properties: γ_C = 2.5 t/m^3 for R.C. and 2.2 t/m^3 for P.C.

iv. Concrete C_{28}= 300 Kg/cm^2, St 52, f_s = 2000 Kg/cm^2

v. For one meter strip of the shown abutment

Rt= 24.996 t/m, Surcharge load w_2 = 2.00 t/m'

E_1 = 4.67 t, E2 = 14.7 t W_1= 14 t/m, W_2= 4.25 t/m, W3= 5.00 t/m, W4= 18.36 t/m,

It is required to:

- Check the stability of the abutment against overturning, sliding, over stresses and settlement.
- Design R.C. section of abutment with reinforcement details.

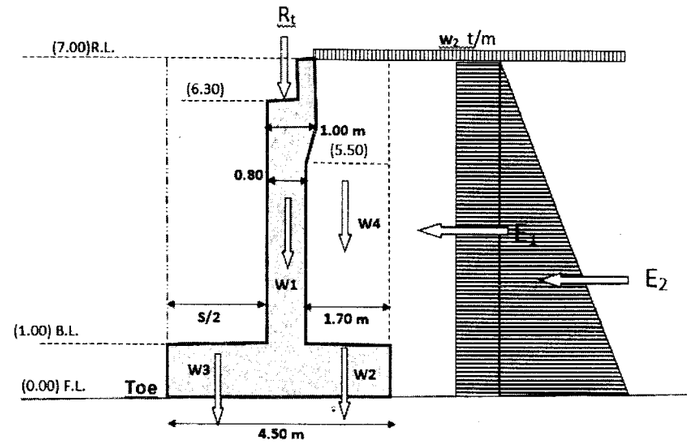


Figure 2

Question No: (3) (20 Points)

A clear over fall sharp crested diversion weir (Fayum type) is constructed across a main canal with a downstream cross section given by Figure 3. The peak discharge passing through the canal is 30 m^3/sec. Percolation coefficient C_B=15, hydraulic conductivity 1.0 m/day, specific weight of plain concrete 24 KN/m^2.

	Upstream	Downstream
bed level	11.50	9.00
bed width	12	12
berm level	15.50	14.50
road level	18.50	16
road width	12	12
water level	15.75	13.5
side slope Z_1 and Z_2	1:1 and 1:2	1:1 and 1:2

It is required to:

1. Calculate weir height and weir crest level
2. Assume elementary weir profile geometry
3. Conduct a complete hydraulic design of the weir.

4. Conduct a structural stability analysis for the weir body only.
5. Draw a longitudinal cross section through the weir centreline.

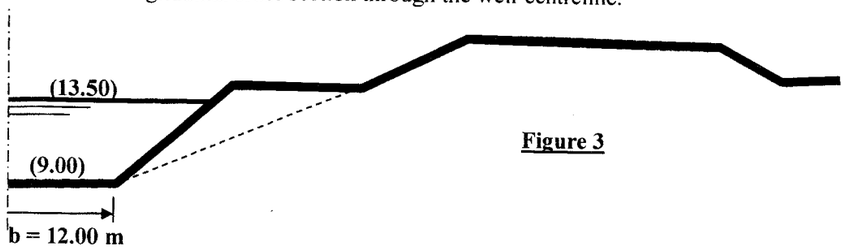


Figure 3

Question No (4) (20 Points)

Figure 4 shows the longitudinal section of an intermediate regulator. It is required to:

1. Find the length (**a**) and the depth of sheet pile (**d**) for the following conditions:
2. Safety against uplift pressures
3. Safety against undermining.
4. Safety against downstream scour.
5. The safe hydraulic gradient for the water leakage through the soil no more than 1:10.
6. The thickness of the floor at section (1) - (1) should not be more than 2.00 m.

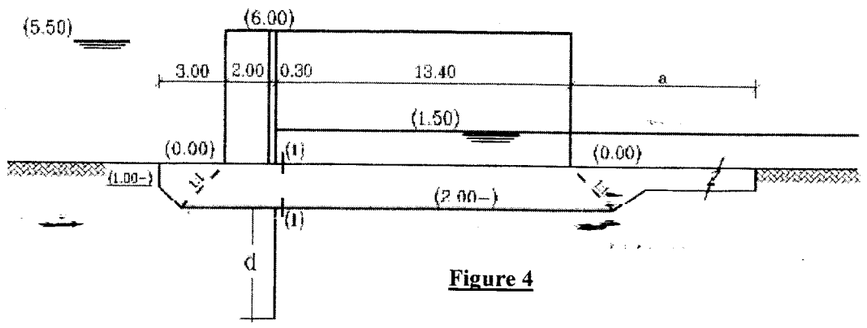


Figure 4

Question Number (5) (15 Points)

Figure 5 shows a regulator pier, if you have the following data:

- The regulator has 4 vents each 3 meter in width.
- The level of the pier top is (8.00) m, and width of the pier is 1.25 m.
- The upstream water level is (7.50) m, and the floor is horizontal at level (3.80) m.

- The reactions from adjacent spans including the dead and live loads that are transmitted from the bridge to piers through points (A, B, C, D, E, F, G, and H) were calculated as follows:
- RD.L. Reaction/girder of bridge = 6 ton.
- RL.L. Reaction/girder of bridge = 5 ton.

It is required to:

- Check the maximum and minimum stresses on the base section of the pier from the different possible cases of loadings.

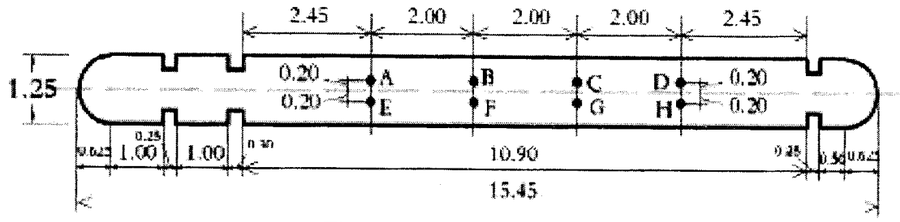
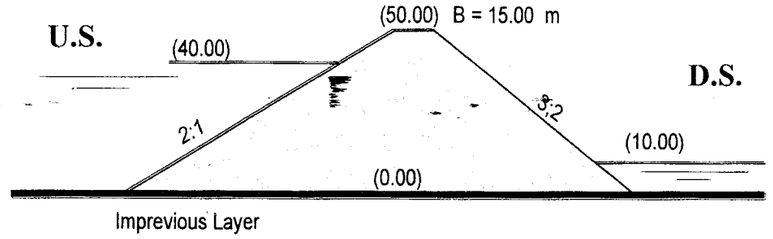


Figure 5

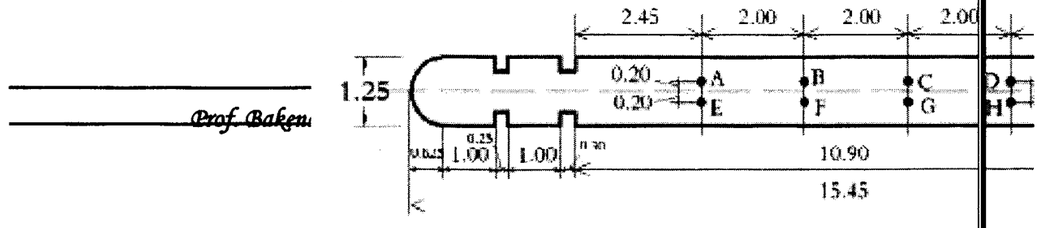
Question Number (6) (10 Points)

Draw the flow net for the seepage from upstream to downstream through the earth fill Dam showing in Fig (2), and calculate the seepage discharge and exit gradient, $K = 2*10^{-2}$ cm/sec.



Impervious Layer

Fig.6



Prof. Baken

Tanta University

Structural Engineering Department
Total Marks: 75 Points

Faculty of Engineering

Course Title: Foundations Engineering (2)	Course Code: CSE4116	Year: 4th
Date: Sunday, 22/1/ 2023 (First term)	Allowed time: 3 hrs (Term Exam)	No. of Pages: (4)

Answer all the following questions.

Problem number (1) (10 points)

(a) Discuss the different types of flow net and define heaving and piping failures **(2.0 points)**

(b) Using clear sketches, discuss the different types of retaining piles for excavation sides illustrating when each type should be used showing the method of design **(2.0 points)**

(c) Explain how to check the possibility of constructing additional floors on an old R.C. building **(2.0 points)**

(d) Define the swelling pressure and discuss the different methods of treatment of swelling soil **(2.0 points)**

(e) Illustrate the procedures to design raft over piles **(2.0 points)**

Problem number (2) (12 points)

(a) The section of an excavation is circular (diameter = 30 m) and 4.50 m in depth. The soil profile consists of 6.0 m stiff clay underlain by 4.0 m fine sand underlined by stiff clay and the initial ground water table is (-1.50 m). The coefficient of permeability for sand layer = 0.013 m/sec. well point was placed around the site 1.0 m apart from the excavation. The available well points are 0.075 m in diameter and 8.0 m in length with the yield discharge of the well is 0.003 m^3/sec. The radius of influence for well point group (R= 600) m

Design the well points pressure relief system **(4 points)**

(b) The basement of building requires 50 x 50 m excavating 5.0 m deep in a bed of clay 8.0 m, which overlies a 2.0 m bed of sand with an impervious layer below. The initial ground water table is (-1.00 m) and the coefficient of permeability for sand layer = 0.005 m/sec. Eight Fully penetrating **deep wells** were placed around the site 1.0 m apart from the excavation and 26.0 m spacing center to center. The radius of deep well and influence well system are 20 cm and 800 m respectively. The discharge of each deep well 50.0 m^3/hour.

Check the drawdown of the deep well system **(4 points)**

(c) The section of trench excavation is 2.00 wide and 6.00 depth and 150 m long. The soil profile consists of 16.0 m fine to medium sand on very stiff to hard clay. The initial ground water table is (-1.0 m). The coefficient of permeability for sand layer = 0.0006 m/sec. One row of 16.0 m in length **deep wells** -40 cm in diameter- was placed at 1.0 m apart of the trench and. The available pump is 50 m^3/hour and the yield discharge of the well = 40.0 m^3/hour. If the constant C =2000;

(i) Design the pressure relief system. **(2 points)**

(ii) Check the drawdown at the midway point of the trench **(2 points)**

Problem number (3) (16 points)

A reinforced concrete building consists of basement, ground and 13 typical floors. The building was constructed on piled raft as shown in the figure. The following data are given:

- The plane concrete thickness = 0.30 m
- The reinforced concrete thickness = 1.50 m
- The unit weight of soil = 1.80 t/m^3
- The allowable load of pile = 100 ton
- The foundation level = (- 4.00 m) and the raft is 16.0 in length x 8.50 m in width
- The load of one floor = 200 t acting in the right top quarter with e_x=0.30 m and e_y=0.20 m
- The pile diameter = 50.0 cm.
- The live load of basement = 300 kg/m^2
- The acting moment on the raft due to considering the lateral loads in Y direction = 350 t m.
- The acting moment on the raft due to considering the lateral loads in X direction = 400 t m.

(a) **Check the piles loads** **(5 points)**

(b) If this building consists of basement, ground and ten typical floors with the same vertical load, same raft dimensions, same plane concrete thickness, the foundation level = 4.50 m , the allowable net stress at foundation level =1.50 kg/cm^2 and the reinforced concrete thickness = 1.20 m

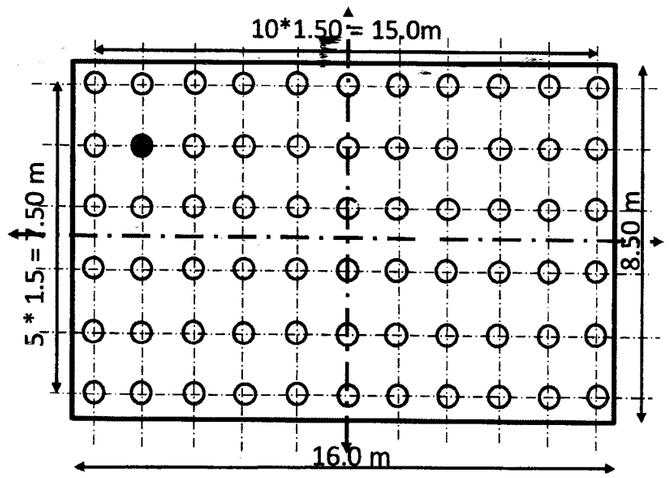
Check the stresses under the raft considering the case of vertical loads only **(5 points)**

(c) If the building consists of ground and (n) typical floors with the same vertical load, same raft dimensions, same plane concrete thickness, the foundation level = 2.50 m , the allowable net stress at foundation level =1.25 kg/cm^2, the live load of ground floor = 500 kg/m^2 and the reinforced concrete thickness = 1.00 m

Determine the safe number of floor (n) considering the case of vertical loads only **(4 points)**

(d) If the black pile was broken during construction,

explain only how to determine the maximum load in the piles **(2 points)**



Problem number (4) (14 points)

1- State with clear sketches the different interlock shapes of the sheet-pile sections. (2 Points)

2- Illustrate with clear sketches the different Construction methods used in sheet pile. (2 Points)

3- Figure (1) shows anchored sheet pile penetrating multi layers profile. The allowable stress of steel is 2000 kg/cm^2. calculate the followings:-

a) The minimum depth of embedment, D, to provide stability. (6 Points)

b) The required section modulus of the steel sheet pile. (4 Points)

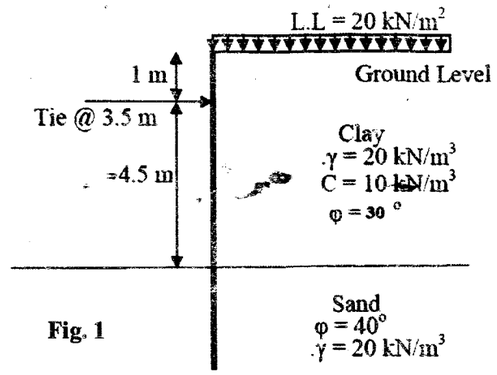
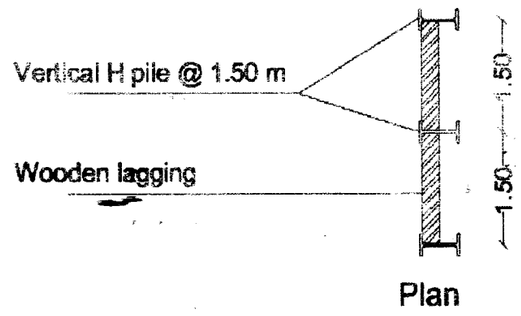


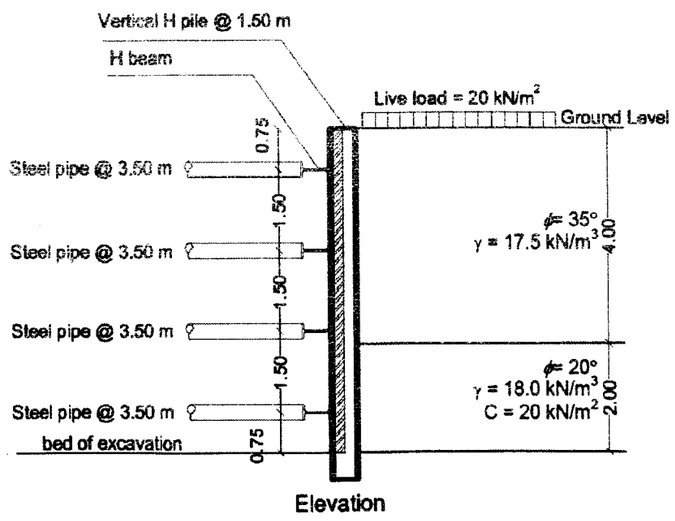
Fig. 1

Question No. 5 (11 Points)

1- Show using clear sketches the main types of braced cuts. (3 Points)

2- Figure (2) shows the cross section of continuous braced cut. The spacing of the struts is 3.50 m in the plan. Design the whole structural elements. (8 Points)





Problem number (6) (12 points)

1- Discuss using sketches the different types of caissons. (3 Points)

2- A square section caisson with outer/inner length of 11.6 / 10.00 m and reinforced concrete wall of .080 m thick. It is required to sink to a depth of 10.0 m to rest on Gravely sand (.γ = 17 kN/m3, .φ = 35°) assuming that the ground water level is located at 2.00 meter below the existing ground elevation. It is required to calculate the followings:-

(a) The thickness of the concrete seal to prevent the water inters the caisson (assuming the seal is simply supported to the walls). (5 Points)

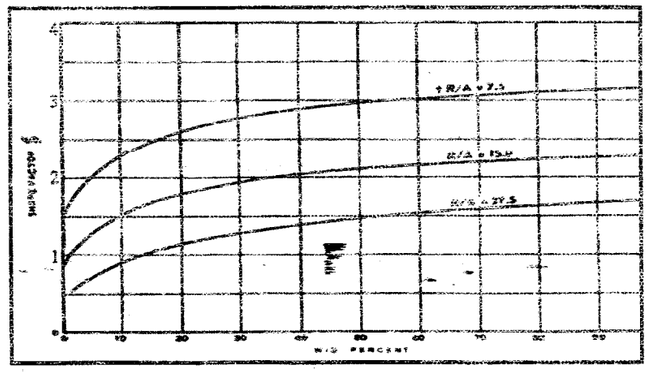
(b) Check the stability of the caisson against the uplift. (4 Points)

Equations:

$$Q = K D (H - h_e)\,\$ \quad \text{and} \quad R = C (H - h_e)\sqrt{K}$$

$$Q_w = \frac{2\pi K D}{\ln (R/r_w)} (H - h_e) \quad \text{and} \quad H - h = \frac{1}{2\pi K D} * \Sigma Q_i \ln (R/r_i)$$

$$Q_w = \frac{\pi K}{\ln R/r_w} (H^2 - h_e^2) \quad \text{and} \quad H^2 - h^2 = \frac{1}{\pi K} * \Sigma Q_i \ln (R/r_i)$$



$$t_{seal} = \sqrt{\frac{6\,\alpha q_s B^2}{f_c}}$$

L/B	1	1.2	1.4	1.6	1.8	2	3
α	0.051	0.064	0.073	0.078	0.081	0.083	0.083
β	0.048	0.063	0.075	0.086	0.095	0.102	0.119

أ.د. مصطفى عبد اللطيف الصواف أ. د. / أشرف كمال نظير د. أحمد فوزى