Alexandria University - Faculty of Engineering

Department	: **Structural Engineering**
Course	: **Soil Mechanics-2 (Elective Course - 3), CE-386**
Lecturers	: **Prof. Dr. / Khaled Gaaver and Prof. Dr. Hassan Abouseeda**
Students	: **Third Year Civil**
Date	: **June, 2015** — **Time : 3 Hours**

FINAL EXAM

Question 1 (25%)

(a) Compare between standard Proctor test and modified Proctor test. Calculate the compaction energy for the two tests.

(b) Compare between vibroflotation, dynamic compaction, and blasting to compact a loose granular soil in a construction site.

(c) The following are given for a natural soil deposit: moist unit weight, $\gamma = 16.00$ kN/m^3, water content, wc = 14%, and Gs = 2.70. This soil is to be excavated and transported to a construction site for use in a compacted fill. If the specification requires that the soil is to be compacted to a minimum dry unit weight of 18.40 kN/m^3 at the same water content, how many cubic meters of soil from the excavation site are needed to produce 40,000 m^3 of compacted fill ?

Question 2 (25%)

(a) Explain the principles of pre-compression (pre-loading) of soil to minimize post-construction settlement of a building on a consolidated clayey layer.

(b) A soft clay layer of 12.00 m depth is drained on one side. The following data are available for soft clay; $C_v = 2.45$ m^2/year, and $C_h = 4.00$ m^2/year.

1. Determine the time required for 90% consolidation, in case of without sand drains.
2. Determine the time required to achieve 90% consolidation, in case of using sand drains of 400 mm diameter and arranged in a square grid of 2.65 m spacing.
3. Determine the time required to achieve 90% consolidation, in case of using prefabricated vertical drains (PVD) of 26 mm by 225.4 mm and arranged in a square grid of 2.40 m spacing.

Question 3 (25%)

(a) Draw neat sketches to show the following: surface dewatering, well-point system, and deep wells.

(b) A construction site, of dimensions 30.00 m x 45.00 m, will be excavated to a depth of 7.00 m below the existing ground surface. Site investigation showed that the excavation will be carried out in a clay layer of 13.00 m thick which overlies a 12.00 m layer of sand. The sand layer has impervious layer below. The saturated unit weight of clay is 17 kN/m^3. The initial GWT was found to be at depth 3.00 m below the ground surface. The coefficient of permeability of sand is 2.5 x 10^{-3} m/sec.

1. Calculate the level to which GWT must be lowered to provide a factor of safety of 1.50 against ground heave and to satisfy water level is at depth of not less than 0.50 m below the excavation level.
2. Design a dewatering system to lower GWT to the target level using fully penetrating deep wells. Each well will be provided by a pump of operating capacity 15 liter/ sec.
3. If a footing is 70 m far from the center of the proposed excavation, determine the vertical stress increase under the footing due to dewatering operation.

Question 4 (25%)

(a) Explain with neat sketches the difference between the free head pile and the fixed head pile. Draw a typical diagram for each of the following:
 -shear force diagram,
 -bending moment diagram
 -lateral displacement diagram.

(b) Explain in detail how to calculate lateral displacements using a structural finite element analysis software. Stress on the following points:

- Choice of soil parameters for the model.
- Element spacing and its relation to soil parameters.
- Boundary conditions of elements

The following data may be used;

For $U_v\% < 60\%$ $T_v = (\pi/4).(U_v\% / 100)^2$.

For $U_v\% \geq 60\%$ $T_v = 1.781 - 0.933 \log(100 - U_v\%)$,

$T_v = (C_v.t)/d^2$, $T_r = (C_h.t)/(4R^2)$, $(1\text{-}U) = (1\text{-}U_v).(1\text{-}U_r)$.

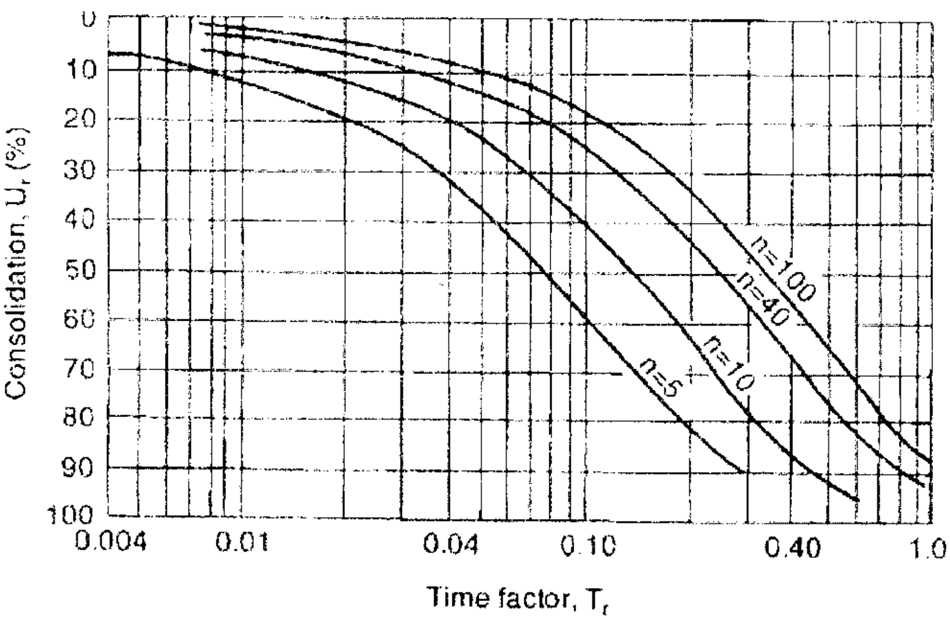
For square pattern sand drains, R=0.564S,

For triangular pattern sand drains, R=0.525S.

For confined aquifer; $q = 2\pi.D.k.(h_2 - h_1)/\ln(r_2/r_1)$,

For unconfined aquifer; $q = \pi.k.(h_2^2 - h_1^2)/\ln(r_2/r_1)$,

$R_o = 3000(H - h).\sqrt{k}$



Alexandria University
Faculty of Engineering
Civil Eng. Dept., 3rd year.

Elective 3: Design of concrete bridges
June 2015
Time allowed: **3 hours.**

Materials to be used:

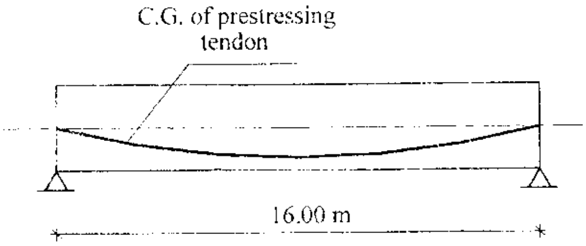
Concrete: f_{cu}=45 N/mm^2, f_{cui}=38 N/mm^2
Steel: f_{py}=1450 N/mm^2 , f_{pu}=1700 N/mm^2
Reinforcing steel for stirrups: st.240/350

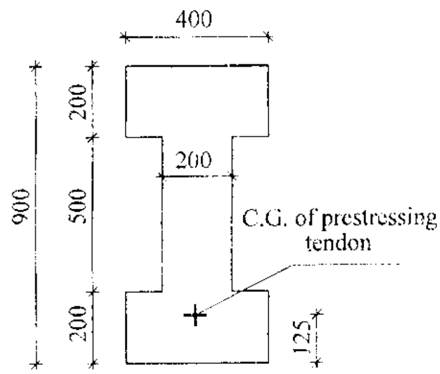
Any required data, that is not given, may be reasonably assumed.

Question 1: (50%)

The given figure shows the main dimensions of a simply supported prestressed beam. Bonded strands (A_{ps}=1800mm^2) are sequentially post-tensioned to apply a transferred prestressing force (P_i=2000kN). The estimated anchorage slip is (Δ_A=4mm). The C.G. of the parabolic prestressing tendon is shown in the figure. Fixed stiff steel ducts are used. The beam is subjected to uniformly distributed superimposed loads (w_{LL}=15kN/m and w_{DL}=8kN/m) in addition to its own weight. The time dependent prestress losses are 20% of the initial prestressing force (P_i). You are required to calculate:

a. The immediate prestress losses.
b. The required shear reinforcement at the critical section.
c. The ultimate flexural strength of the beam.





Beam cross section at mid-span

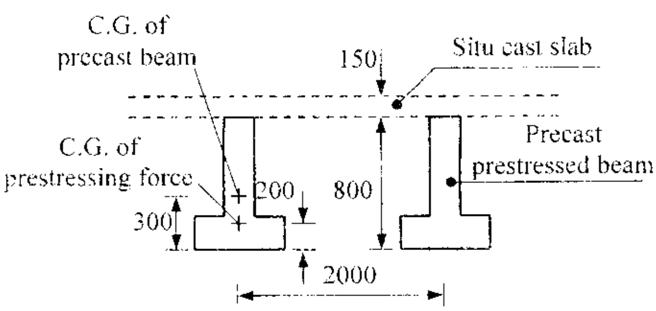
Question 2: (20%)

A pre-tensioned prestressed concrete prismatic bridge beam with variable eccentricity tendon is simply supported over a 12 m span. The beam is subjected to superimposed dead load w_{DL}=8 kN/m (in addition to the own weight of the beam) and live load w_{LL}=12 kN/m. The time dependent prestress losses are 20% of the initial prestressing force (P_i).

You are required to specify a suitable concrete cross section for the beam and calculate the magnitude of the required initial prestressing force (P_i) and its eccentricity (e) given that the beam has a symmetrical I section.

Question 3: (30%)

The roof of a building is constructed using prestressed inverted T-beams (case B) spaced at 2.0m center to center. The roof slab is situ cast unshored reinforced concrete (t=150mm, f_{cu}=25N/mm^2, f_c=9.5N/mm^2). The weight of the roof covering material is (1.5kN/m^2) and the roof is subjected to live load (w_{LL}=2kN/m^2). The beams are simply supported (L=12.0m). The given figure



shows the main dimensions of the selected precast concrete beams and topping slab. The geometric properties of the cross section of the precast beam are (A_c=200×10^{3}mm^2 and I_c=15×10^{9}mm^4). The beams are pretensioned using straight wires (P_i=1800kN for each beam). The time dependent losses may be assumed 15% of the transferred prestressing force. <u>You are required to</u>:

a. Check the stresses at mid span in the prestressed beams and floor slab both at transfer and at service load.
b. Calculate the maximum live load that can be carried by the roof considering the concrete stress limits.

Best wishes...

Data sheet

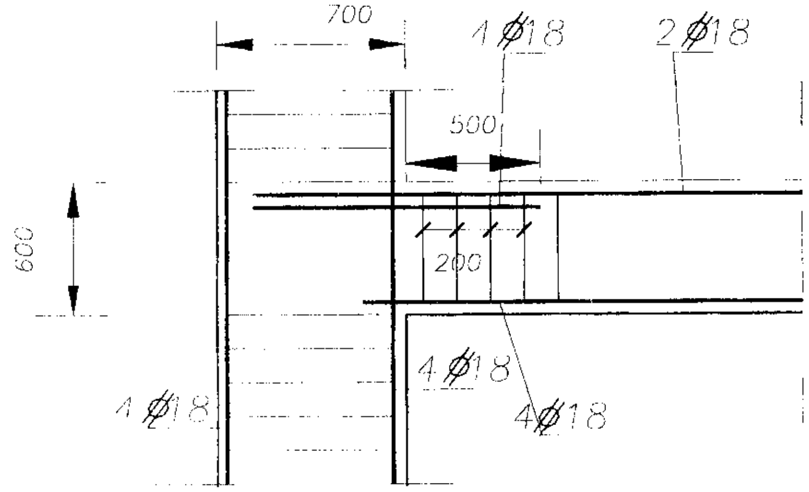
At the time of initial tensioning before time dependent losses produced by creep, shrinkage, or relaxation have occurred (At Transfer)	
1. Maximum compressive stress	$0.45 f_{cui}$
2. Maximum tensile stress except as permitted in item 3	$0.22\sqrt{f_{cui}}$
3. Maximum tensile stress at the ends of simply supported members	$0.44\sqrt{f_{cui}}$
Service load flexural stresses, assuming all prestressed losses have occurred (At Service Loads)	
1. Maximum compressive stress due to prestressed plus sustained loads	$0.35 f_{cu}$
2. Maximum compressive stress due to prestressed plus total loads	$0.40 f_{cu}$
3. Maximum tensile stress in pre-compressed zone tensile zone	Case A- zero Case B- $0.44\sqrt{f_{cu}}$ Case C- $0.60\sqrt{f_{cu}}$ $\leq 4\ N/mm^2$ Case D- $0.85\sqrt{f_{cu}}$

- خرسانة مقاومتها المميزة $f_{cu}=30\ N/mm^2$
- التسليح الطولي من حديد عالي المقاومة (رتبته ٥٢٠/٣٦٠) .
- الكانات من صلب طري (رتبته ٣٥٠/٢٤٠)
- **يسمح بكود الأحمال و كود الخرسانة المسلحة و جداول التصميم و ملخص معادلات و اشتراطات تصميم المنشآت لمقاومة الزلازل**

أجب عن جميع الأسئلة التالية

١- (٢٠%)

أ-شكل التسليح الموضح هو تسليح الوصلة الخارجية بين كمرة وعمود تشكلان جزءً من إطار مقاوم لأحمال الزلازل(ذو ممطولية كافية) ، والمطلوب إعداد جدول يحدد عيوب و مخالفة نظام التسليح من حيث التسليح الطولي و الكانات وشكل التسليح و أبعاد القطاعات ثم ارسم بكراسة الاجابة أسفل الجدول السابق شكل التسليح المطابق للمواصفات (بدون أي حسابات).



ب- حدد الخسائر الحادثة نتيجة التعرض لزلزال بالمبني بالصور التالية واذكر أسباب حدوثها.

أ	ب	ج
		

-ملحوظة: معادلات توزيع الأحمال الجانبية في اتجاه X باستخدام طريقة الجساءة النسبية:

$$F_{xi} = \frac{F_x}{\sum I_y} I_{yi} + \frac{F_x * e_y}{\sum (I_x * x^2 + I_y * y^2)} I_{yi} * y_i$$ "for X-dir. resisting elements"

$$F_{yi} = 0 - \frac{F_x * e_y}{\sum (I_x * x^2 + I_y * y^2)} I_{xi} * x_i$$ "for Y-dir. resisting elements"

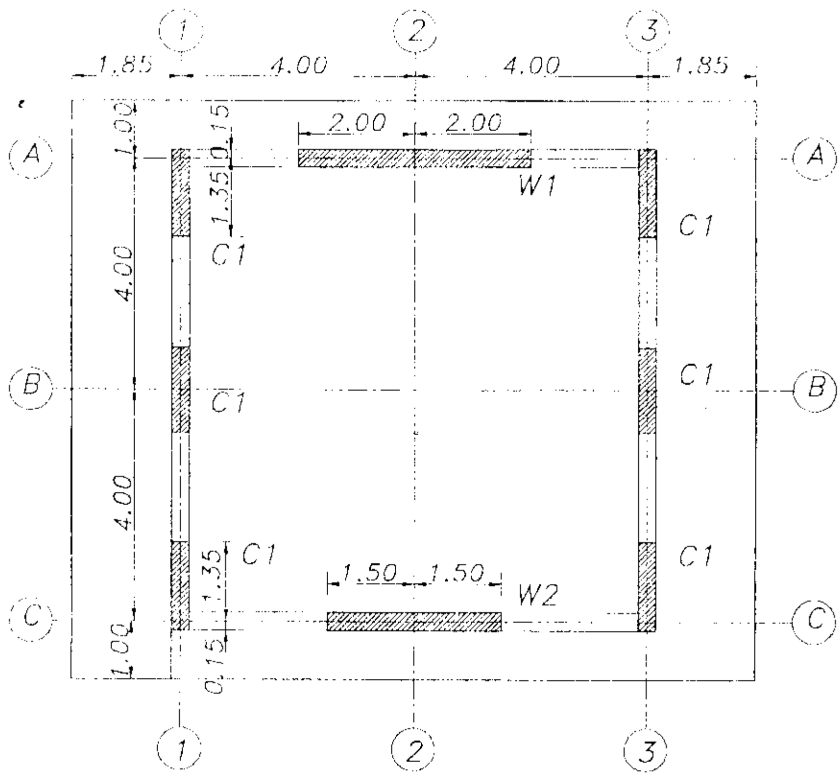
٢- (٣٠%) المسقط الأفقي المبين لمبني خدمي بأحد المدن النائية (الارض مستوية خارج المدينة بمنطقة خالية من المباني)، و يتكون من دور أرضي وعشرة أدوار علوية(اجمالي احدي عشر دورا") بارتفاع ٥,٠٠ متر للدور الأرضي و ٣,٠٠ متر للادوار العلوية , والحمل الميت الكلي شاملا الحوائط و الكمرات = **15.0 kN/m²** والحمل الحي= **5.0 kN/m²** فإذا كانت قطاعات الأعمدة والكمرات والحوائط كما يلي:

- *COLUMN C1: 300 x1500 mm ; BEAMS: 700*300mm*
- *WALL W1 :300 x 4000 mm ; WALL W2 :300 x 3000 mm -*

والنظام المقاوم للأحمال الأفقية في اتجاهY مكون من:**الاطارات ذات الممطولية المحدودة عند محوري 1 , 3**

والنظام المقاوم للأحمال الأفقية في اتجاه X مكون من: **حوائط القص عند محوري A , C فقط**.......... و المطلوب :

١. تحديد مركز الجساءه(Center of rigidity).
٢. حساب حمل العمود C1 الأقصى الكلي علي محوري B و3 بالدور الأرضي نتيجة الأحمال الرأسية (Gravity Loads).
٣. تحديد نوع النظام الإنشائي لمقاومة الأحمال الأفقية و تحديد قيمة معامل تخفيض رد الفعل و الفترة الزمنية الأساسية لكل اتجاه.
٤. حساب قوة الزلازل الأفقية في اتجاه X و قيمتها عند الدور الأخير.
٥. إيجاد القوي الأفقية المؤثرة علي الحائط W1 علي محور A بسقف الدور الأخير نتيجة أحمال الزلازل في اتجاه X *مع أخذ تأثير الإزاحة الإضافية (Accidental eccentricity) باستخدام طريقة الجساءة النسبية*. قارن الإجابة عن طريق الحل باستخدام طريقة معامل التكبير.



مدني ٢

السؤال الثالث :-

1- أذكر الفرق بين المواسير الصلبة ,المرنة و شبة مرنة ؟

2- المطلوب حساب الأحمال و تصميم الأساس لماسورة صلبة قطر 1 متر (سمك 5 سم) و ذات حمل امن 1800 كجم/م.ط, موضوعة في خندق عرضة 1.2 م في منتصف الطريق. عمق الراسم العلوي للماسورة 5 م, كثافة مادة الردم 1.8 طن/م^3 و زاوية الأحتكاك 30°, في حالة:

- طريق ممتد بعرض 8 م يمر عليه سيارات وزن العجلة 4500 كجم, و سمك مادة الرصف 20 سم و كثافة 2.2 طن/م3.
- طرق سكة حديد يمر عليه قاطرة بوزن 90 طن و طولها 20 م, و عرض الفلنكات 3 م, و معامل الوزن C_s يساوي 0.4.

$$C = [1 - e^{-2\,k \tan\varphi * (H/B)}] / 2K \tan\varphi \qquad K = \{1 - \sin\varphi\} / \{1 + \sin\varphi\}$$

تصرفات الحريق طبقاً لتعداد السكان ونوعية المنطقة

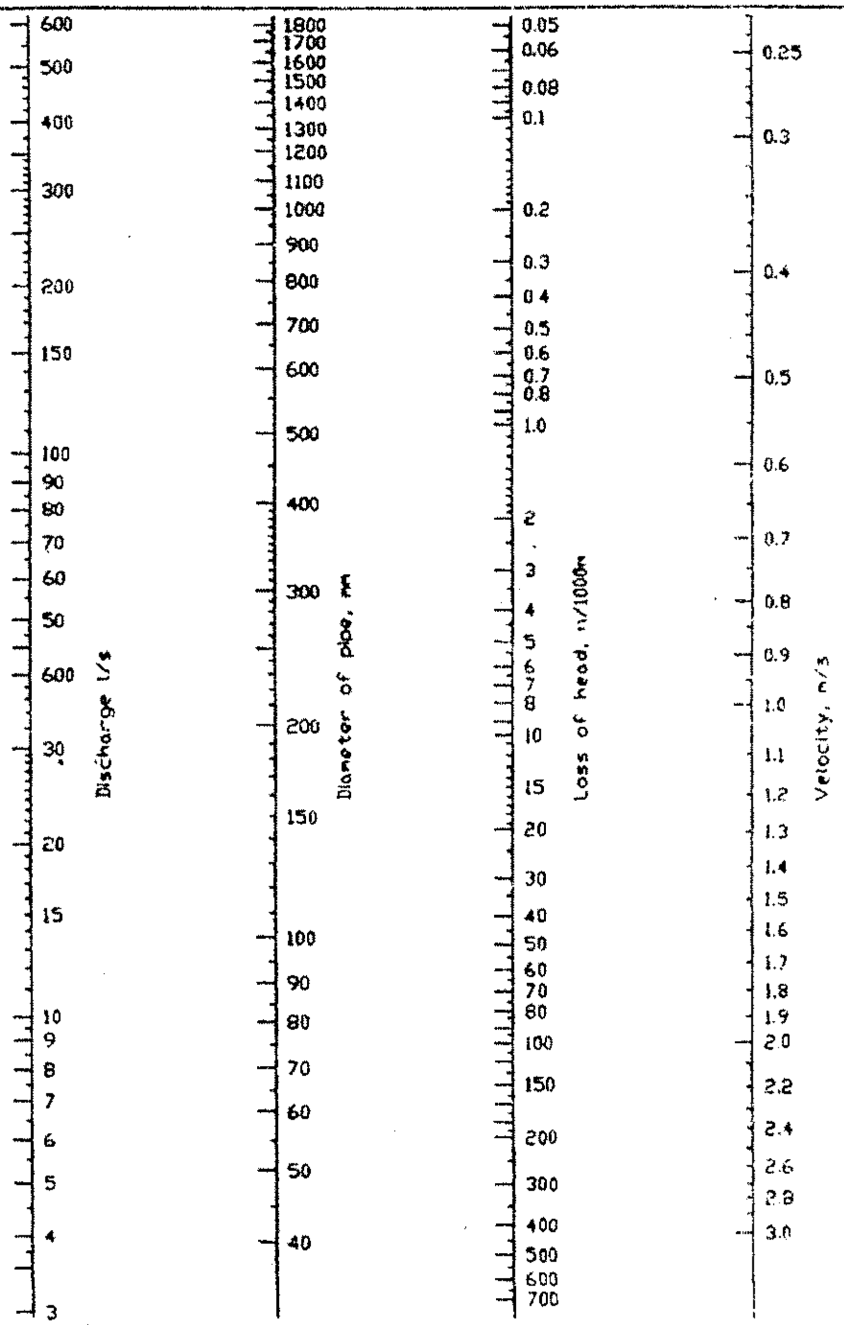
تعداد السكان (نسمة)	تصرف الحريق (ل/ث)	فترة الحريق (ساعة)
حتى10000	20	2
10,000-25,000	25	2
25,000-50,000	30	3
50,000-100,000	40	3
100,000-250,000	50	4
250,000-1,000,000	60	4
أكبر من1,000,000	70	4

جدول رقم (٤-٤) قيم معامل الوزن (C_s)

D/2H or B_c/2H	M/2H or L/2H													
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0	5.0
0.1	0.019	0.037	0.053	0.067	0.079	0.080	0.097	0.103	0.108	0.112	0.117	0.121	0.124	0.128
0.2	0.037	0.072	0.130	0.131	0.155	0.174	0.180	0.202	0.211	0.219	0.229	0.238	0.244	0.248
0.3	0.053	0.103	0.149	0.190	0.224	0.252	0.274	0.292	0.306	0.318	0.333	0.345	0.355	0.360
0.4	0.670	0.131	0.190	0.241	0.284	0.320	0.349	0.373	0.391	0.405	0.425	0.440	0.454	0.460
0.5	0.079	0.155	0.224	0.284	0.336	0.379	0.414	0.441	0.463	0.481	0.505	0.525	0.540	0.548
0.6	0.080	0.174	0.252	0.320	0.379	0.428	0.467	0.499	0.524	0.544	0.572	0.596	0.613	0.624
0.7	0.097	0.189	0.274	0.349	0.414	0.467	0.511	0.546	0.584	0.597	0.628	0.650	0.674	0.688
0.8	0.103	0.202	0.292	0.373	0.441	0.499	0.546	0.584	0.615	0.639	0.674	0.703	0.725	0.740
0.9	0.108	0.211	0.306	0.391	0.463	0.524	0.574	0.615	0.647	0.673	0.711	0.742	0.766	0.784
1.0	0.112	0.219	0.318	0.405	0.481	0.544	0.597	0.639	0.673	0.701	0.740	0.774	0.800	0.816
1.2	0.117	0.229	0.333	0.425	0.505	0.572	0.628	0.674	0.711	0.740	0.783	0.820	0.849	0.868
1.5	0.121	0.238	0.345	0.440	0.525	0.596	0.650	0.703	0.742	0.774	0.820	0.861	0.894	0.916
2.0	0.124	0.244	0.355	0.454	0.540	0.613	0.674	0.725	0.766	0.800	0.849	0.894	0.930	0.956

جدول (٤-٣) معامل الصدم (F)

Traffic Type	F
Highway	1.50
Railway	1.75
Airfields	
Runways	1.00
Taxiways, aprons, hard stands	1.50



شكل (٦-٧)

المخطط البيانى لمعادلة هازن

(C = 100)

Alexandria University
Faculty of Engineering
Structural Engineering Department
June, 2015

جامعة الإسكندرية
كلية الهندسة
قسم الهندسة الانشائية
يونيو ٢٠١٥

Soil Mechanics & Foundation Eng., (CE1-213)
Third year civil
Time allowed: Three Hours.

ميكانيكا التربة وهندسة الأساسات (CE1-213)
السنة الثالثة مدني
الزمن : ثلاث ساعات

The numbers of pages of this exam are THREE pages only.

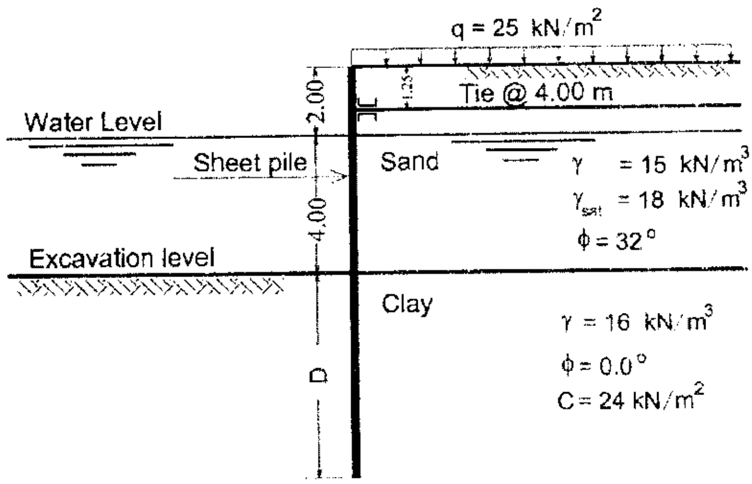
Please answer all the following questions (You may assume any missing data)

(يرجى الاجابة بنفس ترتيب ورقه الاسئله مع تخصيص ورقتين بكراسه الاجابه لكل سؤال وبدء اجابه أي سؤال في صفحه جديده)

Question (1) (25%):

a) Explain using neat sketches the different types of anchorages that can be used to support ties in anchored sheet piled walls.

b) For an anchored sheet pile of free-end support, shown in figure (1), it is required to;
1. Calculate the penetration depth (D), and determine the total length of the sheet pile,
2. Determine the required section modulus of the sheet pile,
3. Design the steel ties (diameter and length), and
4. Check the suitability of a plain concrete block of 1.00 x 1.00 x 1.00 m to support the tie.



Question (2) (20%):

A circular footing of diameter 2m resting in a bed of sand of thickness 4m, at depth 2m where GWT exists. The sand overlies a clay layer of 2m thickness.
The sand has the following properties: γ_{sat} = 2.0 t/m^3, ϕ = 30°, N_c=30, N_q=18, N_γ=10, and the clay has the following properties: γ_{sat} = 1.8 t/m^3, c = 2.0 t/m^2, C_c=0.10, e_o=0.70, N_c=5, N_q=1, N_γ=0.

It is required to calculate the column load to satisfy the two following conditions:-

a) Factor of safety 3.0 against shear failure.
b) Consolidation settlement 5 cm.

Question (3) (20%):

a) Explain how to perform a pile load test, and what are the conditions required to accept the pile load?
b) Nine piles group of square pattern 3x3 spaced at 1.5m, each pile is a circular reinforced concrete pile of diameter 0.5m and its length is 20m. Piles are driven into a sandy soil of γ_{nat} = 1.5 t/m^3, ϕ = 20°, and N_q=30. Its required to:-

1- Calculate the allowable group capacity.
2- While performing a pile load test on the corner pile in the group it failed, redistribute the new group loads on each pile and check the maximum and minimum loads.
3- If the maximum load on the pile is not safe suggest a suitable solution.

Question (4) (20%):

For the foundation system shown in figure (1), Calculate the following:

a) Pile Loads.
b) Geometric design of the foundation system.
c) Structural design.
d) Sketch the reinforcement.

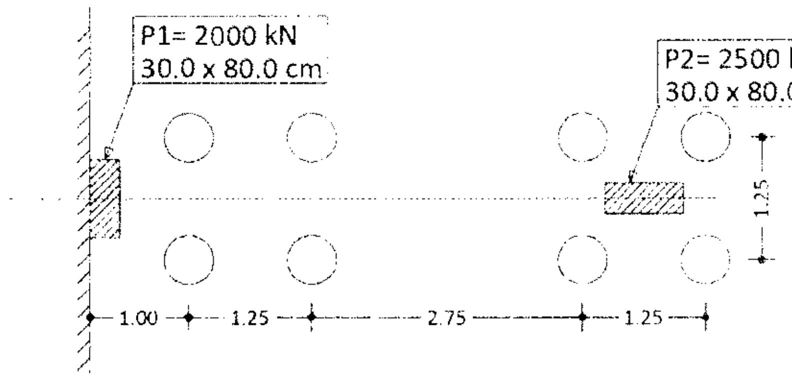


Figure (1)

Parameters:

$q_{all,net}$ = 150 kN/m^2, K_1 = 0.225 , K_2 = 1706 , q_{shear} = 450 kN/m^2, q_{punch} = 900 kN/m^2,

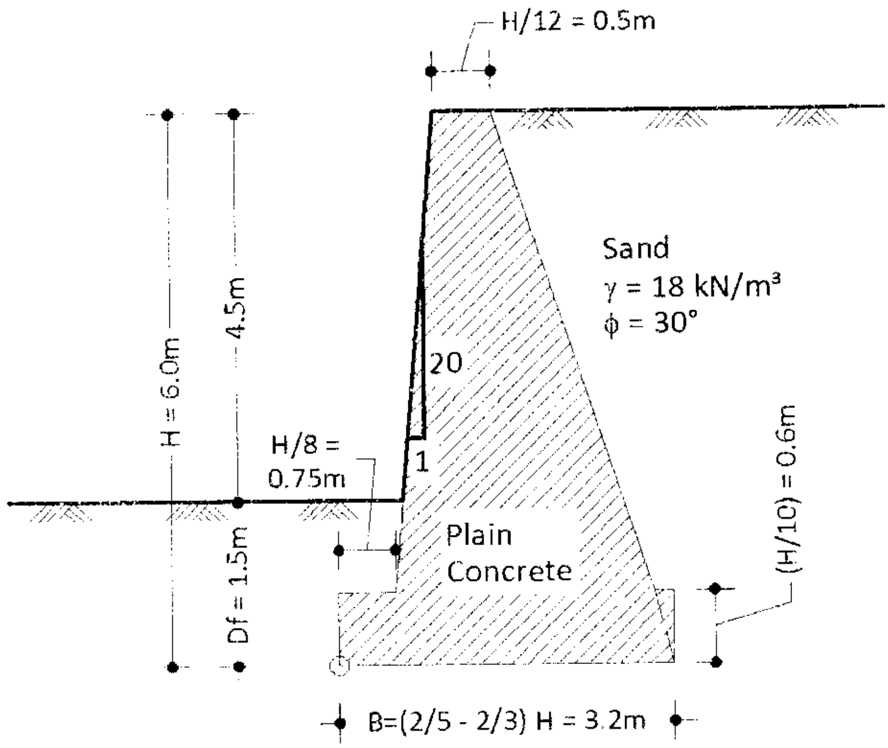
and d_m= K_1 (M / b)$^{1/2}$ (Where M in kg.cm (kN.m x 10^4), b in cm)

Question (5) (20%):

Check stability and dimensions of the gravity wall shown in Figure.

Given:

Safety factor against sliding	= 1.50
Safety factor against overturning	= 2.0
Safety factor for Bearing capacity	= 2.50
q_{ult}	= 400 kN/m^2
Allowable concrete strength in compression	= 4000 kN/m^2
Allowable concrete strength in tension	= 400 kN/m^2



....Best wishes...... ....

Exam committee:

Prof. Dr. Khaled Gaaver, Prof. Dr. Hassan Abouseeda, and Prof. Dr. Amr El-Wakil

امتحان الفصل الدراسي الثاني السنة الثالثة مدني مادة الكتابة التقنية الزمن ساعتان	**جامعة الاسكندرية** **كلية الهندسة** **قسم الهندسة الانشائية**

اجب عن جميع الاسئلة

السؤال الاول (٢٥%)

أ- اذكر المكاتبات التي يحتاجها المهندس المدني؟

ب- ماهي سمات الكتابة التقنية الجيدة ؟

ت- أذكر البيانات التي يتضمنها كل من (المهارات بالسيرة الذاتية - المؤهلات العلمية بالسيرة الذاتية) ؟

أ- تعتبر مرحلة الاعداد و التخطيط للكتابة هي اولي مراحل الكتابة . اذكر مهام تلك المرحلة؟

ث- ماهي انواع الخطابات .ارسم الشكل العام الذي يوضح العناصر الاساسية في الخطاب؟

السؤال الثاني (٢٥%)

أ- أذكر عناوين الفقرات الأساسية للتقارير الفنية عن طبيعة التربة ؟

ب- أكتب نموذج لفقرة المقدمة في تقرير فنى عن طبيعة التربة لمبنى ؟

ت- ماهي السمه الغالبة علي الكتابة في فقرة الخلاصة والتوصيات للتقارير الفنية الأنشائية؟

ث- اذكر نماذج من المرفقات للتقارير الفنية الأنشائية؟

السؤال الثالث (٢٥%)

طلب منك تقديم فكرة مشروع جديد امام لجنة.

أ - ما هي الخطوات التي يجب عليك اتباعها حتي تتمكن من تقديم عرض ناجح من بداية و حتي نهاية العرض. حدد الخطوات التي سوف تقوم بها. اذكر اهم العقبات المتوقعة اما هذا العرض و ما الاستراتيجية التي سوف تتخذها.

ب - حدد كيف تتصرف في المواقف التالية أثناء اعداد أو تقديم العرض

١- احسست بالتوتر الشديد قبل العرض.

٢- تم توجيه سؤال لا تعرف اجابتة و بطريقة غير مهذبة.

٣- علمت قبل العرض بفترة قليلة أن الوقت المحدد للعرض تم تقليله ليصبح ٥ دقائق أقل.

السؤال الرابع (٢٥%)

4- Consider the following information:

You are the Civil Engineer responsible for checking buildings for repair (ترميم) or demolishing (إزالة). You inspected a building, and wrote the following information.

It is required to write a brief (ملخص) technical report to your chief engineer (رئيسك) trying to convince (يقنع) him to demolish the building. (Write in both Arabic and English in **not more than half a page for each**)

a) A multi-storey building of 8 floors.

b) The columns are typically 30x80 cm.

c) The beams are typically 20x70 cm.

d) The slabs are 14 cm thick.

e) Most columns, slabs, and beams experience severe corrosion (تعاني من صدأ متقدم) (cracks exist in most structural elements).

f) Parts of the slabs have excessive (زائد)deflection.

g) There exist diagonal cracks in the walls (suspicion (شك) of uneven settlement)

(Do not forget the elements of technical writing: (Audience, purpose, Style, flow, and organization)

السؤال الخامس (١٠ % اضافي)

اكتب في شكل قائمة حرفية – اهم المهارات التي اكتسبتها بعد دراسة هذا المقرر .اكتب تعليقاتك و اقتراحاتك الفنية عن افضل و اسوأ عرض او محاضرة حضرتها (بدون ذكر اسماء اشخاص او مقررات).

أ.د/ السعيد محمود

كلية الهندسة – جامعة الاسكندرية
السنة : ثالثة مدنى
امتحان نهاية الترم الثانى ٢٠١٥

قسم الهندسة الصحية
زمن الامتحان : ٣ ساعات

الهندسة الصحية

السؤال الرابع : (٢٠ درجة)

١. عرف كل من:
   a. تعديلات طريقة الحمأة المنشطة.
   b. التنقية الذاتية.
   c. الأراضى الرطبة
٢. محطة معالجة مياه الصرف الصحى تعمل بنظام التهوية الممتدة فاذا كان عرض حوض حجز الرمال الواحد ١,٢٠ متر. صمم أحواض التهوية و أحواض الترسيب النهائى.
٣. محطة معالجة للمخلفات السائلة تعمل بطريقة الحمأة المنشطة تصرفها ٨٠٠٠٠ م٣/يوم و كانت نسبة الحمأة المعادة ٣٠% و تركيز BOD ٣٥٠ مجم/لتر فى مياه المجارى الخام. صمم أحواض التهوية و أحواض الترسيب النهائى.

(O.F.R = 1200 m^3/m^2/day – D.T = 60 sec – R= 100% - D.T = (18 – 36) hr O.F.R = 20-40 m^3/m^2/day – D.T = (2-4) hr- O.F.W =450 m^3/m/day- D.T = (6 – 12) hr – O.L.R = 560 gm BOD/m^3/day)

السؤال الخامس : (١٥ درجة)

١- أذكر الغرض من معالجة الحمأة مع ذكر مراحل معالجة الحمأة و الغرض من كل مرحلة.
٢- اشرح نظرية عمل المرشح الزلط البيولوجى.
٣- محطة معالجة صرف صحى تتكون من ٤ أحواض ترسيب ابتدائى مستطيلة بأبعاد ٣٢*٨*٣,٢٥ متر و ٤ أحواض ترسيب ابتدائى دائرية بقطر ٣٦ متر و عمق ٣,٥ متر. أقترح نوع مرشح الزلط المعدل و صمم مرشحات الزلط المعدلة و أحواض الترسيب النهائى اذا كان تركيز BOD ٣٥٠ مجم/لتر فى مياه المجارى الخام.

(O.F.R = 20-40 m^3/m^2/day – D.T = (2-4) hr- O.F.W =450 m^3/m/day- O.L.R = 60 – 180 gm BOD/m^3/day - H.L.R = 2- 4.5 m^3/m^2/day - O.L.R = 400 – 110 gm BOD/m^3/day - H.L.R = 10- 25 m^3/m^2/day)

السؤال السادس : (٢٠ درجة)

١- اشرح نظرية عمل بحيرات الأكسدة موضحا مميزات و عيوب تلك الطريقة.
٢- محطة معالجة الصرف الصحى تعمل بنظام التهوية الممتدة تصرفها التصميمى ١٠٠٠٠ متر مكعب يوميا صمم وحدات معالجة الحمأة المطلوبة اذا كان تركيز المواد العالقة فى مياه المجارى الخام ٣٠٠ مجم/لتر.
٣- بها ٢ حوض ترسيب ابتدائى بقطر ٢٦ متر و ٦ مرشح زلط تقليدى بقطر ٤٠ متر و عمق ٢,٥ متر و 4 حوض ترسيب نهائى بقطر ١٦ متر و كان التصرف الداخل للمحطة ٣٠٠٠٠ م^3/يوم و تركيز B OD 350 مجم/لتر فى مياه المجارى الخام. أحسب معدل التحميل السطحى لأحواض الترسيب الأبتدائى و النهائى و الحمل العضوى و الهيدروليكى لمرشحات الزلط.

(O.F.R = 20-40 m^3/m^2/day – D.T = (2-4) hr- O.F.W =450 m^3/m/day- O.L.R = 60 – 180 gm BOD/m^3/day - H.L.R = 2- 4.5 m^3/m^2/day)

كلية الهندسة – جامعة الاسكندرية
السنة : ثالثة مدنى
امتحان نهاية العام الدراسى 2015

قسم الهندسة الصحية
زمن الأمتحان : 3 ساعات

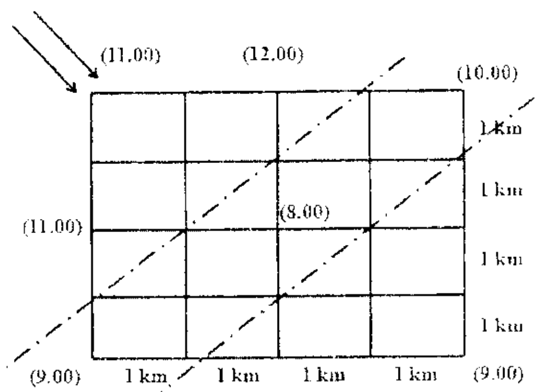
الهندسة الصحية

السؤال الأول : (25 درجة)

1- محطة معالجة مياه تحتوى على عدد زوجى من المرشحات الرملية السريعة مساحة المرشح الواحد 50 م2 وزمن الغسيل 15 دقيقة يوميا ونسبة مياه الغسيل تمثل 1% من التصرف الكلى والمطلوب:

- تحديد عدد المرشحات
- التحقق من معدل الترشيح
- تصميم اقطار شبكة المواسير اللازمة لتشغيل المرشح
- تصميم شبكة المواسير المثقبة فى احد المرشحات
- ارسم قطاعا راسيا فى المرشح مبينا اسماك جميع الطبقات وكذلك جميع الصمامات شارحا خطوات تشغيل المرشح

السؤال الثانى (20 درجة)



- للشبكة المعطاة فى الرسم احسب اقطار المواسير المقطوعة بالقطاعين الموضحين اذا كان القطاعان يقسمان المدينة الى ثلاثة اقسام متساوية علما بان تعداد المدينة 200000 نسمة وتصرف مكافحة الحريق 100 لتر / ث - للمناسيب المعطاة ارسم الصمامات اللازمة لضمان حسن التشغيل والصيانة طبقا للمناسيب المعطاه
- صمم طلمبات الرفع العالى المطلوبة لهذة المدينة اذا كان الخزان العالى يقع فى اخر المدينة

السؤال الثالث (10 درجة)

لمدينة تعدادها 500000 شخص (خمسمائة الف شخص) وكانت نسب معدلات الاستهلاك كما هى بالجدول المرفق

Time (hours)	0h-2h	2h-4h	4h-6h	6h-8h	8h-10h	10h-12h	12h-14h	14h-16h	16h-18h	18h-20h	20h-22h	22h-24h
consumption ratio	2	3	5	10	12	13	18	12	9	8	5	3

- اى الاقتراحين افضل : تشغيل طلمبات الرفع العالى بمعدل ثابت على مدار 24 ساعة ام معدل متغير كل 8 ساعات موضحا معدلات الرفع فى كل حالة وحجم التخزين المطلوب اذا كان متوسط معدل استهلاك الفرد للمياه 150 لتر /فرد/يوم

Alexandria University
Faculty of Engineering
Irrigation & Hydraulics Dept.

Third Year Civil Eng.
12 June 2015
Time Allowed 3 hrs.

Final Term Exam
Design of Irrigation Structures (1)

الإمتحان مكون من ثلاث صفحات

Question No.1 (25 degrees)

1---It is required to make hydraulic design of the reinforced concrete two vents box culvert constructed on the canal cross section shown in figure (1), and check of heading up if entrance and exit wing walls are of the broken type, neglect rack losses.

2---Calculate vertical and lateral loads acting on the culvert (t = 40cm, $\gamma_e = 1.8\ t/m^3$, Live loads is the tanker 60 & 30 ton, and $\phi = 30^0$).

Question No.2 (25 degrees)

1---For the two cross sections shown in figures (2& 3), suggest the water crossing structure constructed of steel pipes and draw section elevation showing levels and dimensions. ($d_{pipe} = 1.0m$, $\gamma_e = 1.8\ t/m^3$ and $\phi = 30^0$).

2---Calculate upstream water level, if U.S and D.S. wing walls of the box type, neglect rack losses.

3---Design the pipe thickness($f_s = 1000\ kg / cm^2$, L.L = $2t/m^2$ on the road level).

Question No.3 (15 degrees)

An open trough aqueduct has an internal bed width of 2.5 m and constructed on a canal shown in figure (4) to pass a discharge 6 m^3/sec. Walls at inlet and exit are of the broken type. Manning coefficient = 0.015, and length of the aqueduct is 25 ms. **It is required to calculate upstream water level.**

Question No.4 (25 degrees)

Figure (5) shows a longitudinal section of a clear over fall weir based on a homogenous isotropic pervious foundation. Sketch out the flow net and carry out the following:

1---Find the distribution of the uplift pressure along the subsurface contour of the floor,

2---Find the distribution of the exit gradient along the exit face,

3---Calculate the seepage discharge beneath the floor in $m^3/day/m$,

4---Check the safety against piping and heave phenomena if the foundation soil is medium sand, where the safe exit gradient value is 0.17.

Question No.5 (15 degrees)

For the counterfort reinforced concrete retaining wall shown in figure (6), **it is required to Design** the vertical and horizontal slabs, the counterfort and sketch out the main reinforcement. (S= 4m, counterfort thickness = 0.3m, β = 0.88, f_s= 1800 kg /cm^2, f_c= 65 kg /cm^2 , k_1= 0.316 and k_2=1584).

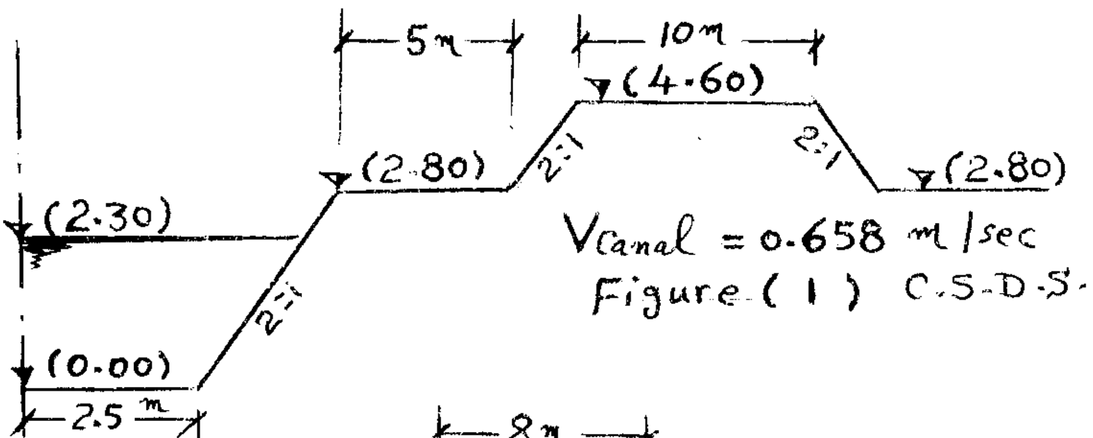


Figure (1) C.S.D.S.

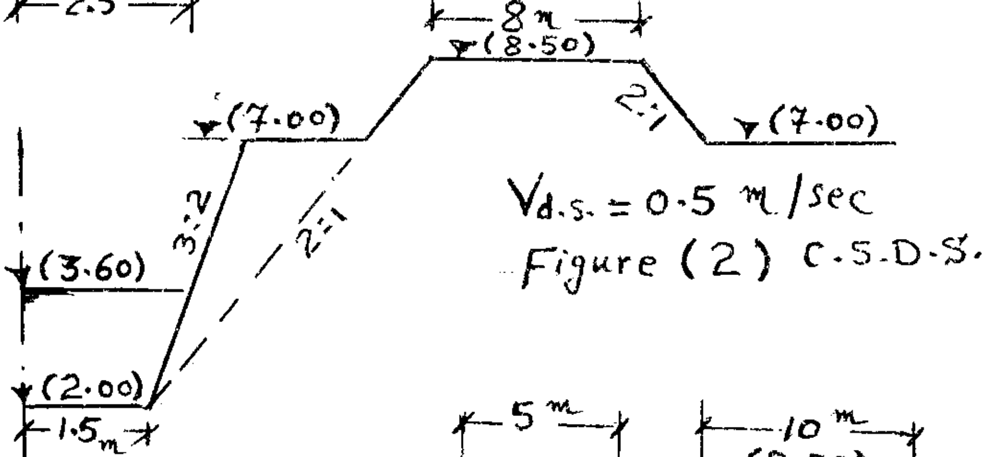


Figure (2) C.S.D.S.

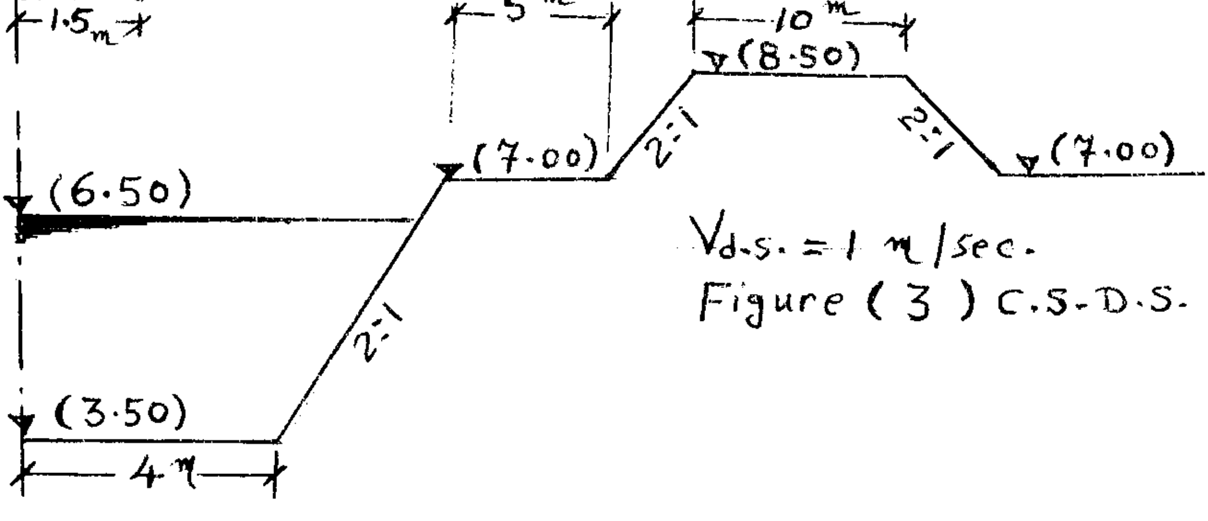


Figure (3) C.S.D.S.

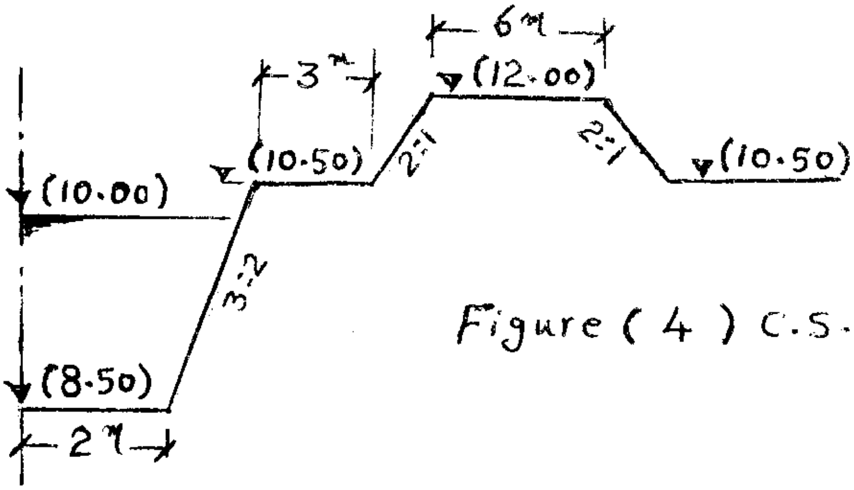


Figure (4) C.S.D.S.

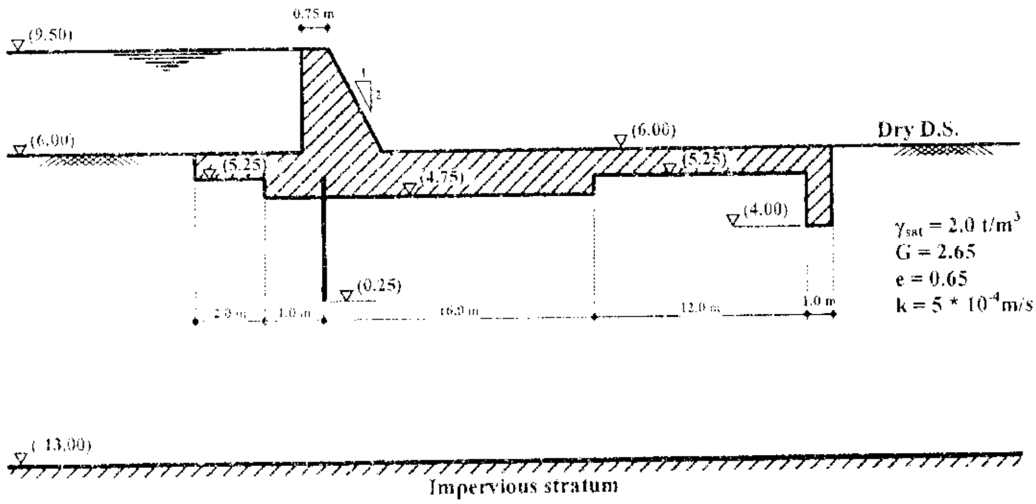
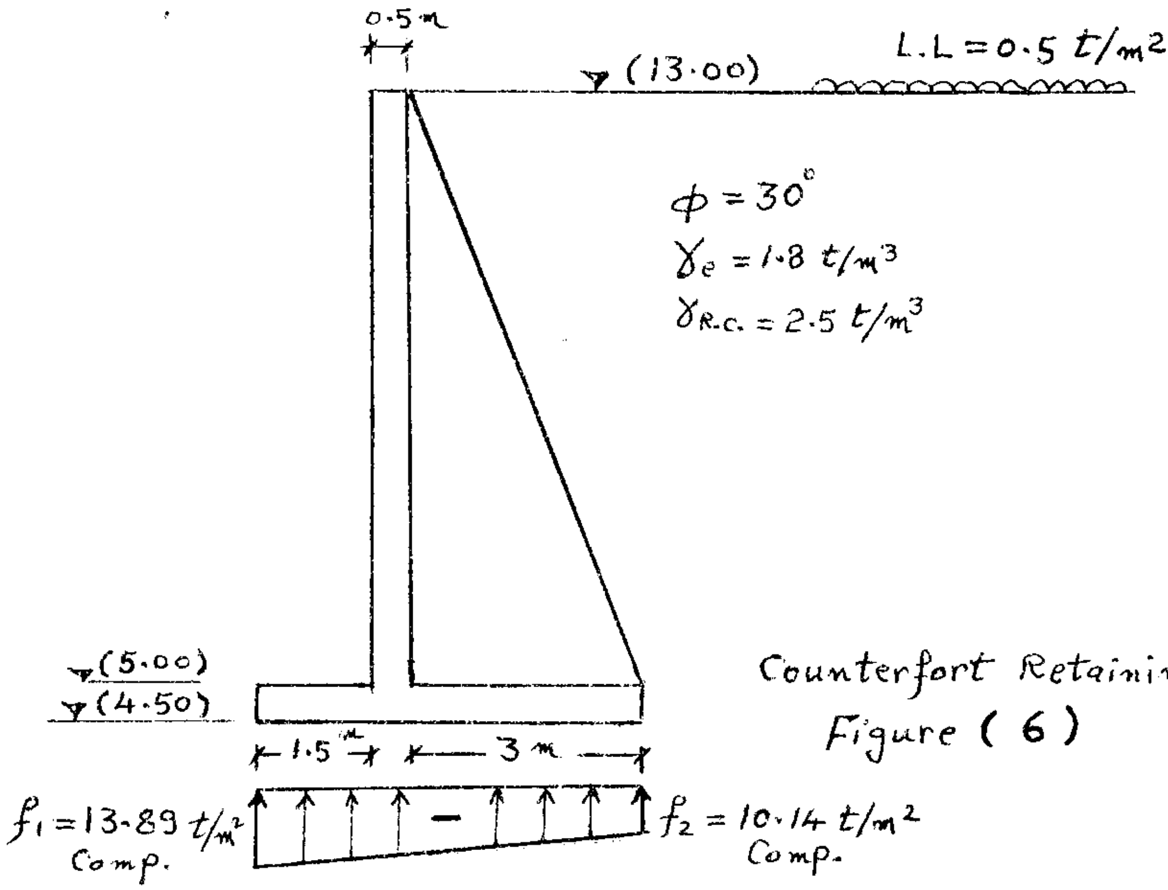


Figure (5)



Counterfort Retaining Wall
Figure (6)

Alexandria University	Third Year Civil Eng.
Faculty of Engineering	June 2015
Irrigation & Hydraulics Dep.	Time Allowed 3 hrs

Final Term Exam

Hydraulic Structures

Question No. 1

A) Using neat sketches, state the different types of canal escapes.

B) For the canal and drain cross sections shown in figure (1), it is required to design the circular escape well and the outlet pipe of the tail escape, if the maximum canal discharge equals 4.5 m^3/sec., the discharge that can be escaped automatically to the drain is 25% of the maximum canal discharge, the length of the last reach of the canal = 2.5 km, and emptying time of the last reach = 24 hrs.

C) Draw neat sketches showing plan (H.E.R.) and longitudinal section of the tail escape.

Question No. 2

For the weir cross section D.S. shown in figure (2), it is required to draw with calculations the following:-

A) Uplift pressure acting on the floor,

B) Net stress acting on soil,

C) Bending moment acting on the floor,

D) Check the floor thickness, and

E) Design the vertical member showing position of the main reinforcement.

Question No. 3

For the counterfort reinforced concrete retaining wall shown in figure (3), it is required to design the vertical and horizontal slabs, the counterfort and sketch out the main reinforcement. (S=4m, counterfoprt thickness = 0.3m, = 0.88, f_s=1800kg/cm^2, k_1 = 0.316 and k_2 = 1584).

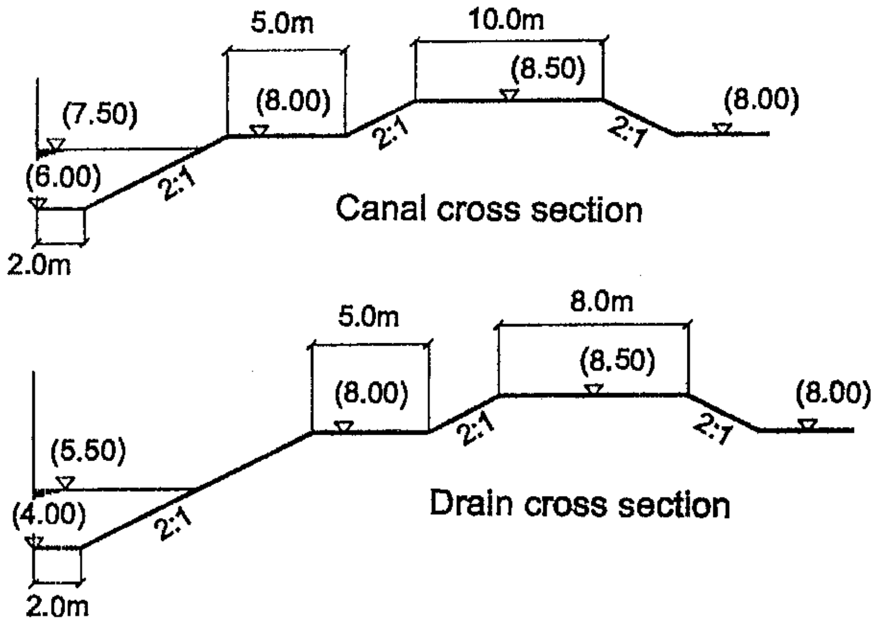


Figure (1)

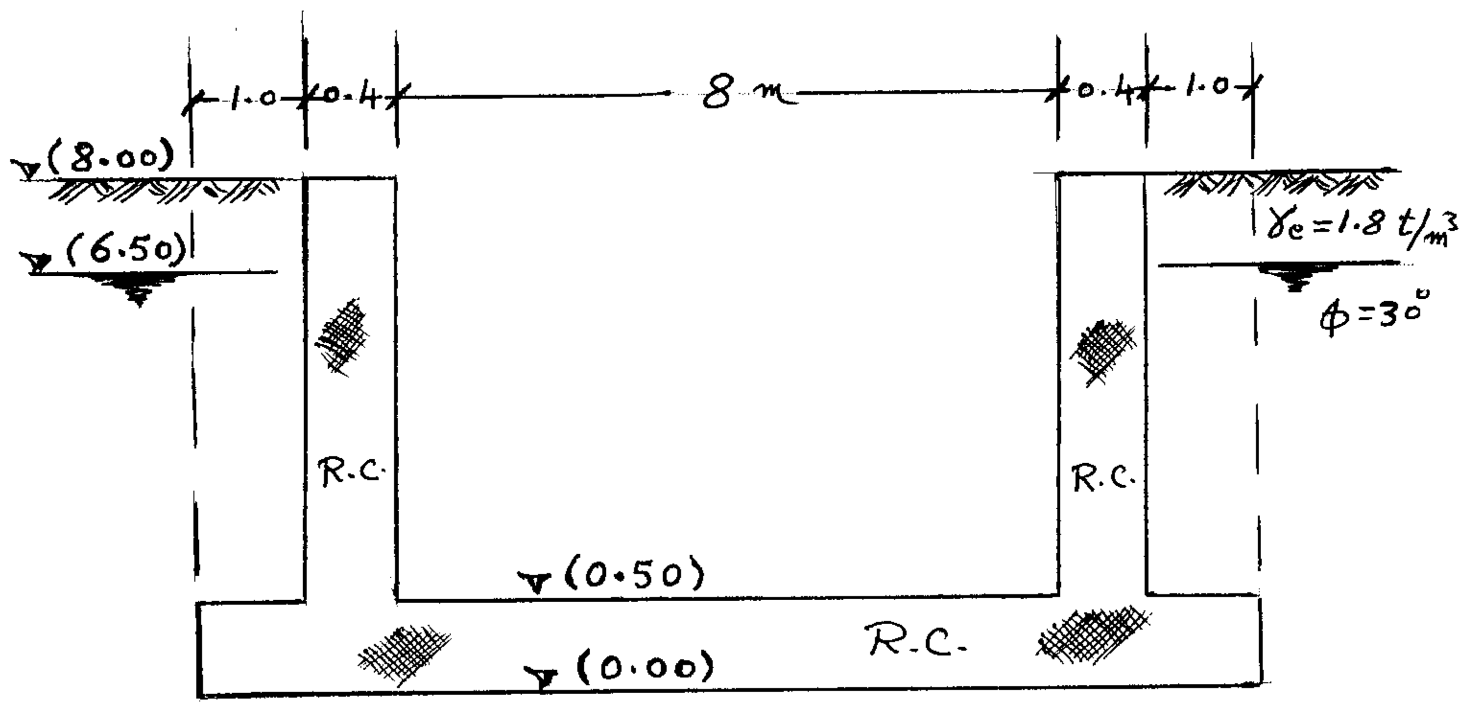
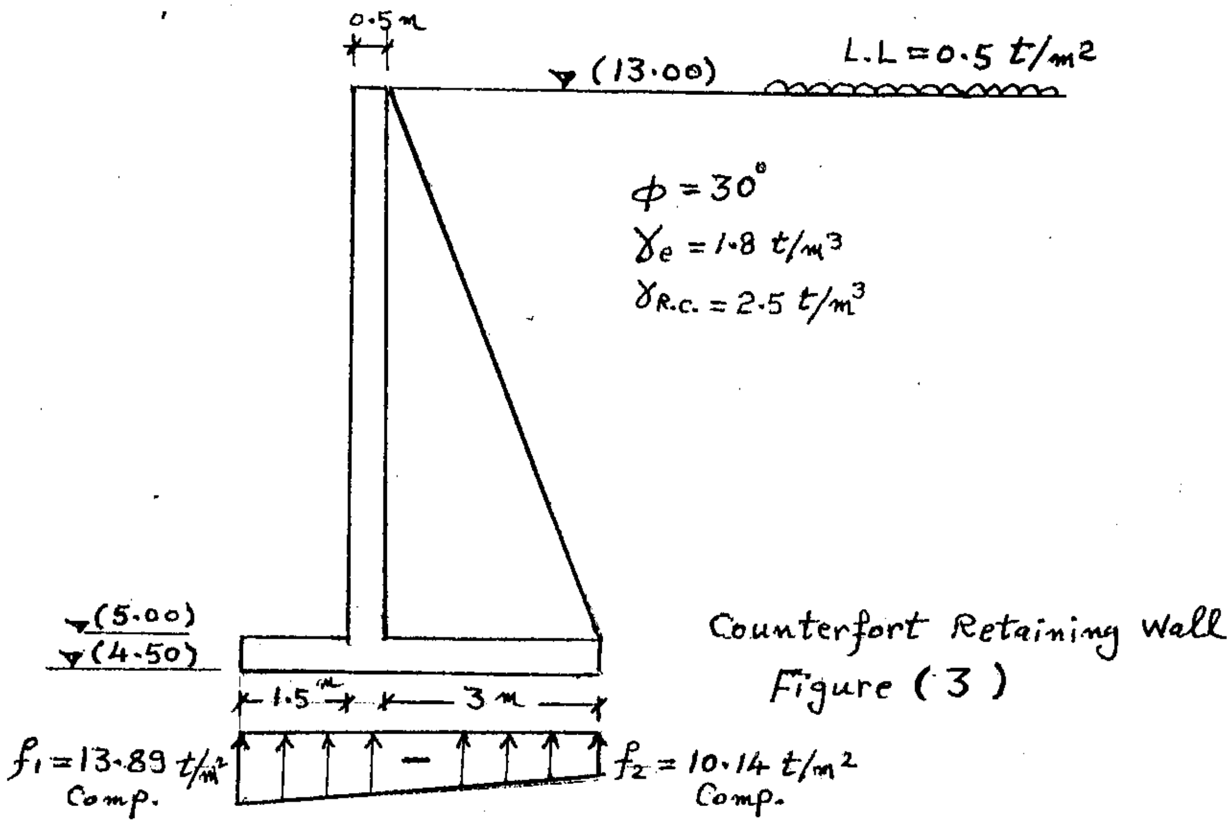


Figure (2)



Question No. 4

A pump station is to be constructed to lift irrigation water of a canal. The passing discharge through the canal is 30 m^3/s. The full data of the canal at the pump station are given in the following table:

	U.S the pump	D.S the pump
Ground level	21.00	21.00
Road Level	18.50	22.00
Berm level	17.50	21.50
Bed Level	13.00	17.00
Water level	17.00	21.00
Bed width	8.0	8.0
Side slopes	2:1	2:1

It is required to:

i- Give the full hydraulic design of the pump station intake,

ii- According to Figure (4), which type of pumps do you recommend, and

iii- Draw a neat sketch showing all levels and dimensions for a longitudinal section through the pump station.

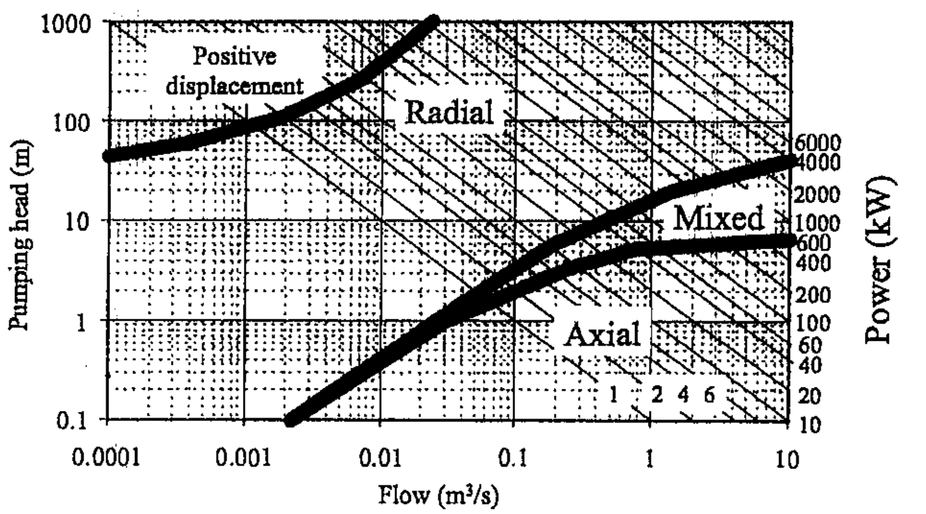


Figure (4) Selection of pump type

Alexandria University
Faculty of Engineering
Civil Engineering Dept.
Wednesday, 17th June, 2015

Academic Year 2014-2015
3rd Year Civil Eng.
Final Term Exam
Time Allowed 3 Hours

Elective Course 4 - CE 325: Design of Pipelines Networks

(Assume any missing data)

Question (1): (20%)

A. Define strength, stiffness and durability of a pipe.
B. What is the difference between rigid and flexible pipes?
C. Prove that the celerity of a surge wave, *a*, in rigid pipes is; $a = \sqrt{K/\rho}$; where *K* is the bulk modulus of elasticity of liquid.
D. Draw the relationship between the pressure head variation at the valve verses time at the **mid-length** of the pipe following an instantaneous valve closure located at the downstream end of a pipeline.

Question (2): (80%)

A steel pressure pipeline is buried in a trench and is used to convey 0.2 m3/s of irrigation water against a static head of 50 m. The following data are available:

- The total length of the pipeline is 4 km. Minor losses may be assumed 20% of the friction losses. The capital cost of steel pipeline is 15000 pounds/ton.
- Water will be pumped 16 hrs/day and 360 days/yr.
- The cost of electrical energy is 0.35 pounds/kWh.
- Cost of the pump is 450 pounds/kW. The overall efficiency of the pumping unit is 80%. The inertia of the pump-motor parts, WR^2, equals to 25 kg.m^2. The speed of the rotating part of the pump is 1680 rpm.
- Friction factor, *f*, is constant and equals to 0.014.
- Capital recovery factor for the pipeline or the pump is 0.15.
- The available pipes in the markets are **12 m long each** with inner diameters, d, equal to 0.3, 0.4, 0.5 and 0.6 m.
- Bulk modulus of elasticity of water is 2.2×10^4 kg/cm^2, while that of the steel is 2.1×10^6 kg/cm^2. Poisson's ratio is 0.3. The yield stress of steel is 2400 kg/cm^2.
- The pipe has expansion joints throughout its length.
- The maximum allowed pressure in the pipeline is 80 m.
- Unit weight of the soil is 1.9 t/m^3. The ratio of active lateral unit pressure to vertical unit pressure is 0.33, the angle of internal friction is 30° and the trench width, B_t, is two times the pipe diameter. The fill height is 1.5 m.
- The live load coefficient, C_s is 0.76.

Considering the above data, it is required to:

A. Find the economical diameter of the pipeline (assume t = 0.01 d).
B. For the case of 0.4 m diameter pipe:
   I. Find the actual thickness needed to resist the maximum internal and external pressures if the distributed live load may be assumed equal to 2.5 t/m^2 and the impact factor is 2.0.
   II. Determine the maximum rise and drop in head at the pump location and at the mid-length of the pipe due to the pump power failure. Is the pipeline safe against

the maximum rise in head or not, why? What is the effect of using a flywheel on the maximum rise and drop in head.

III. If it is required to install an un-throttled air chamber to protect the pipeline from water hammer effects. What should be the size of the air chamber.

Some Useful Equations:

Marston's Fill load / unit length:

$$W_f = \gamma_f C_d B_t\, d \qquad\qquad C_d = \frac{1-e^{-2k\mu\left(h_f/B_t\right)}}{2\,k\,\mu}$$

Marston's live load / unit length:

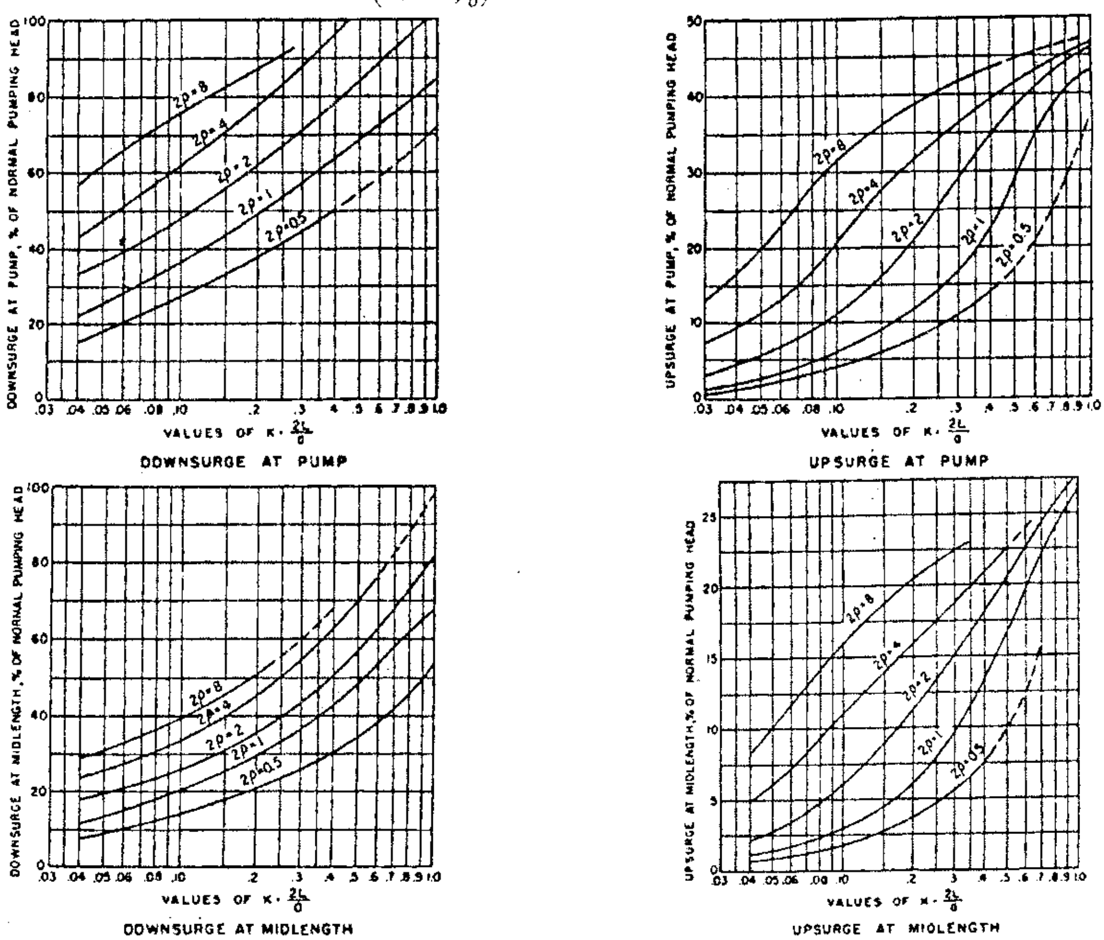
$$W_L = C_s P\, F' d$$

$$a = \sqrt{\frac{K/\rho_0}{1+\frac{K}{E}\frac{D}{t}c}} \quad \text{and } c = 1-\mu^2$$

For Sudden Valve Closure: $\Delta h = \frac{-a}{g}\Delta V$

For Pump Power Failure: $\rho = \frac{a\,V}{2g\,H_r}$ $\qquad K_p = 0.4473\times10^6\,\frac{H_r\,Q}{WR^2\,\eta\,N^2}$

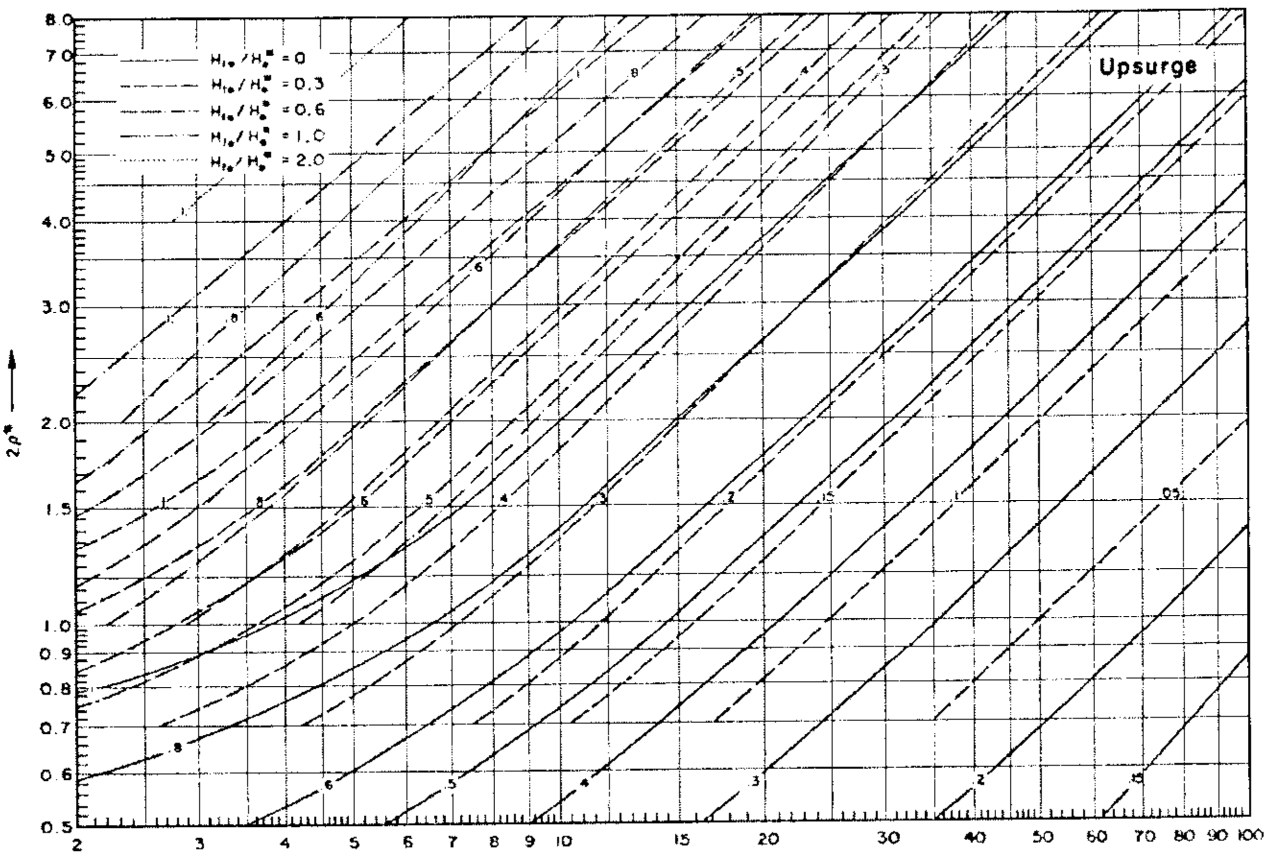
For Air Chamber: $\rho^* = \frac{a\,V}{2g\left(H_o^*+H_{f_o}\right)}$ $\qquad C_{max} = C_{o\,max}\left(\frac{H_o^*+H_{f_o}}{H_{min}^*}\right)^{1/1.2}$



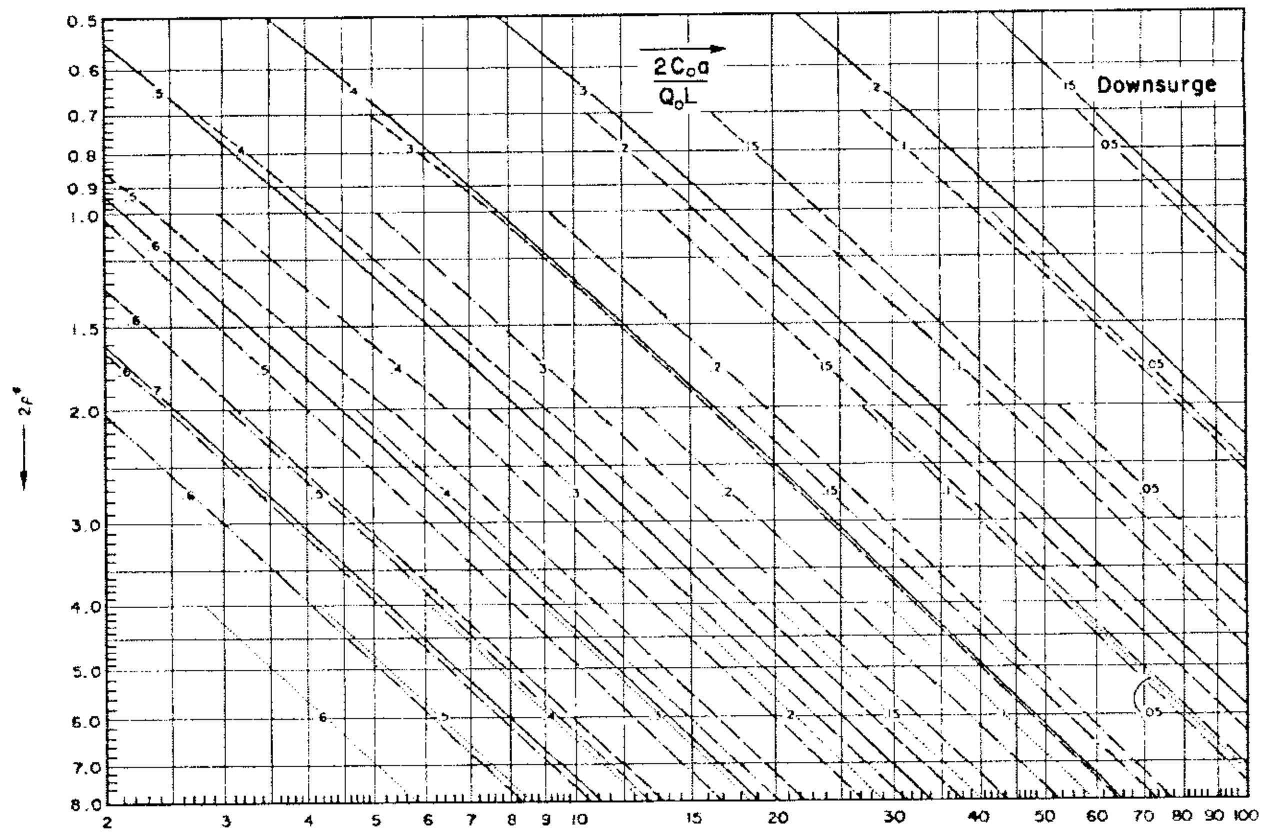
Parmakian curves for pump failure

Best Wishes and Good Luck ,,,

Dr. Mohamed Elkholy and Dr. Haytham Awad



Upsurge at pump



Downsurge at pump

Maximum upsurge and downsurge in a discharge line having an air chamber (After Ruus, 1977)

Alexandria University
Structural Engineering Dept.
CE 416

Faculty of Engineering
Second Semester 2014
Steel Structures (3)

Final Exam

Question (1)

The following figure shows a signboard of dimensions 15.00 x 4.50 meters. The signboard is supported on 4 horizontal beams and the horizontal beams are supported on 4 columns as shown on figure.

The cross sections of the beams and columns are shown on figure.

Data:

- Consider only wind load action.
- Neglect own weight of steel sections and weight of signboard.
- Basic wind pressure, q = 100 kg/m²
- Total wind load factor, C_t = 1.2
- Assume any extra data you may need.

Required:

1. Check the safety of horizontal beam (A) (23%)
2. Check the safety of column at axis (B) (23%)

Question (2)

For the same structure of question (1)

Data:

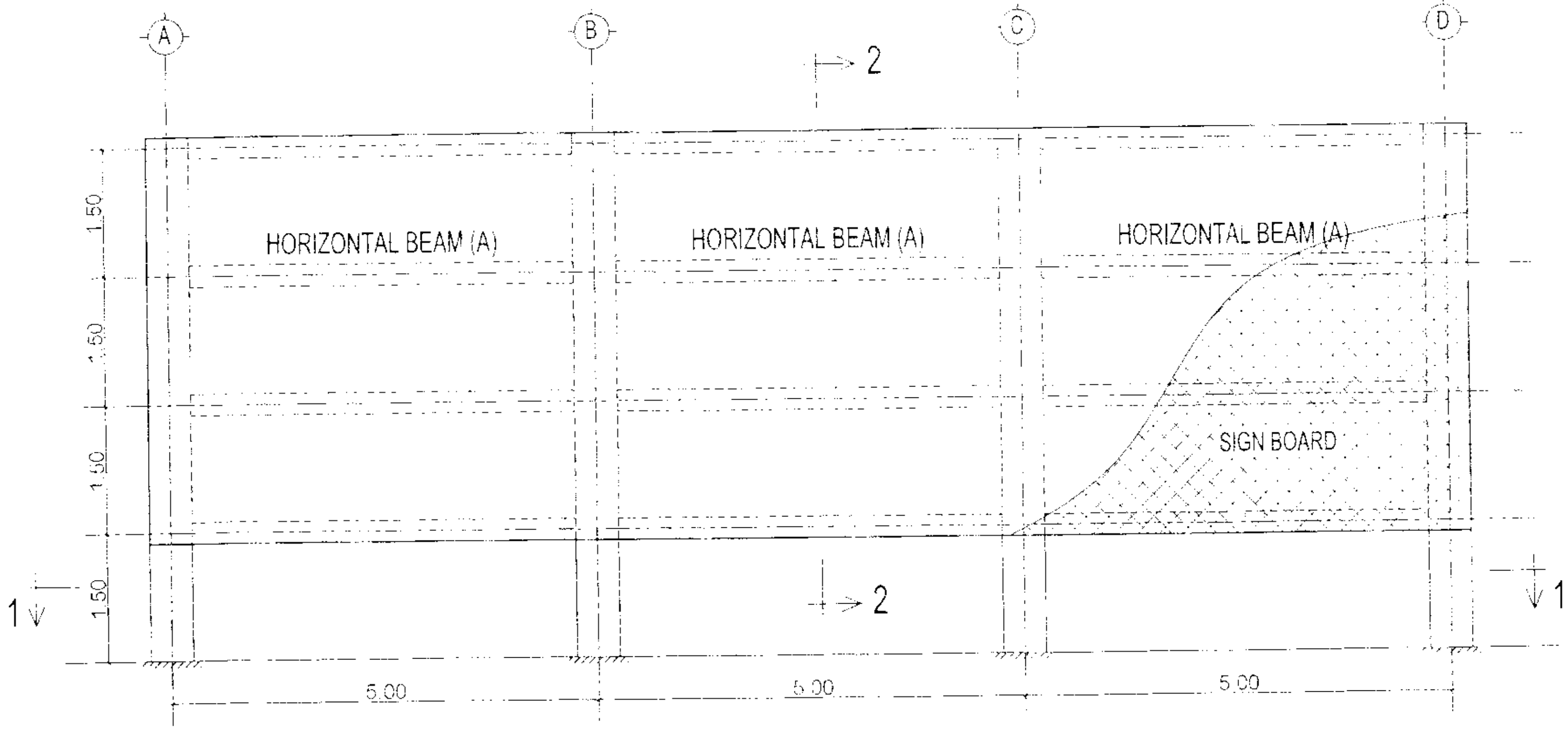
- Neglect wind load action.
- Consider only own weight of steel sections and weight of signboard as:
  - Own weight of horizontal beam (A) = 10 kg/m
  - Own weight of column section = 10 kg/m
  - Weight of signboard = 100 kg/m²
- Assume loads act exactly at C.G of sections, neglect any moment arms.
- Assume any extra data you may need.

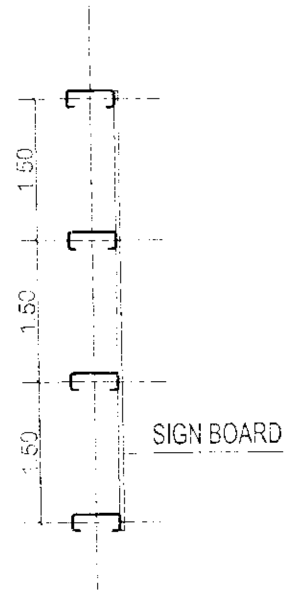
Required:

3. Check the safety of horizontal beam (A) (23%)
4. Check the safety of column at axis (B) (23%)

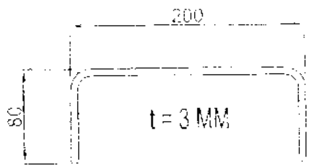
Question (3)

Try to configure the connection of beam to column. It is not required to design it; still it is required to draw clear sketches for the connection in 3 views. (8%)

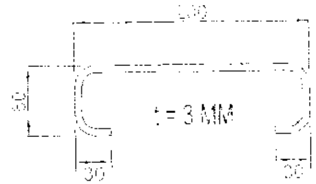




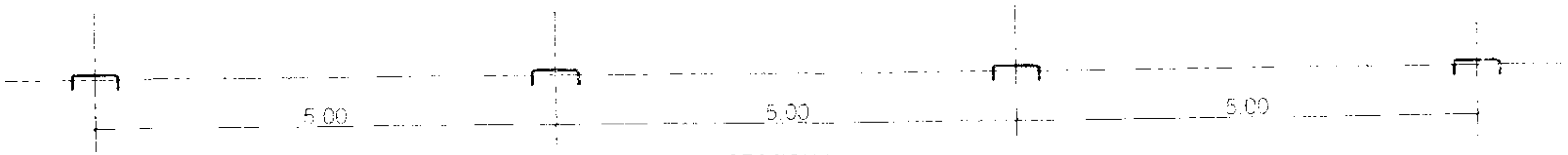
SECTION (2-2)



SECTION OF VERTICAL MEMBERS



SECTION OF HORIZONTAL BEAMS



SECTION (1-1)

Alexandria University
Faculty of Engineering
Civil Eng. Dept., 3^{rd} year.

Elective 3: Design of concrete bridges
Final exam, May 2015 (تخلفات)
Time allowed: ***3 hours***

Materials to be used:

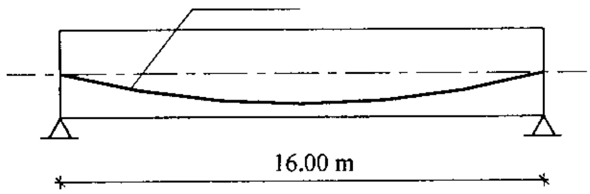
Concrete: f_{cu}=45 N/mm^2, f_{cui}=38 N/mm^2
Steel: f_{py}=1450 N/mm^2 , f_{pu}=1700 N/mm^2

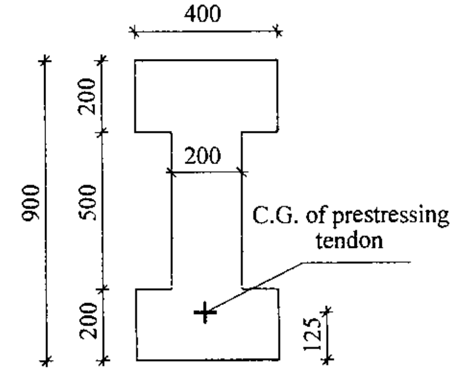
Any required data, that is not given, may be reasonably assumed.

Question 1:

The given figure shows the main dimensions of a simply supported prestressed beam which is categorized as "Case B". Normal relaxation strands (A_{ps}=1800mm^2) are post-tensioned to apply a transferred prestressing force (P_t=2000kN). Fixed stiff steel ducts are used. The C.G. of the parabolic prestressing tendon is shown in the figure. The beam is subjected to uniformly distributed superimposed loads (w_{LL}=15kN/m and w_{DL}=8kN/m) in addition to its own weight. You are required to calculate:

1. The immediate prestress losses.
2. The time dependent prestress losses.
3. Maximum uniformly distributed live load that could be safely carried by the beam.





Beam cross section at mid-span

Question 2:

Derive *the design relationships* for the minimum section modulus $Z_{1\,min}$ & $Z_{2\,min}$.

$[Z_1 = (M_T - \alpha M_g) / (f_{tw} + \alpha f_{ci}),\ Z_2 = (M_T - \alpha M_g) / (f_{cw} + \alpha f_{ti})]$

Question 3:

2- Give ***a complete design*** and ***drawings*** *(without loss and end zone check)* for a post-tensioned S.S. bridge girder of span *L=18 m*. The girder has an **I**-*shape* cross section with $b_{bottom} = b_{top} = 0.45h$ and $t_{top} = t_{web} = 0.5t_{bottom} = 0.15h$. The girders in the bridge are *spaced at 2.00* m, and the bridge deck is carrying *a flooring load of 3 kN/m^2*, and an equivalent uniform *L.L of 9 kN/m^2*.

$A = 0.285\ h^2$

$I = 0.032\ h^4$ *and*

y_1 *(from bottom to c.g.)* $= 0.46\ h$

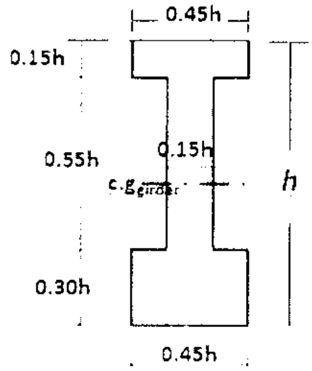
.(you may start calculations assuming h =1.4m and choose e ≤ (y_1 – 100) mm)

It is required to:

a) determine ***h*** and the section dimensions.
b) determine the *values* of ***P*** and the corresponding ***e*** *from* ***Magnel diagram.***
c) check the stresses at the critical sections at both *transfer* and *working* stages.

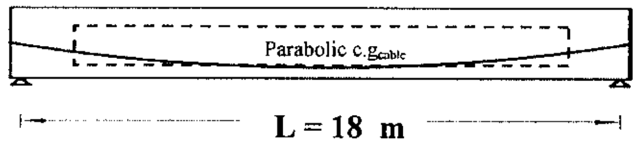
d) draw –to proper scale- the longitudinal *cable profile **zone*** of only *half the span* (L/2).
e) check the girder for shear stresses *(use the **empirical** equation of ECP code).*

Proposed cross section & Longitudinal Section



Proposed cross section

Longitudinal Section



Best wishes...

Data sheet

Prestress losses:

For wobble friction: $\Delta f_{pw} = (P_o - P_x)$

$P_x = P_o\, e^{-kx}$

k = 0.0033 for normal ducts

= 0.0017 for fixed stiff ducts

For curvature friction: $\Delta f_{pf} = (P_o - P_x)$

$$P_x = P_o\, e^{\left(\frac{-\mu x}{r_{ps}}\right)}$$

μ = 0.55 (for steel against concrete)

= 0.30 (for steel against steel)

= 0.25 (for steel against lead)

For parabolic tendons: $r_{ps} \approx \dfrac{L^2}{8\Delta_m}$

ε_{sh} = 300×10^{-6} (pre-tensioning: 3 to 5 days after casting)

= 200×10^{-6} (post-tensioning: 7 to 14 days after casting)

Φ = creep coefficient

= 2.0 (pre-tensioning)

=1.6 (post-tensioning)

$$\Delta f_{pr} = \frac{f_{pi}\,(\log t)}{k_l}\left(\frac{f_{pi}}{f_{py}} - 0.55\right)$$

k_l = 10 (for normal relaxation stress relieved steel)

= 45 (for low relaxation stress relieved steel)

For Magnel diagram:

$$\frac{1}{P_i} \geq \frac{\left(e + \frac{Z_1}{A_c}\right)}{(-Z_1 f_{ct} + M_g)} \qquad \frac{1}{P_i} \geq \frac{\left(e - \frac{Z_2}{A_c}\right)}{(Z_2 f_{tt} + M_g)}$$

$$\frac{1}{P_i} \leq \frac{R\left(e + \frac{Z_1}{A_c}\right)}{(-Z_1 f_{tw} + M_g + M_D + M_L)} \qquad \frac{1}{P_i} \leq \frac{R\left(e - \frac{Z_2}{A_c}\right)}{(Z_2 f_{cw} + M_g + M_D + M_L)}$$

Design for shear (simplified method):

$$q_{cu} = \left(0.045\sqrt{\frac{f_{cu}}{\gamma_c}} + \frac{3.6 Q_u d_p}{M_u}\right) \quad N/mm^2$$

Where:

$$\frac{Q_u d_p}{M_u} \leq 1.0 \qquad q_{cu\,min} = 0.24\sqrt{\frac{f_{cu}}{\gamma_c}} \qquad q_{cu\,max} = 0.375\sqrt{\frac{f_{cu}}{\gamma_c}}$$

$$q_{u\,max} = 0.75\sqrt{\frac{f_{cu}}{\gamma_c}} \leq 4.5\ N/mm^2$$

Allowable stresses for concrete:

At the time of initial tensioning before time dependent losses produced by creep, shrinkage, or relaxation have occurred (At Transfer)	
1. Maximum compressive stress	$0.45 f_{cui}$
2. Maximum tensile stress except as permitted in item 3	$0.22\sqrt{f_{cui}}$
3. Maximum tensile stress at the ends of simply supported members	$0.44\sqrt{f_{cui}}$
Service load flexural stresses, assuming all prestressed losses have occurred (At Service Loads)	
1. Maximum compressive stress due to prestressed plus sustained loads	$0.35 f_{cu}$
2. Maximum compressive stress due to prestressed plus total loads	$0.40 f_{cu}$
3. Maximum tensile stress in pre-compressed zone tensile zone	Case A- zero Case B- $0.44\sqrt{f_{cu}}$ Case C- $0.60\sqrt{f_{cu}}$ $\leq 4\ N/mm^2$ Case D- $0.85\sqrt{f_{cu}}$
Axial compression	
1. Maximum compressive stress	$0.25 f_{cu}$

where
f_{cui} is the concrete characteristic strength at the time of transfer (N/mm^2)
f_{cu} is the concrete characteristic strength at service load (N/mm^2).

Alexandria University **Faculty of Engineering** **Civil Engineering Dept.** **Sunday, 31st May, 2015**		**Academic Year 2014-2015** **3rd Year Civil Eng.** **Final Term Exam** **Time Allowed 3 Hours**

Elective Course 4 - CE 325: Design of Pipelines Networks

لطلاب التخلفات من الفرقة الرابعة مدنى

(Assume any missing data)

Question (1): (10 marks)

A steel pressure pipeline of length 20 km is to convey 1.00 m^3/sec of irrigation water against a static head of 40 meters. The sum of minor losses coefficients is 30. The total capital cost of the steel pipeline is 12000 pounds/ton. Water will be pumped 15 hours per day and 350 days per year. The cost of electrical energy is 0.35 pounds/kWh. Overall efficiency of pumping station is 75%. The friction factor (f) is assumed to have a constant value of 0.015. The following table gives the wall thickness for the available four different steel pipelines.

Pipe diameter in meter	0.70	0.80	0.90	1.00
Pipe wall thickness in mm	7	8	9	10

Neglecting the capital cost of the pumping station, and considering recovery factor for the pipeline = 0.125, find the economical diameter of the pipeline. Arrange your answer in a table. The unit weight of steel is 7.85 t/m^3

Question (2): (10 marks)

A. What is the meant by each of the following terms in water industry: (i) performance indicators, (ii) pressure management, and (iii) leakage management.

B. Determine the thickness of a steel pipeline of internal diameter 1.20 meter. The height of fill above pipe = 2.5 m, γ_f = 1.8 t/m^3, working pressure = 10.0 kg/cm^2, water hammer pressure = 3.0 kg/cm^2, yield stress for steel 37 = 2400 kg/cm^2, factor of safety = 2.0, deflection lag factor = 1.25, bedding constant = 0.10, modulus of elasticity of steel = 2.10×10^6 kg/cm^2, modulus of soil reaction = 30 kg/cm^2 and the allowable pipe deflection = 3%. Check the allowable pipe deflection.

Question (3): (10 marks)

A. What are the main usage of the following type of valves in water supply netwrorks: (i) PBV, (ii) PSV, (iii)PRV, (iv)FCV, (v) TCV, (vi) MPV

B. The water supply network shown in Figure (1) has a single source at 170 m fixed head and 6 pipes arranged in two loops. All pipes (Except pipe 3-4) are 1000 m long with an assumed fixed Hazen-Williams coefficient of 130 and constant diameter of 30 cm. Pipe 3-4 length, Hazen-Williams coefficient and diameter are 1414 m, 120, and 25 cm, respectively. The node data for this network are summarized in Table (1). Using EPAnet® software, it is required to:

(i) Choose one of the following discharge dimensions to simulate nodal demands and different pipe discharges: CFS, GPM, MGD, IMGD, AFD, LPS, LPM, MLD, CMH, and CMD.

(ii) Choose the head loss formula from the following: (D-W), (H-W), and (C-M).

(iii) Explain in steps how you will enter the data of different network elements.

Table (1) Node data

Node	1	2	3	4	5
Demand (m^3/h)	??	100	100	120	270
Ground level (m)	150	110	120	115	110

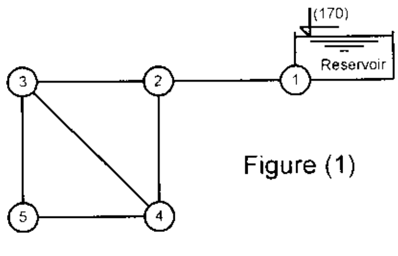


Figure (1)

Question (4): (14 marks)

A. Draw sketches showing the sequence of events following sudden valve closure for a frictionless piping system shown in Figure (2) for different time intervals, t = L/a, 2L/a, 3L/a and 4 L/a. Where a is the celerity of the surge wave.

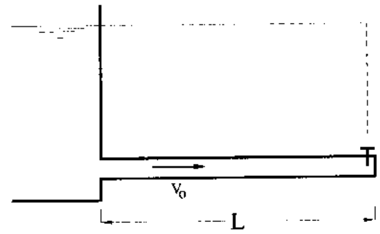


Figure (2)

B. A copper pipe with diameter = 0.2 m (E = 120 × 10^9 Pa, μ = 0.34) having a wall thickness of 25 mm is conveying kerosene oil at 20^0C (K = 1.32 × 10^9 Pa, ρ = 804 kg/m^3) from a container to a valve with a flow rate of 45 liter/sec. If the valve is closed suddenly, at what velocity would the pressure waves propagate in the pipe. Assume the pipe is totally fixed. What is the pressure head rise in this case.

Question (5): (12 marks)

A pump is conveying water with a flow rate of 0.8 m^3/s in a steel pipeline 0.9 m in diameter, 1000 m long. The rated pump head equals to 64 m, the inertia of the pump-motor parts, WR^2 equals to 20 kg.m^2 and the pump is rotating with a speed of 1680 rpm. Determine the maximum rise and drop in head at the pump location due to pump power failure. Assume any missing data. What is the effect of using a flywheel on the maximum rise and drop in head.

Question (6): (14 marks)

A. Explain with sketches six different methods used to protect pipelines from water hammer.

B. A pipeline having a pump at its upstream end followed by an air chamber (K_{or}^* = 0.2) is used to convey 150 l/s of water against a static head equals to 41 m. The pipeline is 0.4 m in diameter, 10 km long, with friction factor equal to 0.017 and the calculated wave speed is 1216 m/s. If the maximum allowed pressure in the pipeline is 9 atm (1 atm = 10.33 t/m^2). Considering the above conditions, determine the size of the air chamber.

Useful Equations and Charts

$$\sigma_w = \frac{pD}{2t},\ \sigma_{fc} = 0.18 \times w_f \times \frac{D^2}{t^2},\ \sigma_{fb} = 0.24 \times w_f \times \frac{D^2}{t^2},\ \Delta x = D_l\left[\frac{KWr^3}{EI + 0.061 \times E'r^3}\right]$$

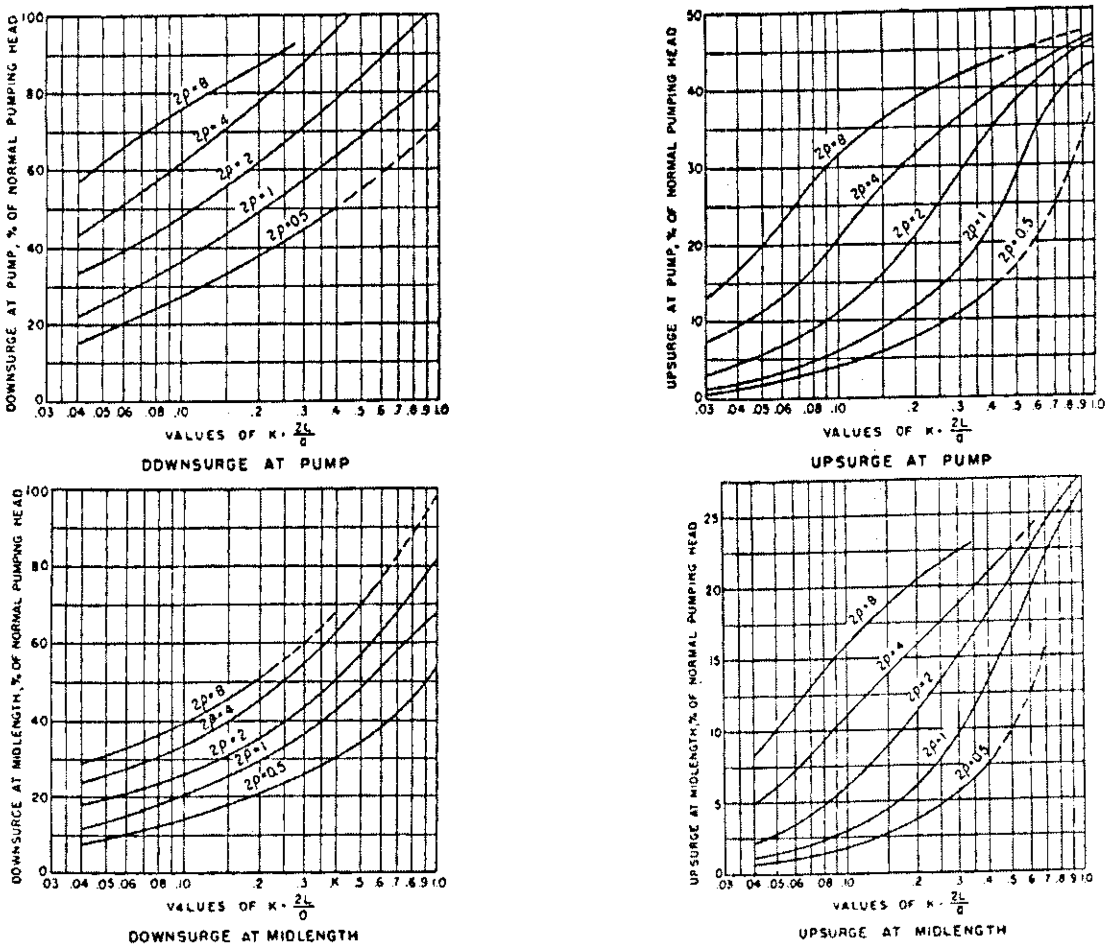
$$a = \sqrt{\frac{K/\rho_0}{1 + \frac{K}{E}\frac{D}{t}c}} \text{ and } c = 1 - \mu^2$$

For Sudden Valve Closure: $\Delta h = \frac{-a}{g}\Delta V$

For Pump Power Failure: $\rho = \frac{aV}{2g\,H_r},\ K_p = 0.4473 \times 10^6 \frac{H_r\,Q}{WR^2\,\eta\,N^2}$

For Air Chamber: $\rho^* = \frac{aV}{2g\left(H_o^* + H_{f_o}\right)},\ C_{max} = C_{o_{max}}\left(\frac{H_o^* + H_{f_o}}{H_{min}^*}\right)$

Good Luck and Best wishes,
Dr. Mohamed El-Kholy and Dr. Haytham M. Awad



Parmakian curves for pump failure

EPANET 2

File Edit View Project Report Window Help

Network Map

Property	Value
*Reservoir ID	1
X-Coordinate	-74.01
Y-Coordinate	7319.08
Description	0
Tag	0
*Total Head	0
Head Pattern	0
Initial Quality	0
Source Quality	...
Net Inflow	#N/A
Elevation	#N/A
Pressure	#N/A
Quality	#N/A

Pipe 1

Property	Value
*Pipe ID	1
*Start Node	3
*End Node	2
Description	0
Tag	0
*Length	0
*Diameter	0
*Roughness	0
Loss Coeff.	0
Initial Status	Open
Bulk Coeff.	
Wall Coeff.	|
Flow	#N/A
Velocity	#N/A
Unit Headloss	#N/A
Friction Factor	#N/A
Reaction Rate	#N/A
Quality	#N/A
Status	#N/A

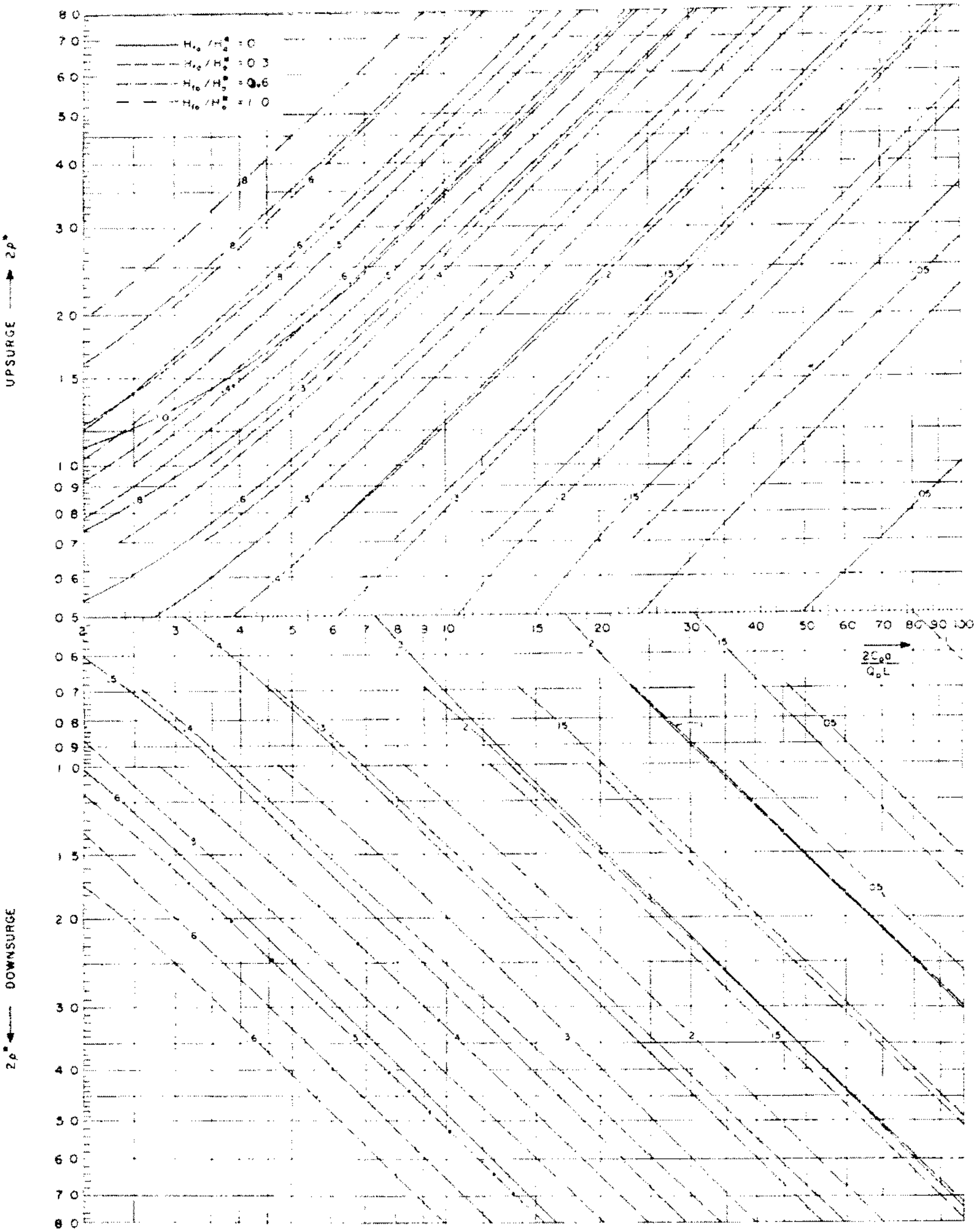
Property	Value
*Junction ID	1
X-Coordinate	3149.67
Y-Coordinate	6842.11
Description	0
Tag	0
*Elevation	0
Base Demand	0
Demand Pattern	0
Demand Categories	1
Emitter Coeff.	0
Initial Quality	0
Source Quality	...
Actual Demand	#N/A
Total Head	#N/A
Pressure	#N/A
Quality	#N/A

Data Map

Junctions

- Junctions
- Reservoirs
- Tanks
- Pipes
- Pumps
- Valves
- Labels
- Patterns
- Curves
- Controls

EPAnet Tables



Maximum upsurges and downsurges at the pump end, $H_{ur}/H_0^* = 0.2$.

Russ curves for sizing air chambers

Alexandria University
Faculty of Engineering
Irrigation & Hydraulics Dept.

Third year Civil Eng.
June 2015
Time Allowed (3.0 hours)

Final Term Exam

Design of Irrigation Structures (1)

Assume any reasonable data according to the given lectures

لطلبة السنة الرابعة مدني (تخلف في مادة تصميم منشآت الري من السنة الثالثة)

Question No. 1 (40 Marks)

It is required to construct a R.C. one vent culvert on the canal cross section shown in Figure (1), if the passing discharge = 8 m^3/sec.

It is required to:

1- Design the culvert dimensions (2m/sec $\geq v_{cul} \geq$ 1.6m/sec),
2- Check of heading up,
3- Design the culvert thickness if moments at sections I, II, III, IV equal $\frac{-ws^2}{36}, \frac{ws^2}{12}, \frac{-ws^2}{36}$ & $\frac{-ws^2}{36}$ for vertical loads and equal $\frac{-eh^2}{36}, \frac{-eh^2}{36}, \frac{-eh^2}{36}$ & $\frac{eh^2}{12}$ for horizontal loads, respectively.
4- Draw plan and section elevation of the culvert **exit only** showing levels and dimensions.

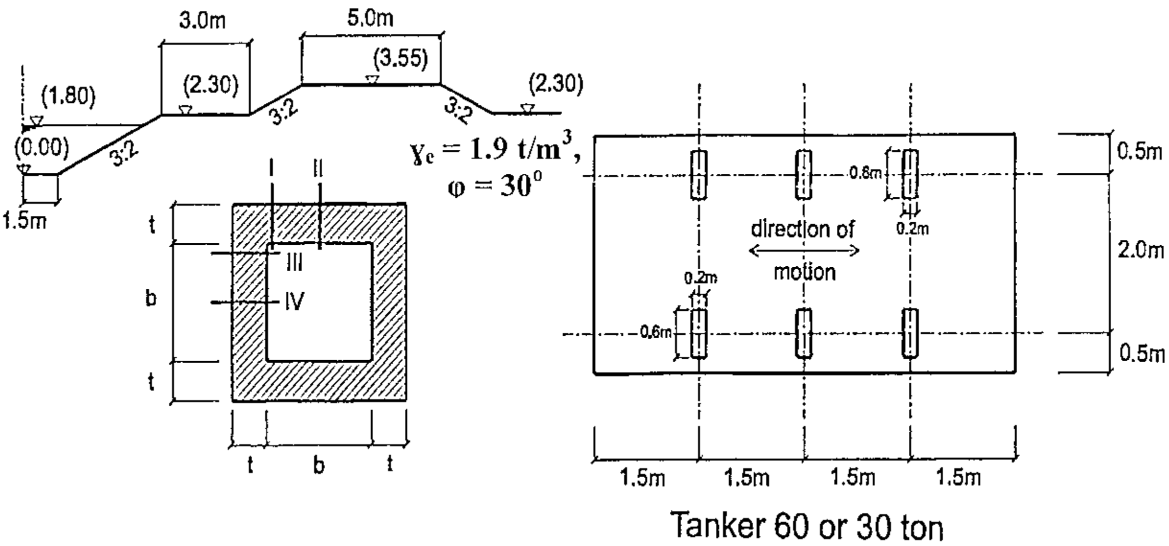


Figure (1)

Question No. 2 (25 Marks)

It is required to construct a R.C. Open Trough Aqueduct to pass discharge of the branch canal. Cross section of branch canal and main drain are shown in Figure (2).

It is required to:

1- Give full hydraulic design of the Open Trough R.C. Aqueduct,
2- Compute the maximum moment and normal force for upper slab, side beams, and lower slab in cross section, and
3- Describe, without calculations, step by step procedure that you will adopt for design of plain concrete supports of Aqueduct.

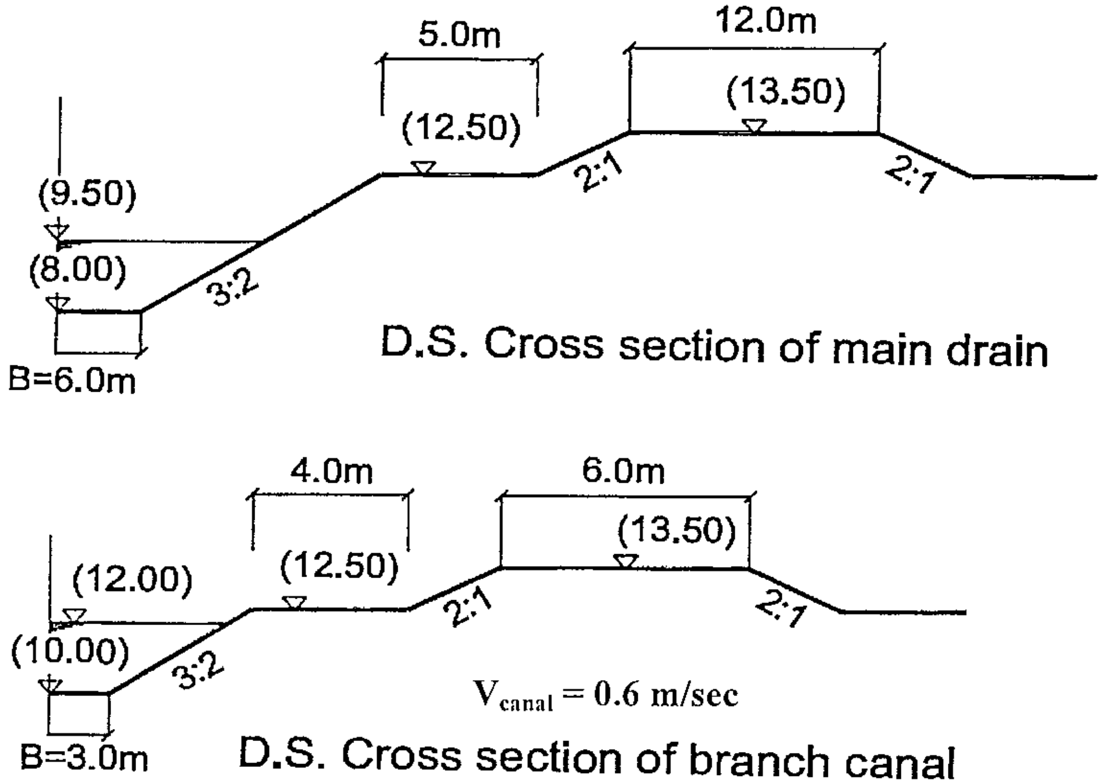


Figure (2)

<u>Question No. 3 (25 Marks)</u>

Figure (3) shows a longitudinal section of a control Regulator based on homogeneous isotropic sandy soil.

<u>It is required to:</u>

a. Draw the flow net of seepage flow, then find the distribution of the potential head along the subsurface contour of the floor,
b. Find the seepage discharge under the floor (derive the used expression),
c. Check the given floor thickness against uplift using Bligh's method, $\gamma_f = 2.5$ ton/m^3.
d. Draw the distribution of factor of safety against piping along the exit face, and determine the required length to be protected.

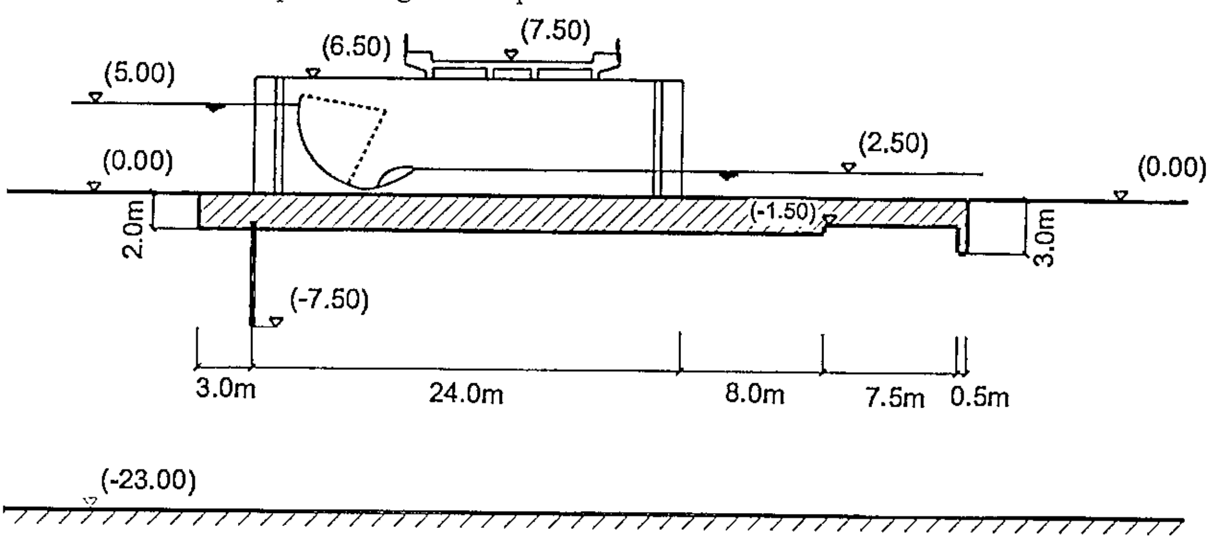


Figure (3)

Question No. 4 (15 Marks)

A clear over fall weir of the Fayum type is to be constructed at a canal drop. The passing discharge is 7.25 m^3/s. The full data of the canal at the weir site are given in following table,

	U.S the weir	D.S the weir
Water level	12.35	10.35
Bed level	10.35	8.35
Bed width	6.0	6.0
Side slopes	2:1	2:1
Road Level	14.35	13.00
Berm Level	12.85	11.50

The soil properties at the weir site are: γ_{bulk} = 1.7 t/m^3, ϕ=30°, soil bearing capacity=1.5 kg/cm^2, and Bligh's coefficient CB=14.

It is required to:

i- Give the full hydraulic design of the weir,

ii- Check the weir floor thickness at section (A-A) shown in Figure (4), and

iii- Draw a neat sketch showing all levels and dimensions for a longitudinal section through the weir.

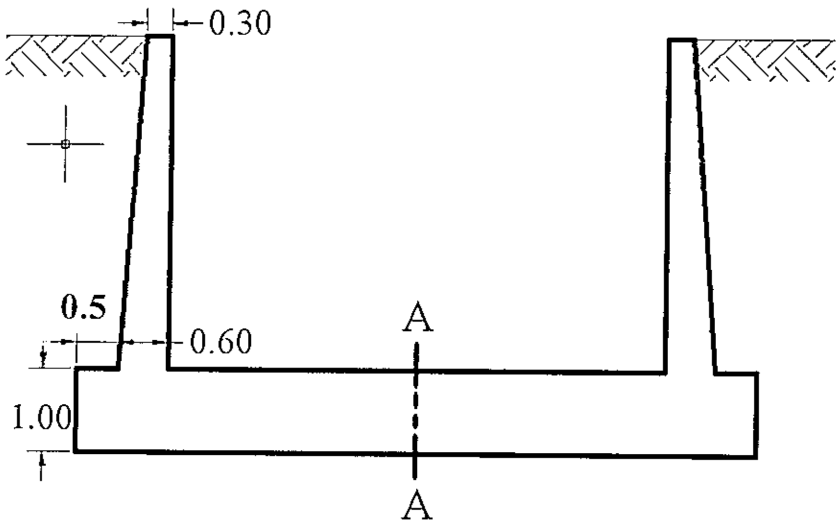


Figure (4) Weir cross-section

Prof. Dr. Mohamed Abd El-Razek M. Rezk
Dr. Amr Elsayed Fleifle

Dr. Zakaria Shuloma
Dr. Mohamed R. Soliman