



برجاء الإجابة على قدر السؤال فقط و توضيح الإجابة بالرسم كلما أمكن ذلك

**Question No. 3**

(21 Marks)

- Explain the difference between the stresses in short fibers with length greater than critical length and stress in short random round fibers, which pull out, rather than break based on your knowledge in class. (3 Marks)
- Define the critical volume fraction, calculate and compare** between the critical volume fraction for fiber reinforced slab of 600 mm in depth (D) for the different cases: 1- Aligned continuous fiber, 2- 2-D random short fiber with 0.4 mm diameter x 80 mm long & 3-Short random fibers with 0.5 mm diameter x 50 mm long (3-D orientation). Assuming that the average sliding friction bond strength ( $\tau$ ) = 4.5 MN/m<sup>2</sup>, fiber tensile strength ( $\sigma_{fu}$ ) = 1620 MN/m<sup>2</sup>,  $E_m$  = 20.0 GN/m<sup>2</sup>,  $E_f$  = 210.0 GN/m<sup>2</sup> and matrix cracking stress ( $\sigma_{mu}$ ) = 4.60 MN/m<sup>2</sup>. Also determine the change in modulus of elasticity of concrete before cracking in the previous cases, if the efficiency factor for orientation before cracking in case 2 and case 3 is 0.4 and 0.18, respectively. (6 Marks)
- Explain the influence of the specimen size, methods of deflection measurement and load control on the flexural toughness of fiber reinforced concrete beam. (3 Marks)
- Calculate the ultimate bending moment** for concrete beam reinforced with 5.00 % steel fiber, four steel bars (16.0 mm diameter) in the tension side, if bond efficiency factor = 1.20, yield strength of steel = 360 MN/m<sup>2</sup>, modulus of elasticity = 200.0 GN/m<sup>2</sup>, compressive strength = 40.0 MN/m<sup>2</sup>, cross section of beam = 300 mm width & 700 depth and the fibers to be used are 0.5 mm (diameter) x 55.0 mm (length). (5 Marks)
- Discuss the effect of both short fibers and matrix composition on the following: a) fresh concrete b) concrete compressive strength c) interaction between fiber and matrix d) durability (4 Marks)
- State the precaution of pumped fiber reinforced concrete. (1 Mark)

**Question No. 4**

(20 Marks)

- A cracked highway pavement slab with 400 mm is reinforced with 2.0 percent of aligned short steel fibers. The fibers to be used are 0.45 mm (diameter) x 60.0 mm (length) with an average sliding friction bond stress ( $\tau$ ) of 6.0 MN/m<sup>2</sup>,  $\sigma_{mu}$  = 4.5 MN/m<sup>2</sup> and ultimate tensile strength ( $\sigma_{fu}$ ) of 1800.0 MN/m<sup>2</sup>. Find the pre-cracking tensile strength ( $\sigma_c$ ) and post cracking tensile strength ( $\sigma_{cu}$ ) in this case. If the time that causes fracture in short fiber rather than pull out is 20 years, calculate the allowable percentage reduction per year (نسبة التخفيض المسموح بها سنويا) in fiber cross-sectional area by corrosion (assuming that the bond strength is almost constant). (5 Marks)
- Explain the effects of use of short fiber on the shrinkage and creep of concrete and also state the factors that affect them. (3 Marks)
- "Higher aspect ratio of fibers helps to form a mat or balling of fibers during the mix", is this true? Discuss this statement showing the factors affecting the balling phenomena. (2 Marks)
- Calculate the minimum crack spacing ( $x_f$ ), crack width ( $w$ ), ultimate tensile strength ( $\sigma_{cu}$ ) and draw the stress strain relation** at the completion of multiple cracking for reinforced concrete slab with 5.0 % percent by volume of short aligned glass fibers of diameter 0.50 mm and length 90 mm. Assume the number of effective short fibers able to transfer their full share of the load equals to 0.60 the number of the continuous aligned fibers (N). Also  $E_f$  = 75.0 GN/m<sup>2</sup>,  $E_m$  = 20.0 GN/m<sup>2</sup>,  $\tau$  = 6.0 MN/m<sup>2</sup>,  $\sigma_{fu}$  = 1620.0 MN/m<sup>2</sup>,  $\sigma_{mu}$  = 5.0 MN/m<sup>2</sup> and fiber additional stress ( $\Delta\sigma_f$ ) = ( $\sigma_{mu} \cdot V_m$ ) / (0.60  $\cdot V_f$ ). If the short random fiber in 3-D orientation ( $V_f$  = 5.0 %) will be used in reinforced concrete slab, **find the minimum crack spacing, crack width and ultimate tensile strength**. Assume, the number of effective short fiber in this case is the same for aligned short fiber and the orientation efficiency factor = 0.40 and  $\Delta\sigma_f$  in this case = ( $\sigma_{mu} \cdot V_m$ ) / (0.4  $\cdot$  0.60  $\cdot V_f$ ). **Comment on your results.** (7 Marks)
- Summarize the shotcrete fiber reinforced concrete through- methods- applications – additives and type of used aggregate. (3 Marks)



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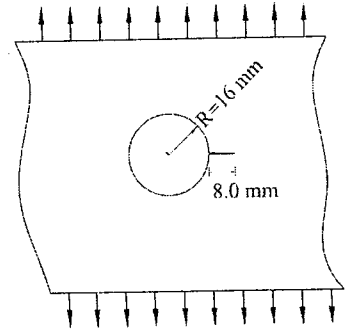
**Question No. 1**

a) Differentiate between the following items:

- Stress concentration factor and stress intensity factor
- Composite materials, alloys, and composite sections.
- Glass transition temperature and melting temperature of polymers.
- Parallel and serial models for calculating the elastic modulus of composites

b) Explain in detail the importance of applying the small scale yielding condition when using linear elastic fracture mechanics. State the condition and show with neat sketches how it is applied. What is implied if SSY does not apply?

c) The following configuration shows long steel plate subjected to a uniform remote tensile stress  $\sigma^\infty$ . The plate has a hole of 16 mm radius and a crack of 8 mm length as shown. If the fracture toughness of the plate material is  $52 \text{ MPa}\sqrt{\text{m}}$  and its yield stress is 1200 MPa, what would be remote tensile stress  $\sigma^\infty$  at failure?



d) "Concrete is a two-phase particulate composite". Is this statement true? Explain and support your answer. How can you explain the difference between failure surface of concrete made out of crushed pink limestone and that made out of gravel using neat sketches

e) "High strength concrete is much better than normal strength concrete in all aspects". Is this statement true? Draw the stress-strain curve for concrete with different grades and show the main differences.

f) "Size Effect is one of the most important aspects in concrete behavior" In view of what was explained in class, explain this statement and show how the concrete size effect is reflected in the design code.

**Question No. 2**

a) Explain the advantages and disadvantages of using polymer adhesives. What are the basic precautions for achieving the best results for this type of adhesives

b) Explain the main two principles used in polymer modified concrete. Explain with neat sketches how each of these principle works. Show how the understanding of these two principles helps in dealing with such materials in practice

c) How can you explain, based on scientific facts, that the elastic modulus of polymer impregnated concrete increases significantly after the impregnation process, while the elastic modulus of polymer modified concrete is not affected by the addition of polymers.

d) It is required to strengthen a reinforced concrete section of dimensions 25X70 cm having tension bottom reinforcement of 6  $\phi$  16 (consider  $d=65 \text{ cm}$ ), given that  $f_{cu}=250 \text{ kg/cm}^2$  and steel 360/520 ( $E_s=2000 \text{ t/cm}^2$ ), using carbon fiber reinforced polymer (CFRP) with dimensions 20x0.2 cm and an elastic modulus of 1350 t/cm<sup>2</sup>. The ultimate strength of the CFRP is 20000 kg/cm<sup>2</sup>, and its behavior is brittle. Compare the ultimate moment capacity of the section before and after strengthening  
أنظر خلفه

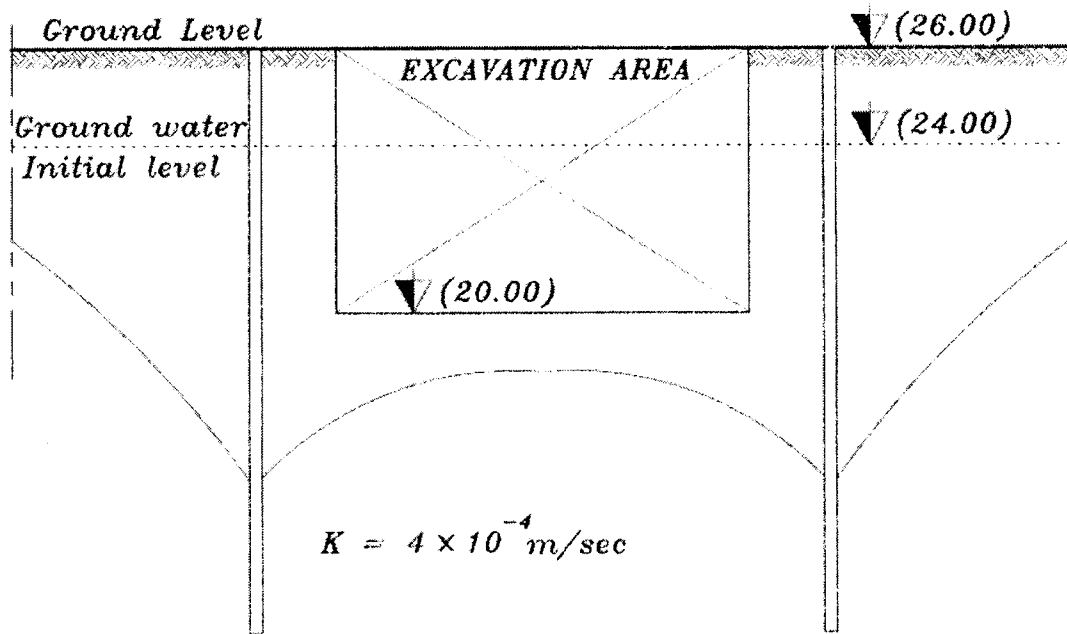


Figure (2) Section elevation for the excavated area

#### USEFUL DATA

$$Qp = \frac{0.208 AR}{0.5D + 0.6tc}$$

$$R = \frac{(P - 0.2S)^2}{p + 0.8S}$$

$$tc = 0.115 L^{0.77} / S^{0.385}$$

$$S = \frac{1000 - 10CN}{CN}$$

$$R_0 = Ch\sqrt{k} \quad Q = \frac{\pi k(H^2 - h^2)}{\ln(R_0/r)}$$

$$F(x) = \exp \left[ -\exp \left\langle -\frac{x - u}{\alpha} \right\rangle \right]$$

$$\alpha = \frac{\sqrt{6}s}{\pi}$$

$$u = \bar{x} - 0.5772 \alpha$$

With our best wishes

Dr. Osama Ragab

Dr. Mohamed R. Soliman



**FINAL EXAM**  
**APPLIED HYDROLOGY**

**Assume any reasonable data according to the given lectures**

**QUESTION NO. (1)**

- 1- What is the calibration process? and Mention the calibration problems.  
ما هي المعايرة واذكر مشاكلها
- 2- Explain briefly the calibration procedures for the hydrological models?  
أشرح النظام العام للمعايرة في النماذج الهيدرولوجية
- 3- What are effects of variation the following parameters on volume ration and peak ratio in WinTR-20 Hydrology Model:  
اذكر تأثير العوامل التالية علي Volume ration and peak ratio
  - a- Drainage Area
  - b- Runoff Curve Number (RCN)
  - c- Time of Concentration ( $t_c$ )

**QUESTION NO. (2)**

The annual maximum values of 10-minute-duration rainfall at Nweibaa City, Egypt, from 1950 to 1984 are presented in Table (1). Develop a model for storm rainfall frequency analysis using the Extreme Value Type I distribution and calculate the 5-, 10-, and 50-year return period maximum values of 10-minute rainfall at Nweibaa.

**Table (1) 10-minute-duration rainfall at Neibaa City (mm)**

year	1950	1960	1970	1980
0	53	33	34	92
1	76	96	70	66
2	57	94	57	65
3	49	80	80	63
4	66	66	62	60
5	36	68	71	
6	58	68	111	
7	41	61	64	
8	47	88	52	
9	74	49	64	

### QUESTION NO. (3)

A drainage basin of Nweibaa City comprising four sub-catchments is shown in Figure (1). Determine the required flow rate of the storm a 5-year return period storm of 120 min duration. Properties of The sub-catchments are shown in the following table:

Basin	Basin (A)	Basin (B)	Basin (C)	Basin (D)
Area (km <sup>2</sup> )	1.0	1.2	5.0	2.0
Travel time (min)	40	60	80	90
Slope %	2	3	5	3
Length (km)	1.0	1.0	10	1.0
Precipitation (mm)	80	80	80	80
Curve No.	80	65	65	65

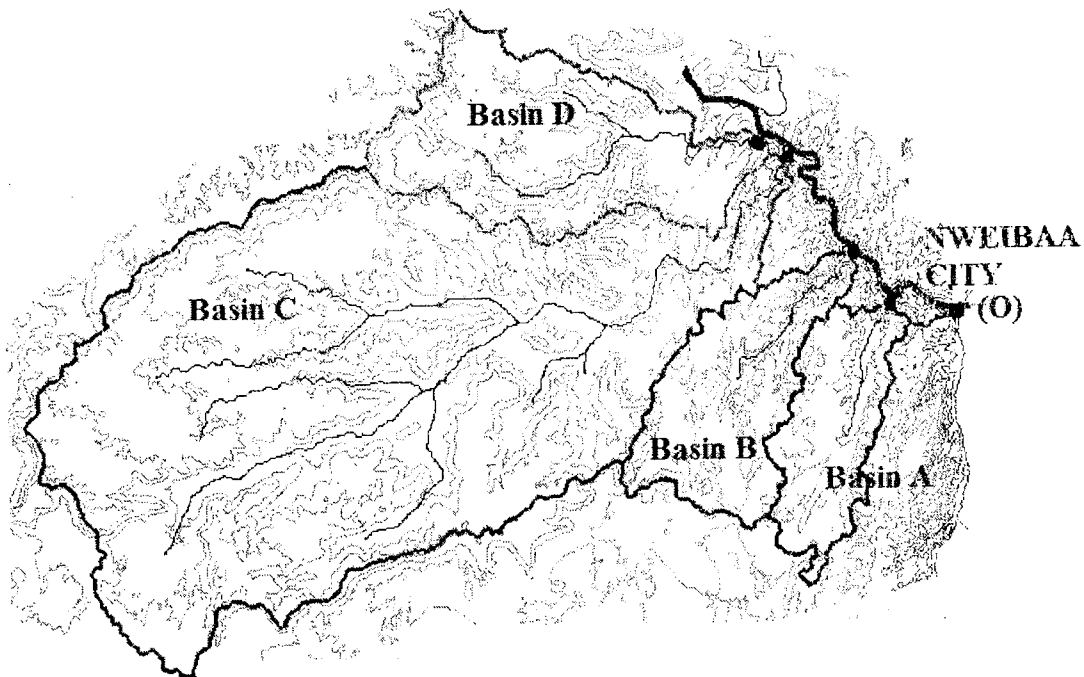


Figure (1) Layout of sub-basins of Nweibaa City

### QUESTION NO. (4)

A deep well system is used to construct a building of area =  $80 \times 50 \text{ m}^2$  in an unconfined soil layer of permeability,  $k = 4 \times 10^{-4} \text{ m/sec}$  and depth = 60 m. Figure (2) shows the initial ground water level, the ground level and the excavation site.

It is required to calculate the total discharge and the number of wells if the well discharge = 50 l/s.

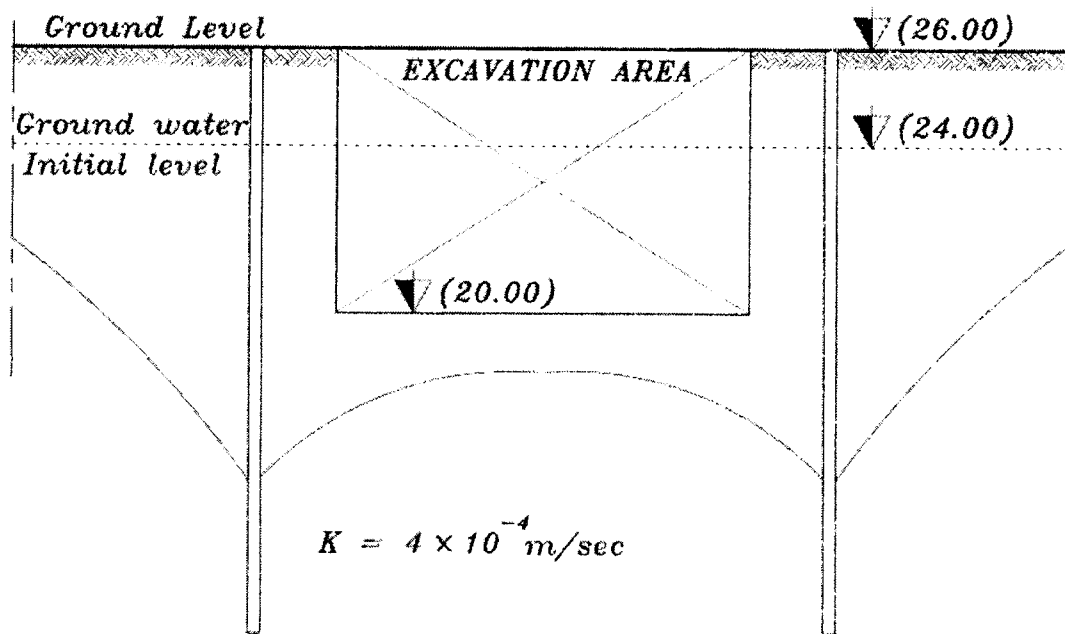


Figure (2) Section elevation for the excavated area

#### USEFUL DATA

$$Qp = \frac{0.208 AR}{0.5D + 0.6tc}$$

$$R = \frac{(P - 0.2S)^2}{p + 0.8S}$$

$$tc = 0.115 L^{0.77} / S^{0.385}$$

$$S = \frac{1000 - 10CN}{CN}$$

$$R_0 = Ch\sqrt{k} \quad Q = \frac{\pi k(H^2 - h^2)}{\ln(R_0/r)}$$

$$F(x) = \exp \left[ -\exp \left\langle -\frac{x-u}{\alpha} \right\rangle \right]$$

$$\alpha = \frac{\sqrt{6}s}{\pi}$$

$$u = \bar{x} - 0.5772 \alpha$$

With our best wishes

Dr. Osama Ragab

Dr. Mohamed R. Soliman





**Final Term Exam - CE 333: Hydraulics (2)**

**Question (1): (17 Marks)**

An intermediate pump station is to be constructed to relief the pressure on an existing prestressed concrete pipeline, feeding the 6<sup>th</sup> of October city. The delivery pipeline is of diameter 1.30 m, length 4 Km and the design absolute roughness 0.20 mm. The maximum static head is 40 m, the sum of minor losses coefficient is estimated to be 20. The design discharge is 1000 lit/sec. Three different pumps are available, the characteristics of which are given in the following table where Q is in lit/sec, H in meter and  $\eta$  is %. Which pump would you recommend to be used? Why?

	Q	0	200	400	600	800	1000	1200	1400
Pump 1	H	152	150	145	138	126	110	90	70
	$\eta$	0	40	60	73	82	86	82	75
Pump 2	H	75	74	72	69	63	56	46	
	$\eta$	0	42	65	78	84	85	77	
Pump 3	H	73	72	65	53	40			
	$\eta$	0	60	80	81	60			

**Question (2): (18 Marks)**

- A) Two identical channels running side by side with the same slope and the same roughness coefficient. The ratio of depth to width is 0.50. What would be the relative saving in the cost of excavation if the total discharge of the two channels is to be carried by one channel of the same form and properties?
- B) A sewer pipeline is laid on a slope 0.0045, and is designed to convey a flow of 300 liters/sec. The sewer pipeline is designed so that it will be partially full, and the water area is 3/4 the full pipe area. Determine the diameter of the sewer pipeline and the water depth. Take  $n=0.015$ .

**Question (3): (17 Marks)**

- A) Derive the condition for a rectangular section to be best hydraulic section.
- B) An open channel is constructed in non-cohesive material to convey a discharge of 25 m<sup>3</sup>/sec. The channel side slope are 3:2, the longitudinal bed slope is 12 cm/km and Manning  $n = 0.033$ . It is required to carry out the following: (i) Design the channel so that the bed width is four times the water depth. (ii) Check the hydraulic stability of the section against scouring if the critical shear stress of the channel bed material = 8 N/m<sup>2</sup>, the angle of repose = 36° and for  $b/y = 4$ :  $(\tau_s)_{\max} = 0.75 \gamma_{YS}$  &  $(\tau_b)_{\max} = 0.98 \gamma_{YS}$ .



**Question (4): (17 Marks)**

- A) Derive relationships for critical depth, critical velocity and minimum specific energy for the case of (i) Trapezoidal channel, and (ii) Rectangular channels.
- B) A discharge of  $22 \text{ m}^3/\text{sec}$  is flowing in a rectangular channel. At section (1), the bed width = 8 m and the water depth = 3 m. The channel bed width is gradually contracted to reach a bed width of 6 m at section (2). Within the contracted zone, the bed level is gradually raised by 0.8 m. It is required to determine all the following: (i) The type of flow and the water depth at section (2) showing the specific energy curve (or curves). (ii) The minimum rise in bed level at section (2) so that the flow is critical. (iii) The relation between the rise height and the water depths, and (iv) The water depth at sec (2) if the rise height is 1.2 m.

**Question (5): (18 Marks)**

- A) Sketch the water surface profile if the channel bed slope is changed from  $0.2S_c$  to  $1.4S_c$  to  $0.4S_c$  where  $S_c$  is the critical bed slope.
- B) A long rectangular channel of constant bed width consists of three reaches of different longitudinal bed slopes. A control gate is located in the middle of the second reach and the gate produces a minimum water depth of 20 cm. In the first reach, the normal water depth equals to 1.5 m and the bed slope is  $0.5 S_c$ . In the second reach, the bed slope is equal to 0.018 and the flow is uniform for a distance of 2 Km. In the third reach, the bed slope is critical and equals to 0.002 and the normal depth is equal to 1.20 m. Neglect gate losses, it is required to:
- Sketch the water surface profile showing the water depths and the bed slopes;
  - Determine the distance in which the flow is non-uniform in the third reach and;
  - Find the thrust on the gate.

**Question (6): (18 Marks)**

- A) Discuss in details with numbers why it is almost practically impossible to satisfy both Reynolds-number and Froude-number similarity in the same model. (hint: use  $L_r = 10$ ;  $\nu_{\text{water}} = 1.006 \times 10^{-6} \text{ m}^2/\text{s}$ ;  $\nu_{\text{mercury}} = 0.11 \times 10^{-6} \text{ m}^2/\text{s}$  and  $\nu_{\text{Gasoline}} = 0.42 \times 10^{-6} \text{ m}^2/\text{s}$ ).
- B) The rate of flow through a rectangular weir is some function of head,  $h$ ; gravitational acceleration,  $g$ ; velocity of approach,  $v$  and weir width,  $b$ . Apply the  $\pi$  theory, find the general form of the discharge equation.
- C) Air at 1 atmosphere and  $20^\circ\text{C}$  flows with an average velocity of 12 m/s through a pipe having a diameter of 30 cm. A model of this flow is to be constructed using water as flow medium. What must be the average water velocity in a 8 cm diameter pipe? If the pressure drop in the model is 250 KPa, find the corresponding pressure drop in the prototype. [Kinematic viscosity of air and water at  $20^\circ\text{C}$  are  $1.51 \times 10^{-5} \text{ m}^2/\text{sec}$  and  $10^{-6} \text{ m}^2/\text{sec}$ , respectively and  $\gamma_{\text{air}} = 7.13 \times 10^{-5} \text{ t/m}^3$ ].

**Best Wishes and Good Luck ,,,**

**Dr. Magdy Abo El-Ela, Dr. Zakaria Mohey El-Din, Dr. Mohamed El-Kholy, and Dr. Haytham Awad**





- d. What are the situations where the consultant may require field tests to evaluate the concrete strength of a structural element recently cast? Explain in details the procedure for performing a core test on a slab. Do you prefer to extract only two cores from the slab or three cores? Explain.

(ما هي الحالات التي يطلب فيها الاستشاري إجراء اختبارات موقعية لتحديد رتبة خرسانة أعمدة مبني حديثة الصب؟ اشرح خطوات إجراء اختبار القلب الخرساني على بلاطة خرسانية. هل تفضل الاكتفاء باستخراج عدد ٢ قلب خرساني أم ثلاث قلوب من البلاطة؟ اشرح إجابتك)

- e. Discuss the different types of concrete cracks that may occur in concrete elements in a building.

(ناقش أنواع الشروخ المحتمل حدوثها في العناصر الخرسانية في مبني)

### Question No. 3:

(23 marks)

- a. Explain the followings:

1- A test to predict the life time of a concrete building. (اشرح اختبار للتنبؤ بعمر مبني خرساني).

2- Five differences between the current Egyptian Code (ECP 203-2007) and the expected new version of the code (ECP 203-2015) with respect to "Quality" and "Quality Control".

(اذكر خمسة اختلافات بين متطلبات الكود المصري الحالي (ECP 203-2007) والتعديل المقترح للكود المصري (ECP 203-2015) من ناحية الجودة وضبط الجودة)

- b. Discuss what you understand from the attached photographs. Explain the techniques shown in Fig. 4 and 5. Suggest approaches to repair the defects shown in Fig. 6 and 7 only.

(ناقش ما تفهمه من الصور المرفقة. اشرح الأساليب الموضحة في شكلي ٤، ٥. اقترح طرق لترميم العيوب الموضحة في شكلي ٦، ٧ فقط)

- c. An internal column located inside a commercial building that consists of a ground floor and six repeated floors. The cross section of the column at the ground floor is 40 x 60 cm. The column is covered with marbles. The spacing between the columns in the building is almost 5.0 m in both directions. The allowable concrete stress of the column is 60 kgf/cm<sup>2</sup>. Each floor is a flat slab having a thickness of 24 cm. It is required to:

- 1- Estimate the axial load applied on the column's section at the ground floor then check the safety of the column.
- 2- If the column is not safe at the ground floor, identify also other floors where the chemise is required.
- 3- Calculate the new dimensions of the column at the ground floor by constructing chemise for this column around all sides. Assume that the allowable concrete strength of the chemise is also 60 kgf/cm<sup>2</sup>.
- 4- Explain the procedure for constructing the chemise for the column. Draw sketches.
- 5- Can you strengthen the column by using other new technique?

(عمود داخلي في مبني تجاري مكون من دور أرضي + ٦ أدوار متكررة. قطاع العمود مغطي بالرخام في الدور الأرضي ٤٠ × ٦٠ سم والمسافة بين الأعمدة ٥.٠ متر في الاتجاهين. الإجهاد التصميمي لخرسانة العمود ٦٠ كجم/سم<sup>٢</sup>. الأسقف بلاطة لا كمرية بسبك ٢٤ سم. المطلوب: ١- احسب الحمل الواقع على قطاع العمود بالدور الأرضي وادرس أمان العمود. ٢- إذا تبين أن العمود غير آمن حدد الأدوار التي يلزم فيها تدعيم العمود. ٣- احسب أبعاد العمود في الدور الأرضي بعد تنفيذ القميص باعتبار الإجهاد التصميمي لخرسانة القميص أيضا ٦٠ كجم/سم<sup>٢</sup>. ٤- اشرح وارسم خطوات تنفيذ القميص. ٥- اشرح طريقة بديلة لتدعيم العمود باستخدام مواد وأساليب حديثة).

### Question No. 4:

(20 marks)

- a. Determine the concrete mix design strength if the structural design strength is 250 kgf/cm<sup>2</sup>.

1- Follow the requirement of the Egyptian Code if:

- 30 data are available and  $\sigma = \text{zero}$ .
- 50 data are available and  $\sigma = \text{zero}$ .
- 100 data are available and  $\sigma = 50 \text{ kgf/cm}^2$ .

2- Follow the two main criteria of ACI 214R assuming  $\sigma = 40 \text{ kgf/cm}^2$ .

3- Use Table A (statistics) assuming 20% falling percent and  $\sigma = 60 \text{ kgf/cm}^2$ .

- b. A contractor requests a concrete mix design for a new project with a specified strength = 250 kgf/cm<sup>2</sup>. The contractor submits results of cubes tested during the construction of another project during the past 6 months. Results in kgf/cm<sup>2</sup> are as follows:

340	340	265	330	275	280	280	325
240	240	280	255	285	220	270	260
250	245	320	250	240	265	245	320
350	245	260	280	245	230	220	265
240	240	325	255	285	330	270	270

Table 1

نتائج كسر مكعبات في مشروع سابق قام المقاول بتنفيذه خلال الستة أشهر الماضية



According to the contractor's request and the data submitted, three trial mixes were designed in the lab. Results of the three lab trial mixes are:

Trial Mix. No.	Concrete mix proportions, kg/m <sup>3</sup>					No. of cubes	28-day compressive strength, kgf/cm <sup>2</sup>
	Cement	Water	Sand	Crushed Stone	Additive		
A	350	155	700	1210	4 liters	6	300, 310, 300, 320, 310, 320
B	375	160	690	1190	4.5 liters	5	320, 335, 340, 350, 330
C	400	165	675	1180	6.0 liters	6	340, 370, 380, 400, 390

Table 2

نتائج  
كسر  
مكعبات  
المعمل

The contractor used one mix to cast the concrete foundations with a specified strength = 250 kgf/cm<sup>2</sup> in the new project in Alexandria. Cubes were taken from 10 field batches. Results of 28 day-compressive strengths in kgf/cm<sup>2</sup> are given below:

Batch No.	No. of cubes	Comp. Strengths	Batch No.	No. of cubes	Comp. Strengths
(1)	3	270, 290, 330	(6)	6	260, 260, 260, 260, 300, 300
(2)	3	280, 280, 250	(7)	6	280, 290, 290, 310, 280, 280
(3)	3	290, 280, 260	(8)	6	250, 280, 250, 280, 250, 260
(4)	3	290, 260, 290	(9)	3	230, 260, 290
(5)	2	270, 270	(10)	5	260, 210, 270, 260, 280

Table 3

نتائج  
المشروع  
الجديد  
للمقاول

- 1- Determine the mix design strength  $f_{cr}$ .
- 2- Select the mix that should be given to the client.
- 3- Does the new work of the client satisfy the requirement of ECP 203?
- 4- Does the new work of the client satisfy the requirements of ACI 214R?
- 5- Evaluate all degrees of control according to ECP 203.
- 6- Evaluate all degrees of control according to ACI 214R.
- 7- At this stage, is it possible to change the mix for the contractor?
- 8- Draw the quality control chart for the obtained data given in Table 3.
- 9- Mention the corrective actions that should be taken to improve the overall degree of QC.

(مقاول يحتاج الى خطة تصميمية لأساسات مشروع جديد بالإسكندرية تحقق ٢٥٠ كجم/سم<sup>٢</sup>. قدم المقاول لمعمل الاختبار نتائج لمكعبات سابقة له في مشروع سابق: كما في جدول ١. قام المعمل ببناء علي هذه البيانات بصب ٣ خلطات معملية واختبارها في المعمل كما في جدول ٢. أخذ المقاول خطة واحدة من المعمل واستخدمها في المشروع الجديد وحصل علي نتائج جديدة لعدد ٤٠ مكعب مأخوذة من ١٠ قليات كما في جدول ٣) المطلوب: (١) حدد مقاومة تصميم الخلطة. (٢) اختار الخلطة المناسبة. (٣) هل نتائج المقاول تحقق متطلبات ECP-203؟ (٤) هل نتائج المقاول تحقق متطلبات ACI-214R؟ (٥) حدد جميع درجات ضبط الجودة وفقاً للـ ECP-203. (٦) حدد جميع درجات ضبط الجودة وفقاً لـ ACI-214R. (٧) في هذه المرحلة هل يمكن تغيير الخلطة للمقاول؟ (٨) ارسم منحني ضبط الجودة للنتائج. (٩) اذكر الإجراءات التصحيحية اللازمة لرفع المستوى الكلي لضبط الجودة.

#### Question No. 5:

(10 marks)

- a. The ultrasonic pulse velocity tester was used to evaluate the quality of a column in a building. Direct transmission was followed. Data collected at three levels (عند ٣ مناسيب) are:

	Cross Section, m	Transit time, micro second		
		Near the floor (قرب الأرضية)	At mid height (في منتصف الارتفاع)	Near the roof (قرب السقف)
Column	0.40 x 0.40	350	90	95

Analyze the data. Evaluate the quality of the column. Comment. (حلل النتائج وقيم جودة العمود مع التعليق)

- b. Results of a large number of compression tests performed on concrete cubes show that the distribution is approximately normal and the average is 300 kgf/cm<sup>2</sup> with a standard deviation  $\sigma$  of 25 kgf/cm<sup>2</sup> determine:
- 1- The percentage of specimens that have strengths less than 300 kgf/cm<sup>2</sup>.
  - 2- The percentage of specimens that have strengths less than 270 kgf/cm<sup>2</sup>.
- c. Draw a sketch showing the relationship between the safety margin (on y-axis) and the standard deviation (on x-axis).
- d. Explain the surface transmission test of ultrasonic tester. What is the use of 'Profoscope'?

With my best wishes  
Prof. Shafik Khoury

TABLE A Areas Under the Normal Curve.\*

$\frac{X_i - \mu}{\sigma}$	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.00
-3.5	0.00017	0.00017	0.00018	0.00019	0.00019	0.00020	0.00021	0.00022	0.00022	0.00023
-3.4	0.00024	0.00025	0.00026	0.00027	0.00028	0.00029	0.00030	0.00031	0.00033	0.00034
-3.3	0.00035	0.00036	0.00038	0.00039	0.00040	0.00042	0.00043	0.00045	0.00047	0.00048
-3.2	0.00050	0.00052	0.00054	0.00056	0.00058	0.00060	0.00062	0.00064	0.00066	0.00069
-3.1	0.00071	0.00074	0.00076	0.00079	0.00082	0.00085	0.00087	0.00090	0.00094	0.00097
-3.0	0.00100	0.00104	0.00107	0.00111	0.00114	0.00118	0.00122	0.00126	0.00131	0.00135
-2.9	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0017	0.0018	0.0019
-2.8	0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026
-2.7	0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035
-2.6	0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047
-2.5	0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062
-2.4	0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082
-2.3	0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107
-2.2	0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139
-2.1	0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179
-2.0	0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228
-1.9	0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287
-1.8	0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359
-1.7	0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446
-1.6	0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548
-1.5	0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668
-1.4	0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808
-1.3	0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968
-1.2	0.0895	0.1003	0.1020	0.1038	0.1057	0.1075	0.1093	0.1112	0.1131	0.1151
-1.1	0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357
-1.0	0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587
-0.9	0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841
-0.8	0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119
-0.7	0.2148	0.2177	0.2207	0.2236	0.2266	0.2297	0.2327	0.2358	0.2389	0.2420
-0.6	0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743
-0.5	0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085
-0.4	0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446
-0.3	0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821
-0.2	0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207
-0.1	0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602
-0.0	0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000

Table: Factor  $d_2$  (ACI 214R)

Factor $d_2$	1.128	1.693	2.059
No. of specimens	2	3	4 or more

Table 3.2—Standards of concrete control\*

Overall variation					
Class of operation	Standard deviation for different control standards, MPa (psi)				
	Excellent	Very good	Good	Fair	Poor
General construction testing	Below 2.8 (below 400)	2.8 to 3.4 (400 to 500)	3.4 to 4.1 (500 to 600)	4.1 to 4.8 (600 to 700)	Above 4.8 (above 700)
Laboratory trial batches	Below 1.4 (below 200)	1.4 to 1.7 (200 to 250)	1.7 to 2.1 (250 to 300)	2.1 to 2.4 (300 to 350)	Above 2.4 (above 350)
Within-test variation					
Class of operation	Coefficient of variation for different control standards, %				
	Excellent	Very good	Good	Fair	Poor
Field control testing	Below 3.0	3.0 to 4.0	4.0 to 5.0	5.0 to 6.0	Above 6.0
Laboratory trial batches	Below 2.0	2.0 to 3.0	3.0 to 4.0	4.0 to 5.0	Above 5.0

\* $f'_c \leq 34.5$  MPa (5000 psi).

Table 3.3—Standards of concrete control\*

Overall variation					
Class of operation	Coefficient of variation for different control standards, %				
	Excellent	Very good	Good	Fair	Poor
General construction testing	Below 7.0	7.0 to 9.0	9.0 to 11.0	11.0 to 14.0	Above 14.0
Laboratory trial batches	Below 3.5	3.5 to 4.5	4.5 to 5.5	5.5 to 7.0	Above 7.0
Within-test variation					
Class of operation	Coefficient of variation for different control standards, %				
	Excellent	Very good	Good	Fair	Poor
Field control testing	Below 3.0	3.0 to 4.0	4.0 to 5.0	5.0 to 6.0	Above 6.0
Laboratory trial batches	Below 2.0	2.0 to 3.0	3.0 to 4.0	4.0 to 5.0	Above 5.0

\* $f'_c > 34.5$  MPa (5000 psi).

For all problems:  $f_{cu}=25 \text{ N/mm}^2$  Steel grade: 360/520, Assume any missing data  
Tables and design sheets previously prepared by R.C. staff are allowed.

**Question # 1(30%)**

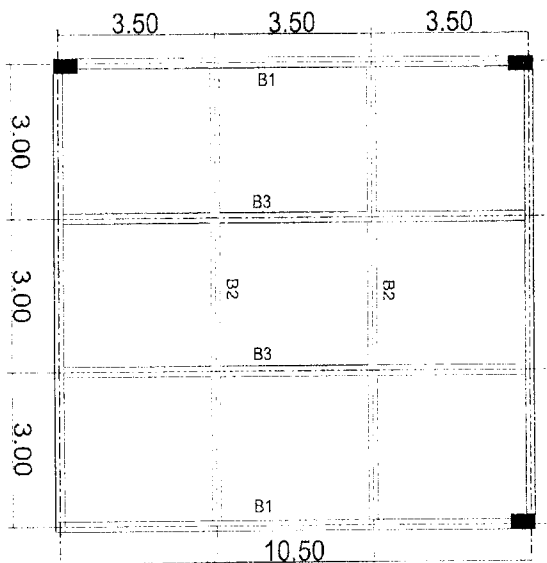
Fig.1 show the plan of **Ribbed** slabs in are loaded with service Live load (L.L.)= $3.0 \text{ kN/m}^2$  and Covering material= $2.00 \text{ kN/m}^2$ . In addition the cantilever is loaded with a handrail with weight= $3.50 \text{ kN/m}^2$  and the handrail height is 1.10 m Given that : width of ribs = 120 mm, clear spacing between ribs 400 mm in each direction. You are asked to:

- Give statical calculation and design the ribbed slab sections.
- By checking the negative bending moment, calculate the required width of the solid part at the support near the cantilever.(i.e calculated value of x)
- Draw the reinforcement section a-a (scale 1:20) and show all dimensions and reinforcement for that section only.

**Question # 2(20%)**

Fig. 2 shows a **Paneled** beams floor system. If the service loads are: Live load (L.L.)= $4.0 \text{ kN/m}^2$  and Covering material= $2.00 \text{ kN/m}^2$ . Beams B2, and B3 dimensions are (250\*700mm) and B1 is (300\*900). In addition the main beams loaded with wall weight= $3.50 \text{ kN/m}^2$  and the height is 3.00 m .You are asked to:

- Give statical calculation and design of each of these beams and draw the reinforcement longitudinal section of B1.



(Consider all columns are (600\*400))

Figure 2

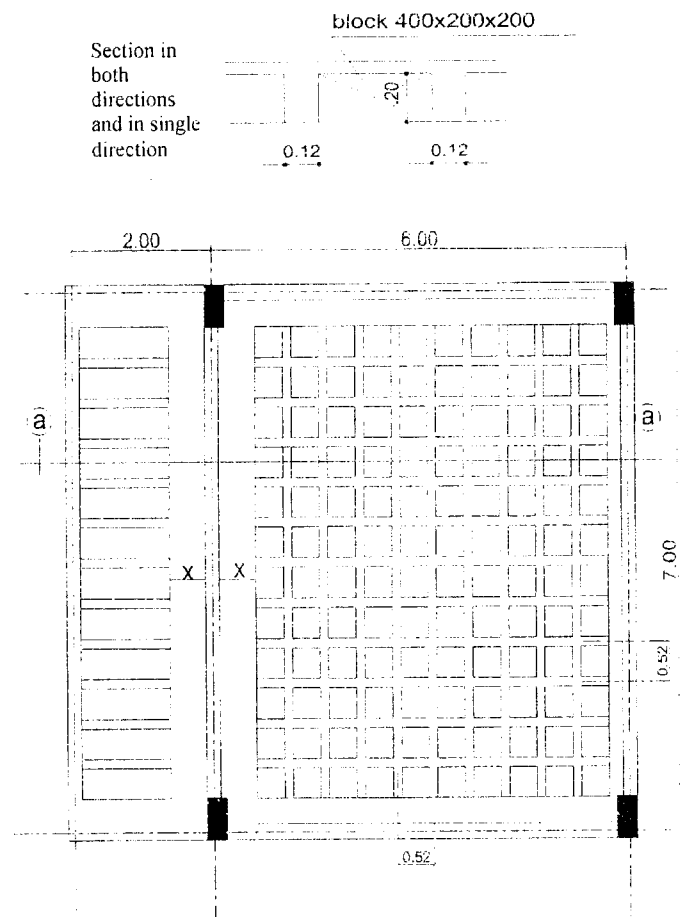


Figure 1

### Question # 3(25%)

a) What is the difference between compatibility torsion and equilibrium torsion?

b) The **Cantilever type-stairs** shown in the figure 3 are subjected to the following service loads: Live load (L.L.) =  $4.0 \text{ kN/m}^2$ , the Cover on the horizontal parts =  $3.00 \text{ kN/m}^2$ , and  $2.00 \text{ kN/m}^2$  on the inclined parts. The stairs are loaded with a handrail on its edge with a weight =  $3.50 \text{ kN/m}$ . You are asked to:

- Design the stairs slab-steps and draw cross sections showing the reinforcement details (scale 1:20).
- Design and give complete reinforcement details (1:20) of the cantilever beam if the beam is  $(300 \times 800 \text{ mm})$  and it is loaded with a half brick wall with weight =  $2.50 \text{ kN/m}^2$  and wall height is  $2.50 \text{ m}$ . (Design the cantilever beam at the support face, section a-a).

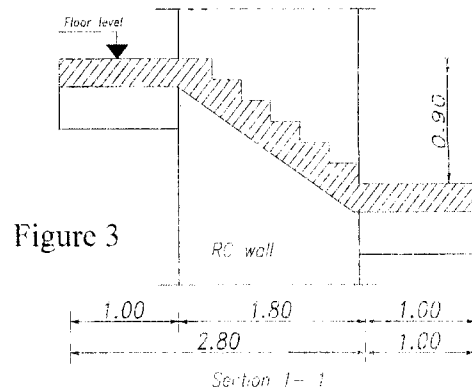
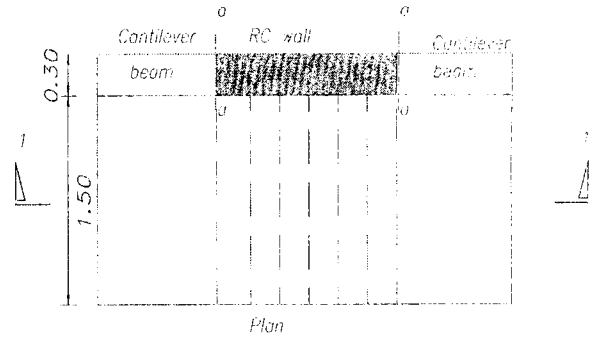


Figure 3

### Question # 4(25%)

Figure (4) shows a column of an **unbraced** building. The cross-sectional dimensions of the column AB are  $350 \times 500 \text{ mm}$ . Also shown in this figure the bending moment diagrams  $M_{ux}$  and  $M_{uy} = 0.00$  acting on the column. The column is also subjected to an axial force  $P_u = 600 \text{ kN}$ . It is required to calculate the required reinforcement for column AB using the interaction diagrams for the following cases:

- Uniform steel.
- Top and bottom steel. (Extra mark).

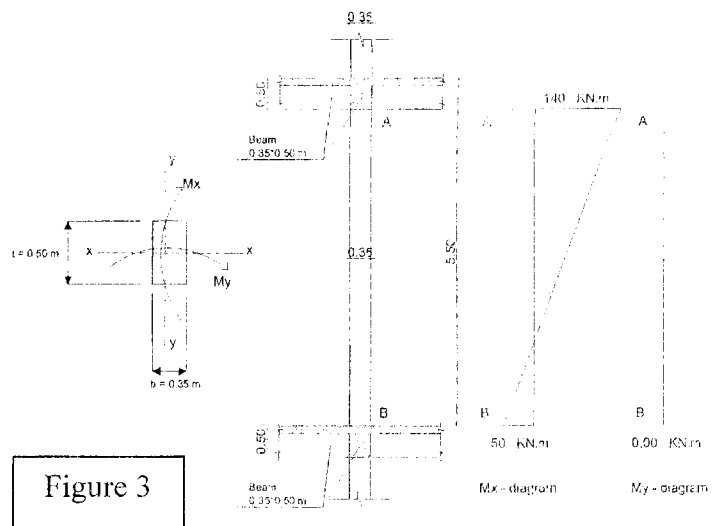
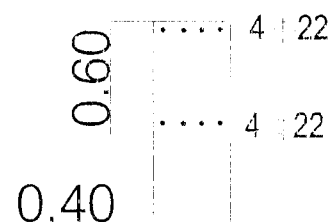


Figure 3

### Question # 5(10% Extra mark)

For R.C section  $400 \times 600 \text{ mm}$  draw the approximate M-P diagram using 3 main characteristic points.





## ادارة مشروعات

Final Exam (January 2015)

Time Allowed: 3.0 Hr

### QUESTION 3 (15%)

Find the optimum solution for the following transportation problem by Vogel's method. Calculate the Total transportation cost.

		Concrete Patch plants				Demand (m3/day)
		P1	P2	P3	P4	
Sites	S1	10	11	10	12	200
	S2	15	16	15	17	150
	S3	13	15	16	12	100
	S4	11	14	12	9	50
	Supply (m3/day)	200	100	170	30	

### QUESTION 4 (15%)

Four gangs of workers (1 to 4) must each be assigned to each of four activities (A to D). The following table shows the durations (days) required for each gang to perform the activity. Gang (1) cannot be assigned to Activity (C).

	1	2	3	4
A	16	20	18	17
B	21	19	22	21
C	18	20	22	21
D	15	17	20	17

Using the Assignment Problem Technique: Find the Minimum total duration.

### QUESTION 5 (15%)

ترغب شركة استثمار عقاري في إنشاء مبني متعدد الاستخدامات من الممكن ان يحتوي علي ثلاث أنشطة مختلفة وهي (1) شقق سكنية، (2) أنشطة تجارية، (3) مكاتب إدارية. الربح المتوقع من هذه الأنشطة هو كالآتي بالترتيب:

- |                     |              |
|---------------------|--------------|
| 1) $10x$            | شقق سكنية    |
| 2) $10y - 0.1y^2$   | أنشطة تجارية |
| 3) $16z - 0.025z^2$ | مكاتب إدارية |

حيث  $x, y, z$  تمثل مساحة الاسقف بالالف متر مربع للشقق السكنية الأنشطة التجارية والمكاتب الادارية بالترتيب. علماً بأن المساحة الكلية لجميع الأسقف = 300,000 متر مربع. احسب أفضل مساحة (optimum floor space) لكل من الاستخدامات الثلاث: الشقق السكنية والمحلات والمكاتب الادارية لتحقيق اعلى ربح.

### QUESTION 6 (15%)

Using Optimization – Graphical Solution: Maximize the Profit  $P$ , where  $P = x_1 + x_2$   
Subject to the following constraints:

- |                          |                             |
|--------------------------|-----------------------------|
| 1) $x_1 + 2x_2 \leq 4$   | 3) $x_2 - x_1 \leq 1$       |
| 2) $4x_1 + 2x_2 \leq 12$ | 4) $x_1 \geq 0, x_2 \geq 0$ |





## ادارة مشروعات

Final Exam (January 2015)

Time Allowed: 3.0 Hr

### QUESTION 1 (20%)

تم عقد مناقصة محدودة بين 5 مقاولين لتنفيذ عمارة سكنية و قد قام المالك بتشكيل هيئة لدراسة العطاءات المقدمة و تقييمها ماليا و فنيا و الجدول التالي يوضح التحليل المالي و الفني لل 5 مقاولين:

Criterion	Contractors				
	A	B	C	D	E
Bid amount ( $10^6$ LE)	9.7	6.5	7.5	8.5	8.2
Life cycle cost ( $10^6$ LE)	1.1	1	1.6	1.6	2
Previous performance	E	VG	VG	VG	E
Construction Method	E	VG	VG	VG	G
Years in business	25	16	30	18	15
Project duration (Months)	18	25	24	22	20
Reputation & staff	E	VG	G	E	VG

Note: E = 100%; VG = 80%; G = 60 %; P = 40 %

Given that:

- Estimated bid price (التقييم المبني من طرف المالك) = 8.6 million LE
- The Bid amount shall have a weight of 30%. The weight of ALL Financial Criterion shall be 50%.
- The Owner committee (لجنة البت في العطاء) decided that "Project duration" should not be considered in the evaluation. Other Technical Criterion shall have equal weights.
- The committee decided that the accepted contractor price must not be less than 80% of the estimated bid price (minimum) and shall not exceed the estimated bid price by more than 10% (maximum).

Using **Multi Criteria Decision Making**. Determine the best contractor to do the job.

### QUESTION 2 (20%)

شركة مقاولات تود استخدام معدة متقدمة للحفر داخل احد الانهار و تقارير الارصاد الجوية السابقة تشير الى حدوث ارتفاعات زائدة لمياه النهر و فيضانات. لن يتم استخدام المعدة الجديدة خلال ال 4 شهور القادمة و الشركة من الممكن ان تنقل المعدة (لحمايتها) و تخزينها خلال هذه الفترة و اعادتها مرة ثانية للموقع بتكلفة اجمالية 1800 LE. اما اذا ارادت الشركة ان تبقى على المعدة داخل الموقع فليديها الاختيار لبناء منصة بتكلفة 500 LE لحماية المعدة حالة حدوث ارتفاع زائد لمياه النهر و بذلك تتجنب خسارة مادية تقدر ب 10,000LE مع العلم بان هذه المنصة لن تحمي المعدة حالة حدوث فيضان. اما اذا حدث فيضان فبالخسارة المتوقعة ستكون 60,000 LE سواء كانت هناك منصة او لا. تشير تقارير الارصاد الجوية بان الارتفاع الزائد لمياه النهر محتمل بنسبة 25% و احتمال الفيضان 2%.

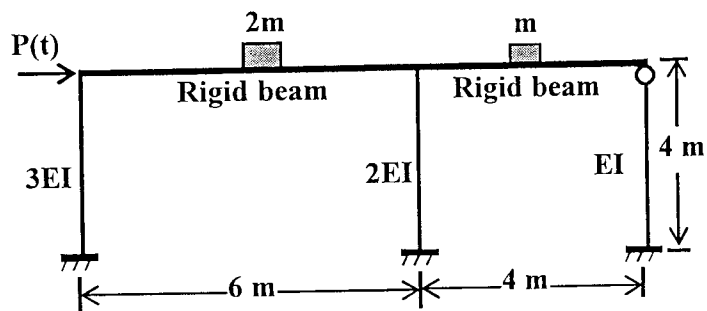
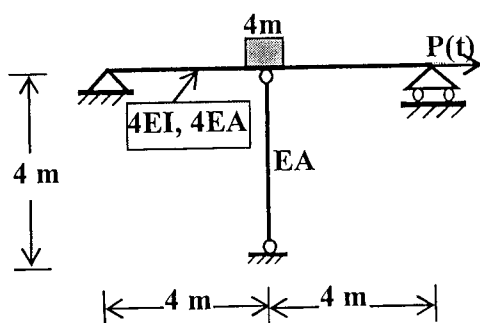
Using **Decision Making under Probabilities**. Draw up the **Decision Tree** for the contractor alternatives. **Determine the EMV** of each action. **Determine which action should be chosen?**



**Assume any missing data**

**Question 1 (15%)**

Create a SDF model and calculate the natural circular frequency ( $\omega_n$ ) and the natural period ( $T_n$ ) in the loading direction for each of the shown structures.  $EI$ ,  $EA$  and  $m$  are equal to 10,000 kN.m<sup>2</sup>, 3000 kN and 5 ton, respectively.

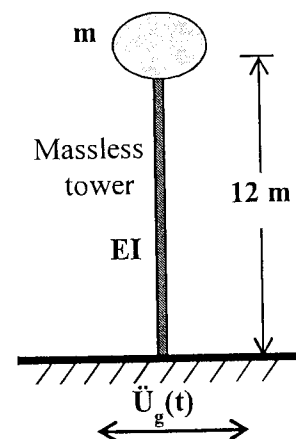


**Question 2 (20%)**

The shown water tank with a massless tower has  $m=120$  ton,  $EI=2.8 \times 10^7$  kN.m<sup>2</sup> and  $\zeta=2\%$ . The tank is subjected to ground motion that has:

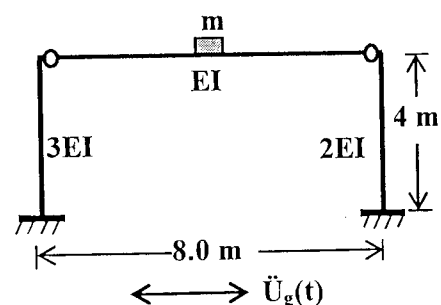
$$\ddot{U}_g(t) = 5.8 \sin(24t) \text{ \{m/sec}^2\}}$$

- Calculate the maximum lateral displacement and bending moment of the tower.
- Describe what will happen to the tank after the ground motion stops.



**Question 3 (20%)**

The shown frame is subjected to a ground motion that has the acceleration record presented in the following table. Calculate the frame lateral displacement response using the central difference method with considering the initial displacement and velocity are equal to zero. Use a damping ratio of 1% and 5 increments with  $\Delta t$  equals to 0.05 sec.



Time (sec.)	0.0	0.05	0.10	0.15	0.20	0.25
$\ddot{U}_g$ (m/sec <sup>2</sup> )	0.0	0.30	0.12	- 0.24	- 0.36	- 0.10

$$EI = 27,000 \text{ kN.m}^2$$

$$m = 10 \text{ ton}$$

### Question 4 (15%)

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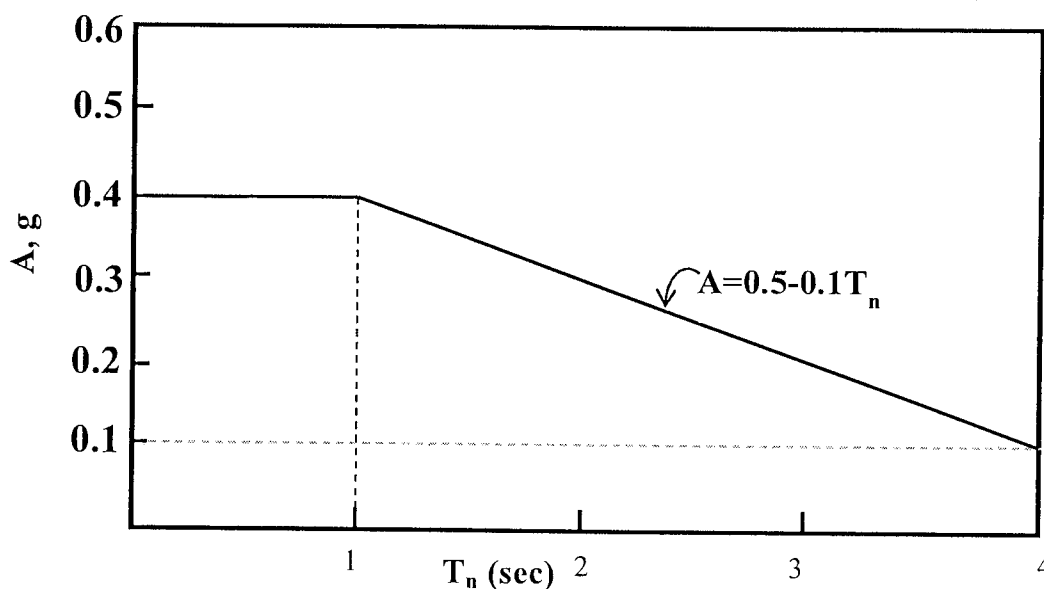
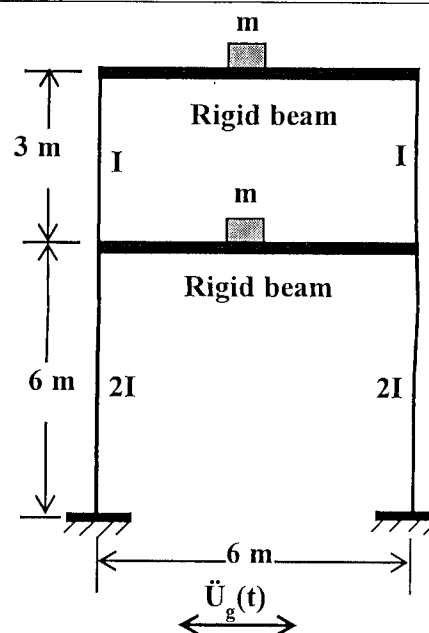
- Discuss the difference between static and dynamic loadings.
- In structures subjected to periodic dynamic forces, explain with sketches how the structure dynamic response is sensitive to the frequencies of both the structure and the force.
- Explain with sketches the difference between the transient and the steady state dynamic responses.
- Define the terms; critical damping, over damping and under damping.
- Explain why and how to use static condensation.
- Define the epicenter distance and the peak ground acceleration of an earthquake.
- Discuss how to construct a design response spectrum.
- Explain without calculations the effect of inelastic deformations and damping on the structure earthquake response.

### Question 5 (30%)

The shown RC frame is assumed to have flexible columns and rigid beams. The frame is subjected to a horizontal earthquake that is characterized by the shown design pseudo-acceleration spectrum. Calculate the maximum deformations and internal forces of the frame in cases of considering:

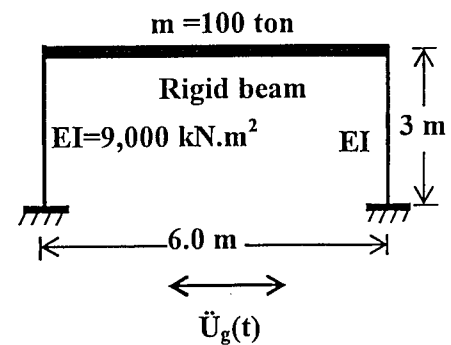
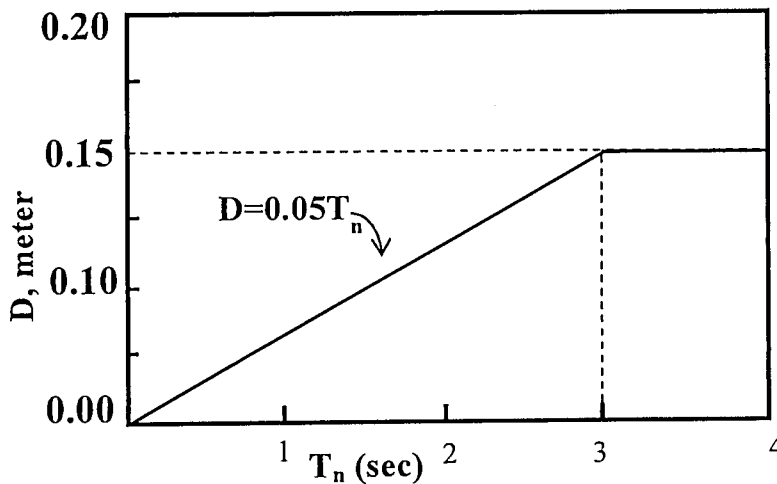
- The two mode shapes of the frame.
- The first mode shape only.

Negelect the axial deformations and consider;  $m=60$  ton and  $EI=100,000 \text{ kN.m}^2$



The shown frame is subjected to a horizontal earthquake that is characterized by the shown displacement design spectrum. Calculate the frame earthquake design force for each of the following cases:

- 1- The frame behaves elastically under earthquake loading.
- 2- The frame behaves inelastically with a ductility factor  $\mu=4$  and obeys the equal displacement rule.
- 3- The frame behaves inelastically with a ductility factor  $\mu=4$  and obeys the equal energy rule.



### Useful data

**Free vibration of under-damped SDOF systems**

$$u(t) = e^{-\zeta\omega_n t} \left[ u(0) \cos \omega_D t + \left( \frac{\dot{u}(0) + \zeta\omega_n u(0)}{\omega_D} \right) \sin \omega_D t \right]$$

$$\omega_D = \omega_n \sqrt{1 - \zeta^2}$$

**Steady state response of a SDOF subjected to  $p(t) = p_o \sin \omega t$**

$$u(t) = \frac{p_o}{k} (C \sin \omega t + D \cos \omega t)$$

$$C = \frac{1 - (\omega/\omega_n)^2}{[1 - (\omega/\omega_n)^2]^2 + (2\zeta\omega/\omega_n)^2}$$

$$D = \frac{-2\zeta\omega/\omega_n}{[1 - (\omega/\omega_n)^2]^2 + (2\zeta\omega/\omega_n)^2}$$

where  $\omega_n = \sqrt{k/m}$  and  $\zeta = c/2m\omega_n$

**GOOD LUCK**

Hamdy Abou-Elfath



(32 درجة)

**Total Station** محطات الرصد المتكاملة

(A) قارن في جدول بين انواع العواكس المستخدمة مع اجهزة الـ Total Station مع بيان حالات الاستخدام الأمثل لكل منها وكذلك ثابت العاكس لكل منها.

(3 درجات)

(B) ما هي الخيارات المطروحة أمام المهندس عند ضبط متغيرات جهاز الـ Total Station التالية:  
H.obs., V.obs, Meas. Mode, Meas. Repeat., Reflector type, P.C.mm, ppm, Meas.Display

(4 درجات)

(C) ماذا نعني بكل من المصطلحات الآتية وكيف تؤثر على اداء الـ Total Station :  
Time Stamp, Control Job, Tolerance, Tilt Correction, Feature Code List, Recipucal Calculations

(3 درجات)

(D) عند رصد ارتفاع برج رأسى معلوم ان ارتفاعه 80 متر باستخدام برنامج REM وضع عاكس ارتفاعه 1.40 متر أسفل البرج تماما و رصد من جهاز T.S. فظهرت القراءات التالية على الشاشة:

(14 درجة)

$$S.dist. = 103.133 \text{ m}, V.obs. = 89^\circ 50' 00'', H.obs. = 155^\circ 48' 00''$$

أوجد :

1. قراءة الدائرة الرأسية المتوقعة عند الرصد على قمة البرج
2. منسوب نقطة الجهاز اذا علم أن منسوب نقطة قاعدة البرج هو (-2.7) متر و ارتفاع الجهاز يساوى ارتفاع العاكس
3. بدون اجراء أى حسابات المسافة الحقيقية (المائلة) بين نقطة الجهاز و قاعدة البرج مع بيان السبب
4. قراءة الدائرة الرأسية المتوقعة عند الرصد على النقطة N التي تقع على البرج و منسوبها (40.0) مترا
5. احداثيات نقطة قمة البرج اذا علم أن احداثيات نقطة الجهاز هي (500W,500S) و الدائرة الأفقية للجهاز تقرأ 30° عند توجيه الجهاز الى اتجاه الشمال المغناطيسي
6. احداثيات و منسوب نقطة M منتصف المسافة بين نقطة الجهاز و البرج و على خط الانحدار الواصل بينهما
7. الأرصاد المتوقعة على شاشة الجهاز عند رصد عاكس موضوع على نقطة M بنفس الارتفاع و بدون حدوث أخطاء

(E) عند ايجاد المسافة بين نقطتين A, B بينهما عائق استخدم الراصد برنامج MLM و كانت الارصاد من جهاز الـ T.S. الى هاتين النقطتين كالآتي:

To Point	S. Dist.	V. Observation	H. Observation
A	145.386	89° 17' 20"	345° 12' 47"
B	213.765	90° 04' 14"	53° 27' 36"

والمطلوب ايجاد :

1. المسافة الأفقية و الرأسية و المائلة و الانحدار بين النقطتين ( حاول تتبع الخطوات الحسابية التى يقوم بها الجهاز )
2. اذا قام الراصد بعد ذلك برصد نقطة أخرى C من نفس مكانه بدون أن يضغط على مفتاح <Move> وكانت الأرصاد كالتالى: H.obs. = 117° 29' 35", V.obs. = 91° 13' 25", S.Distance = 178.345 أوجد المسافة الأفقية و الرأسية و المائلة بين النقطتين المعنيتين.
3. وضح بدون حسابات ماذا يكون الفرق فى الحسابات اذا ضغط الراصد على مفتاح <Move>

(8 درجات)

(24 درجة)

**Digital Mapping** الخرائط الرقمية

- 1- أشرح باختصار مستعينا بالرسم كلما أمكن:  
(a) البيانات الأساسية للخريطة الرقمية.  
(b) الفروق الأساسية بين الخريطة الورقية والخريطة الرقمية.  
(c) نماذج الاليسويد المستخدمة في انشاء الخرائط المصرية.  
(d) الفرق بين الاحداثيات الجغرافية والاحداثيات الجيوديسية.  
(e) خط الطول الأوسط "central meridian" في اسقاط ميركاتور.

(5 درجات)

(9 درجات)

2- Explain the following using neat sketches – if available:

- Digital Mapping is a part of GIS.
- Digital map data sources.
- vector and raster formats of digital maps.
- Point/ stream digitizing modes.
- Undershoot/ pseudonode/ line crossing errors.
- Selection of control points in ArcGIS.

(4 درجات)

3- Calculate UTM zones of Alexandria 31.198° N & 29.919° E.

4- طلب منك أعداد خرائط مساحية لمنطقة العامرية بالاسكندرية مقياس 1: 25,000 بغرض تطوير التخطيط الحضاري للمنطقة، وكان متاح لك استخدام كل أو بعض الآتي: [ فرق مساحية للرفع باستخدام أجهزة المحطة المتكاملة – خرائط ورقية لمنطقة العامرية – صور من جوجل – أجهزة GPS عادية]. اقترح أسلوب مناسب لتنفيذ ذلك موضحاً باختصار الأجهزة والبرامج اللازمة و مدي ملائمة الأسلوب المقترح من ناحية الدقة – الوقت – التكلفة.

(6 درجات)

### السؤال الثالث: نظام التثبيت العالمي GPS

(24 درجة)

(أ) اذكر صحة أو خطأ العبارات الآتية مع تصحيح الخطأ:

(8 درجات)

- 1- أنشأ نظام الـ GPS أساساً للأغراض المدنية ثم بعد ذلك تم استخدامه للأغراض العسكرية .
- 2- عدد الأقمار الصناعية في نظام الـ GPS ثابت ولا يزيد عن 28 قمر.
- 3- يدور القمر الصناعي في نظام الـ GPS حول الأرض ويرجع لنفس المكان بالنسبة لسطح الأرض بعد مرور 12 ساعة تقريباً.
- 4- يتم استخدام atomic clocks في كل من القمر الصناعي والمستقبل receiver.
- 5- يوجد ثلاثة طرق من تحميل الموجات modulation في نظام الـ GPS .
- 6- سطح الجيويد Geoid ينطبق تماماً مع سطح الأرض الطبيعية.
- 7- ينطبق اتجاه العمود على الجيويد Geoid والالبسويد Ellipsoid عند كل نقاط سطح الأرض.
- 8- عرض الشريحة الواحدة في نظام الـ UTM هو 6 درجات.
- 9- لا يعتبر Ionosphere من مصادر الأخطاء في نظام الـ GPS.
- 10- تم إطلاق أول قمر صناعي في نظام GPS عام 1979.

(8 درجات)

(ب) اجب بإيجاز مستعينا بالرسم :

- 1- ما هي مكونات نظام الـ GPS وما هو الغرض الأساسي من هذا النظام.
- 2- ما هي الأشياء المأخوذة في الاعتبار considerations عند تصميم نظام الـ GPS.
- 3- وضح بالرسم الفرق بين الاحداثيات الجغرافية والاحداثيات المركزية.
- 4- وضح الغرض الأساسي من almanac.
- 5- وضح ما هو المقصود بالـ UTM.
- 6- وضح المقصود بالـ Ellipsoid.
- 7- وضح المقصود بكل من مع الرسم Orthometric height - Ellipsoid height – Geoid height

(ج) إذا كانت الاحداثيات الجغرافية للنقطة A هي  $h = 30.0048 \text{ m}$  ،  $\Phi = 31^\circ 10' 12'' \text{ N}$  ،  $\lambda = 29^\circ 5' 30'' \text{ E}$  ، أوجد الاحداثيات الجغرافية لنقطة أخرى B تقع جنوب نقطة A وعلى نفس خط الطول لنقطة A والفرق في الارتفاع بينهما  $\Delta Z = 288898.1371 \text{ m}$  وطول الخط المستقيم  $AB = 332505.3342 \text{ m}$

(8 درجات)

ملاحظة هامة: النهاية العظمى لدرجة الامتحان هي 70 درجة

مع أطيب تمنياتي لكم بالنجاح والتوفيق والتميز....

$$a = 6378137 \text{ m} , \quad b = 6356752.314 \text{ m}$$

$$e = \frac{\sqrt{a^2 - b^2}}{a}$$

$$\tan \varphi = \frac{z}{\sqrt{x^2 + y^2}} \left( 1 - e^2 \frac{N}{N+h} \right)^{-1}$$

$$\tan \lambda = y/x$$

$$h = \frac{\sqrt{x^2 + y^2}}{\cos \varphi} - N$$

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} (N+h) \cos \varphi \cos \lambda \\ (N+h) \cos \varphi \sin \lambda \\ (N(1-e^2)+h) \sin \varphi \end{pmatrix}$$

where

$$N = \frac{a}{\sqrt{1 - e^2 \sin^2 \varphi}}$$



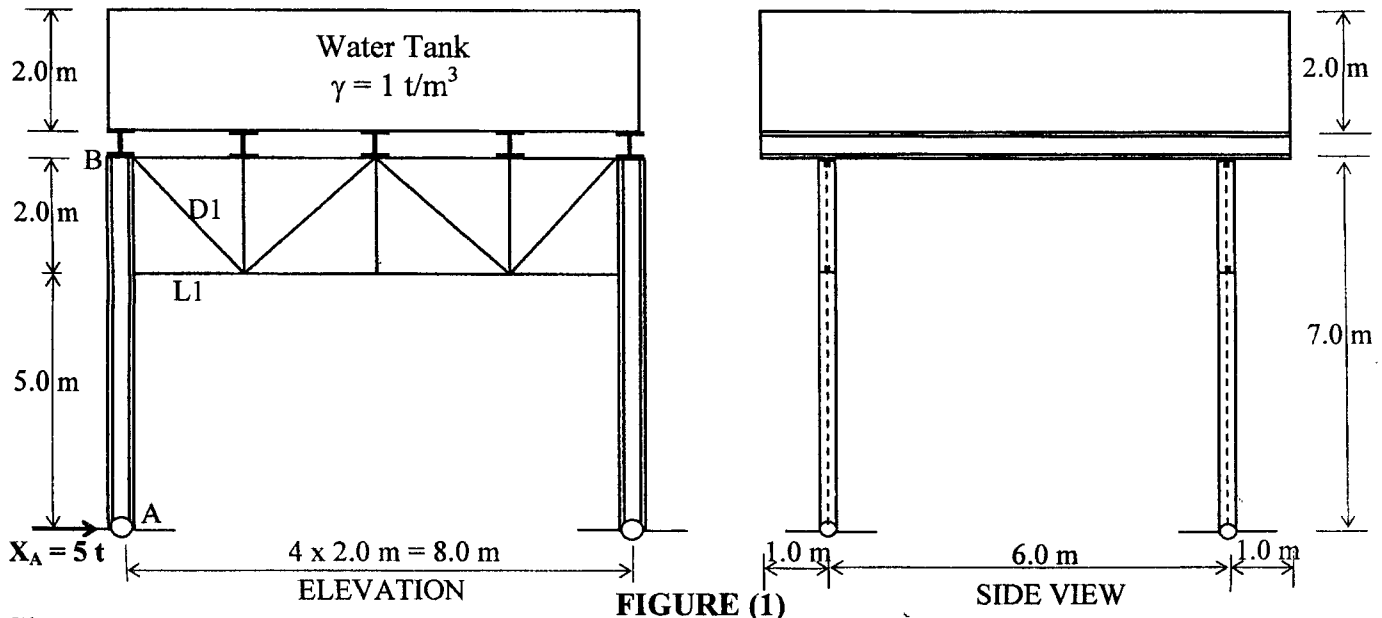
**Metallic Structures**

**3<sup>rd</sup> Year Civil**

**Time allowed: Three Hrs.**

**PART (A) 55%**

An elevated steel water tank of dimensions (8.0 m x 8.0 m x 2.0 m) and capacity 128 ton is resting on 5 secondary beams as shown in Figure (1). The secondary beams are resting on two trussed frames spaced at 6.0 m.



**Given:**

- Weight of water =  $1 \text{ t/m}^3$
- Neglect the own weight of tank and steel structure but consider only the weight of water.
- Horizontal reaction at "A"  $X_A = 5 \text{ ton}$
- St. 52 to be used ( $F_y = 3.6 \text{ t/cm}^2$ ) Bolt diameter 20 mm Gusset Plate thickness = 10 mm

**Required:**

- 1- Draw to scale 1:100 all necessary views of the bracing system required for the structure.
- 2- Design the secondary beam as IPE.
- 3- Compute the design forces in the truss members D1 and L1.
- 4- Design the truss members D1 and L1 as two angles back-to-back.
- 5- Check the column AB as IPE 450.
- 6- Calculate the intensity of wind loads acting on each surface of the tank according to the Egyptian Code. Then, draw neat sketches for the wind load diagrams.

**PART (B) 15%**

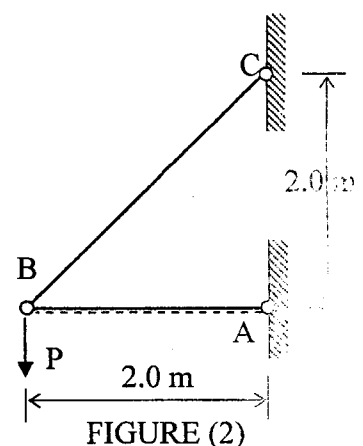
Figure (2) shows three hinged steel structure supported on a reinforced concrete wall at A & C. The structure is loaded at joint "B" by a concentrated load "P". Horizontal bracing is provided to brace the joint B.

**Given:**

- The member AB and BC are 2 angles 80x80x8 back-to-back.
- St. 37 to be used ( $F_y = 2.4 \text{ t/cm}^2$ ).
- Bolt diameter 20 mm & Gusset Plate thickness = 10 mm
- Neglect the own weight of steel structure.

**Required:**

- Compute the maximum concentrated load "P" that can be safely carried by the given structure.





## Part C 40 %

يتم إجابة جميع أسئلة الجزء (C) في كل من لوحة الرسم وصفحات الرسم البياني في نهاية كراسة الإجابة تراعى الدقة والنظام والنظافة في الحسابات والرسم

1- Design the welded bracket-column connection ( $J_1$ ), shown by Figure (3).

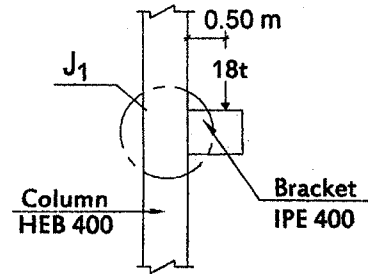


Figure (3)

2- Draw to scale 1:10 Elevation and S.V. for ( $J_1$ ).

3- Design joint ( $J_2$ ), shown by Figure (4), using H.S. Bolts M16 (8.8), and T-section part of HEB 400

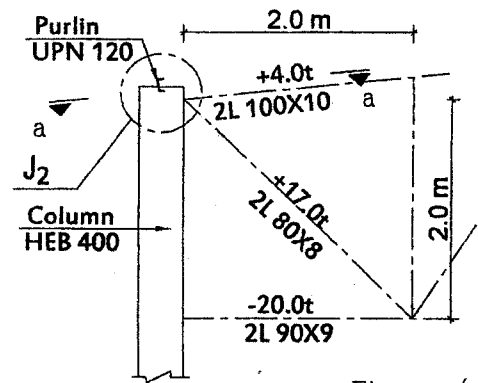
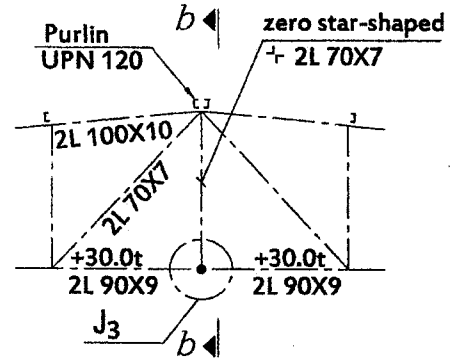


Figure (4)

4- Draw to scale 1:10 Elevation and Sec. a-a of ( $J_2$ )

5- Design the bolted field connection ( $J_3$ ) shown by Figure (5), using gusset plate 12 mm thick, and H.S. Bolts M16 (8.8). Use 8 cm spacing between bolts.



Truss Elevation

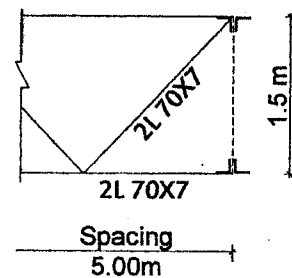
6- Design the bolted field connection ( $J_3$ ) shown by Figure (5), using gusset plate 12 mm thick, and bottom splice plate 10 mm thickness. H.S. Bolts M16 (8.8) are also used.

7- Draw to scale 1:10 joint ( $J_3$ ) of Question (5).

8- Draw to scale 1:10 joint ( $J_3$ ) of Question (6).

9- Draw to scale 1:10 section (b-b) using min. No. of bolts for bracing connections.

Figure (5)



Section (b-b)

١ - (أ) لخص كيفية استلام الموقع وتخطيطه لمشروع انشاء محطة كهرباء .

(ب) إشرح المضخه ذات المكابس . وماهى خواص المواد المستخدمه وإحتياجات التشغيل.

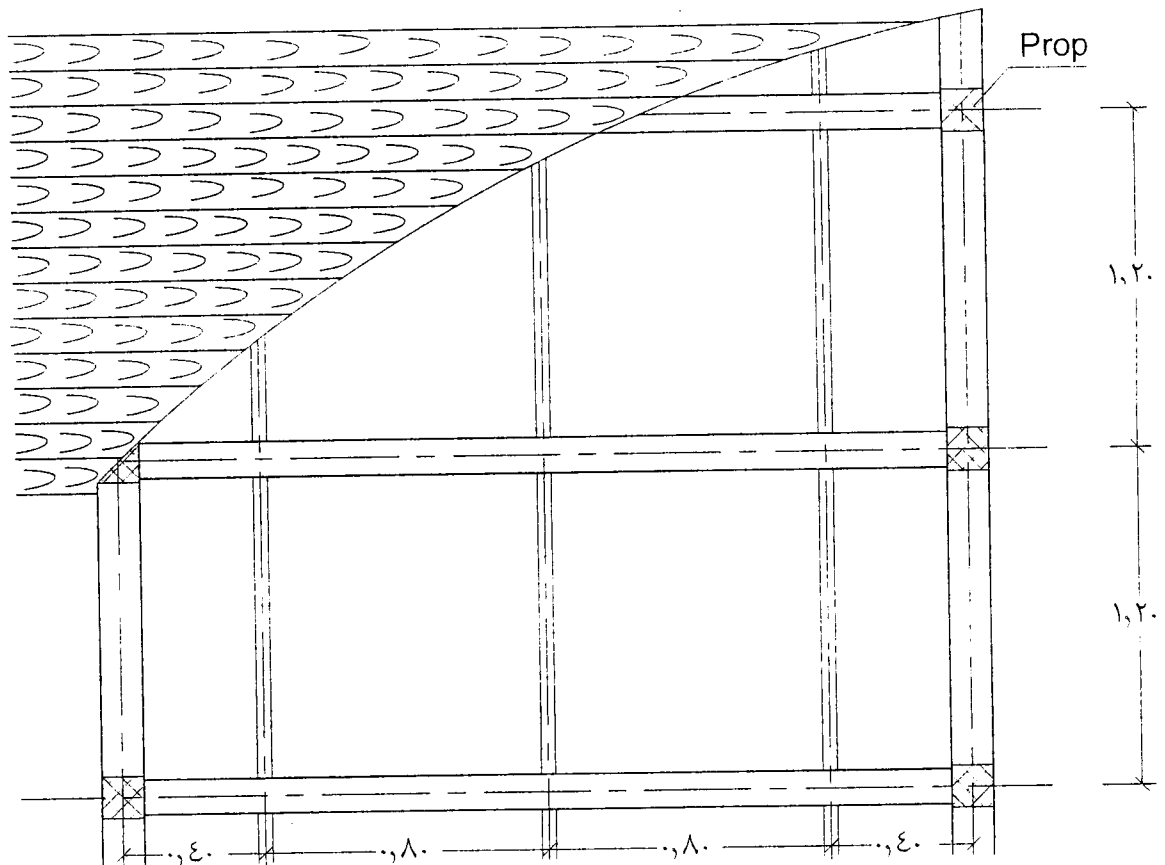
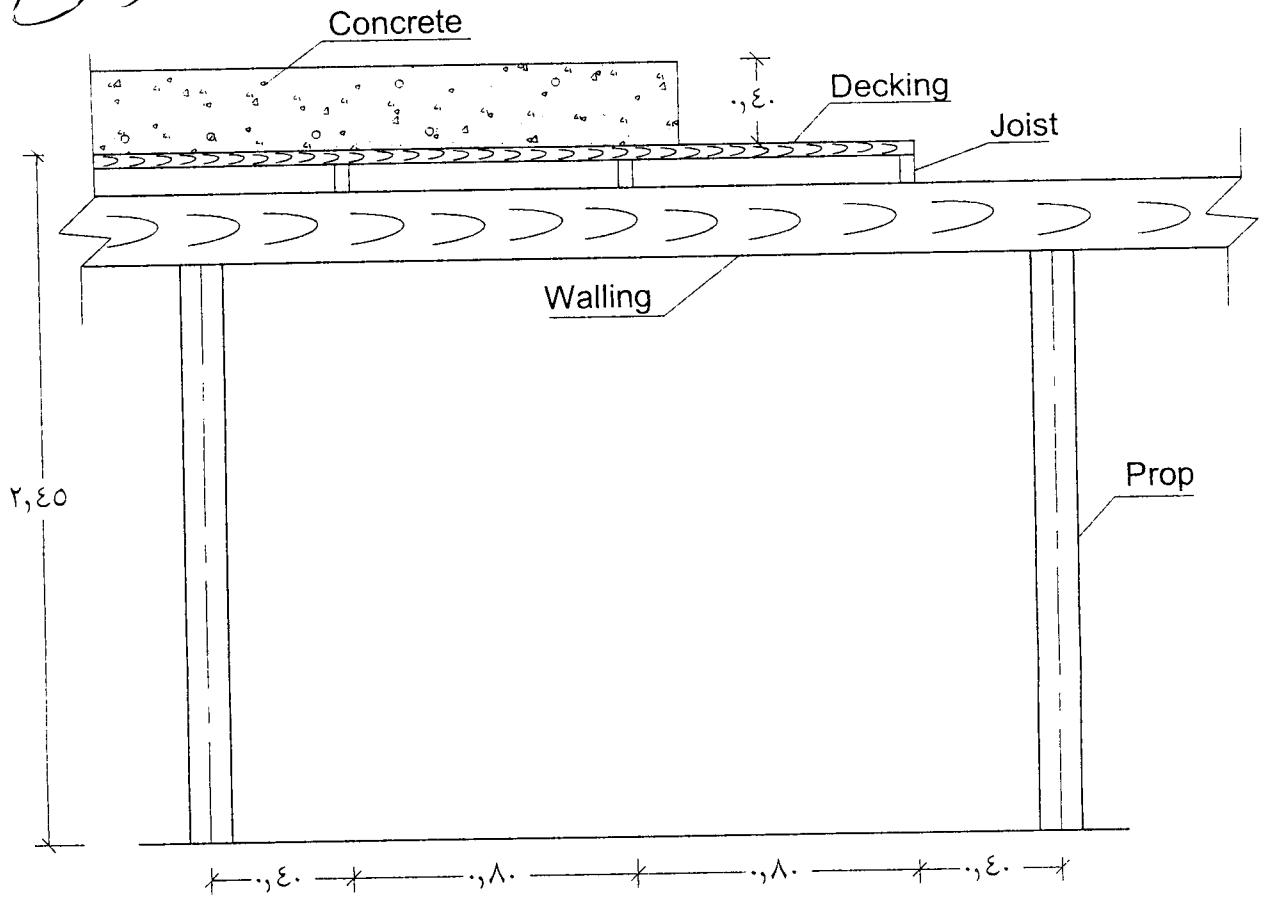
(ج) مبنى يتكون من خمسة عشر طابق وثلاثة بدرومات تحت الأرض ويتم التأسيس بإستخدام لبشه سمكها ١,٠٠ متر وأعصاب بعرض ٨٠ سم وإرتفاع ٢,٠٠ متر .  
لخص طريقة سند جوانب الحفر وتنفيذ اللبشه والبروم الأول والطابق الأول .

٢ - (أ) إشرح طريقة صب صومعه من ثلاث وحدات بأبعاد ٦,٠٠ x ٦,٠٠ متر وسمك الحائط ٠,٦٠ متر وذلك بإستخدام شده منزلقه وإشرح مكوناتها مع رسم قطاع رأسى ومسقط أفقى للشده .

(ب) إشرح خامات الشدات وطرق تبطين الشدات .

(ج) صمم شده خشبيه تحمل سقف يتكون من بلاطه لاكمريه سمكها ٠,٤٠ متر بإستخدام الترتيب الموضح بالشكل التالى إذا علم أن الطريقه المستخدمه هى الطريقه التقليديه .

6M4





## CONSTRUCTION ENGINEERING

Final Exam (January, 2015)

(CE-384)

Time Allowed: 3.0 Hrs.

### Part 2

#### QUESTION 2 (50%)

**A.** A loader, its bucket capacity equal to  $2.0 \text{ m}^3$ , and one cycle of the loader takes 0.1 hour, considering that: -  
Excellent job conditions with Good management conditions  
8 working hours per day & 25 working days per month and 11 working months per year.

- How many days will take for loading  $5,000 \text{ m}^3$ ?
- What is the cost per unit of production in case of total loader cost equal to 350,000 EGP per year?

		Management Conditions		
Job Conditions		Excellent	Good	Poor
	Excellent	0.84	0.81	0.70
	Good	0.78	0.75	0.65

**B.** A Company purchases an equipment, if initial cost is equal to 150,000 EGP, salvage value is equal to 50,000, useful life is equal to 10 years, operating hours is equal to 1,800 Hrs/Year, interest rate is equal to 9 %, insurance rates is equal to 7 %, storage rate is equal to 8 %, grease consumption rate is equal to 2.5 Kg/Hr, unit cost of grease is equal to 5 EGP/Kg, oil consumption rate is equal to 2.7 Liter/Hr, unit cost of oil is equal to 15 EGP/Liter, fuel consumption rate is equal to 22 Liter/Hr, unit cost of fuel is equal to 1.0 EGP/ Liter, maintenance is equal to 8,000 EGP/Year, repairs is equal to 40 % of annual straight line depreciation, operator's salary is equal to 160 EGP/day, if the company wants to get 25 % profit.

- What is the price per hour should the company rent equipment?
- If the price per hour should be 220 EGP/Hr. find the salvage value of equipment?

**C.** Estimate the (Bank; Loose; and Compacted) volumes of excavation are required to excavate the basement. which is divided into 9 panels, the panel dimensions as shown in the Figure, knowing that:-

- A Natural soil weight is equal to  $1200 \text{ kg/m}^3$ ;
- A Loose soil weight is equal to  $1000 \text{ kg/m}^3$ ; and
- A compacted soil weight is equal to  $1600 \text{ kg/m}^3$ .

	30 m	30 m	20 m
15 m	(3.0 m)	(2.8 m)	(1.8 m) (1.6 m)
15 m	(2.9 m)	(2.4 m)	(2.0 m) (1.5 m)
15 m	(2.2 m)	(1.9 m) (1.7 m)	(1.8 m)
15 m	(1.9 m) (2.3 m)	(2.0 m)	
	(2.1 m) (2.2 m)		

Plan of Basement

*Good Luck*

For all problems:  $f_{cu}=25 \text{ N/mm}^2$  Steel grade: 360/520  
Tables and design sheets prepared by R.C. staff is allowed.

**Question # 1(40%)**

For the shown floor system you are asked to:

- Design and give full detailed drawings (use scale 1:50) for the solid slabs shown in Figure 1 if the service loads are: Live load (L.L)= $4.0 \text{ kN/m}^2$  and Covering material= $2.00 \text{ kN/m}^2$ .
- If beams B1, B2, and B3 dimensions are (200\*700mm) and are loaded with a brick wall with a weight= $3.50 \text{ kN/m}^2$ , and The height of floor is 3.20m. , find the complete loadings of each of these beams and draw bending and shear diagrams..
- Design beam B1 and draw a longitudinal section of the beam (scale 1:20) as well as cross sections.

(Consider all columns are (400\*400))

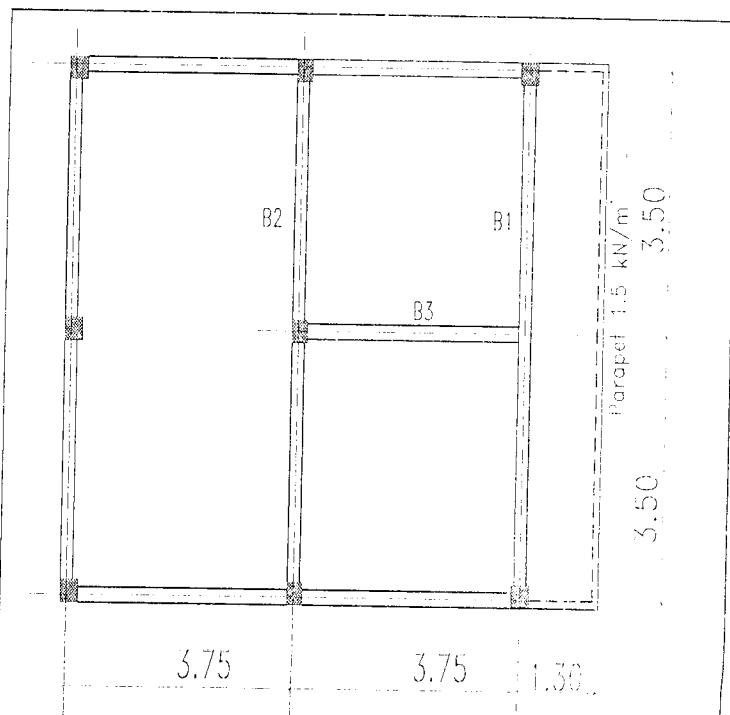


Figure1

**Question # 2(25%)**

For the shown panelled beams floor system in Fig. 2, you are asked to:

- If beams B1, B2, and B3 dimensions are (250\*900mm) , find the complete loadings of each of these beams.
- Design beam B2 and draw a longitudinal section of the beam (scale 1:20) as well as cross sections.

(Consider all columns are 600\*400)

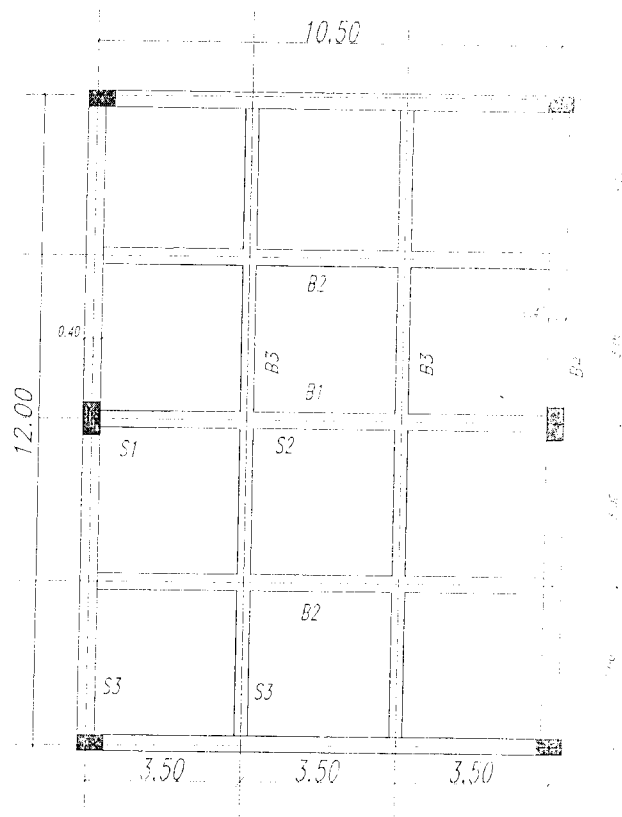
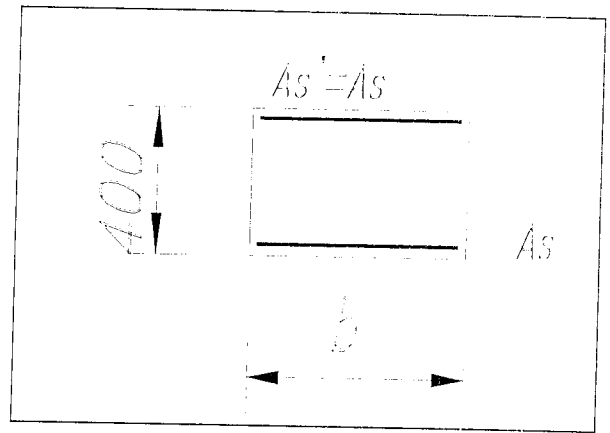


Figure2

**Question # 3(15%)**

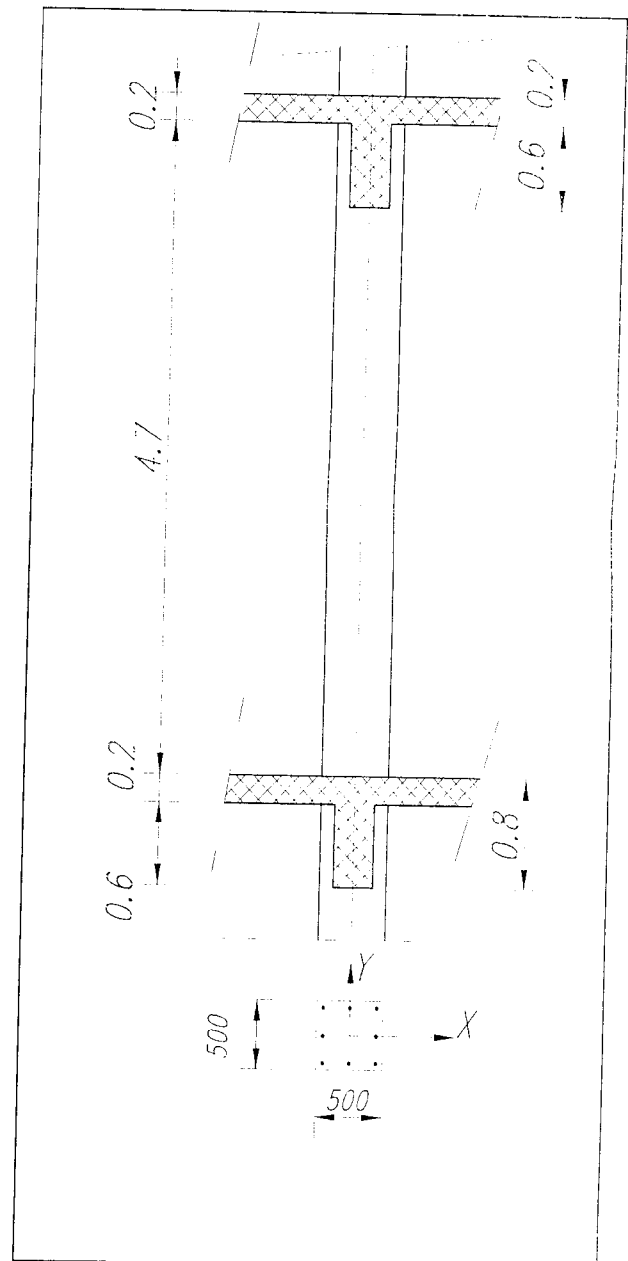
Using the N.I.D, if the section is subjected to an ultimate axial load=1600 kN and an ultimate moment=200kN.m,  $d'=40\text{mm}$ , find the section bottom and top reinforcement if  $\mu$  (for each side) =1.5 %. And find the section width.



**Question # 4(20%)**

The shown unbraced column section(500\*500mm) is subjected to an ultimate axial load=2500kN and is reinforced with 8  $\phi 25$ . You are asked to:

- Check if the section is safe or not.
- Draw the column section (scale 1:20).





January, 2015

Metallic Structures

3<sup>rd</sup> Year Civil

Time allowed: Three Hrs.

منشآت معدنية

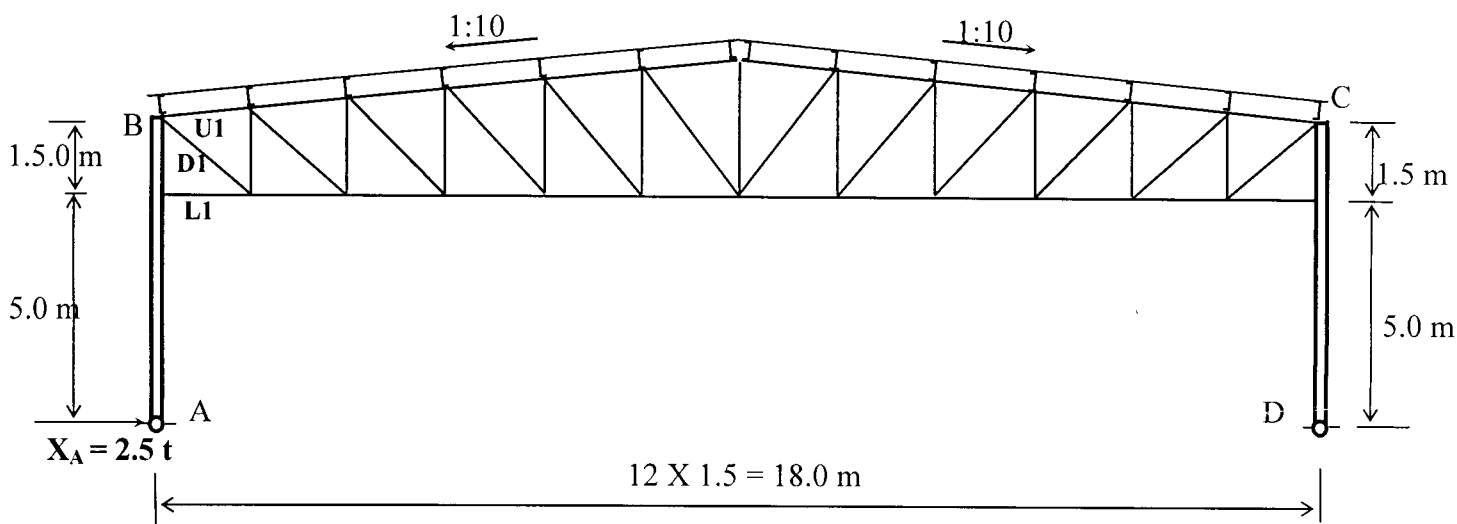
السنة الثالثة مدني

الزمن : ثلاث ساعات

## إمتحان التخلقات

### PART (I)

The steel structure of a workshop is covering an area of 18.0 x 30.0 m. The main structures are trussed frames 18.0 m span and 6.0 m spacing.



### Given:

Spacing between trusses = 6.0 m

Weight of cover = 10 kg/m<sup>2</sup>

Weight of steel = 35 kg/m<sup>2</sup>

Live load = 55 kg/m<sup>2</sup>

Horizontal reaction at "A"  $X_A = 2.5$  ton

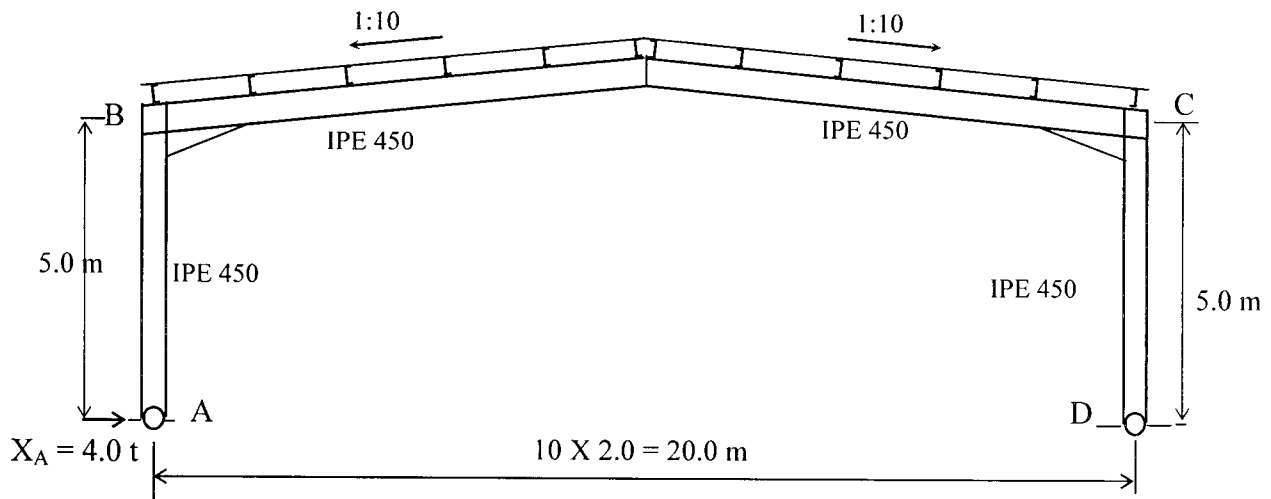
St (37) Bolts diameter 16 mm grade (10.9) Gusset Plate Thickness  $t_{GP} = 10$  mm

### Required:

1. Draw to scale 1:200 the bracing system required for the shown structure. 3-views are required.
2. Compute the force in the truss members U1, D1, and L1.
3. Check the diagonal member D1 as 2L 60 x 60x 6 back-to-back.
4. Design the truss member L1 as two angles back-to-back.
5. Check the column AB as HEA 360.
6. Design the roof purlin as UPN.

## **PART (II)**

The shown steel structure consists of steel frames spaced at 5 m to cover an area of 20.0 x 30.0 m.



### **Given:**

Total load on the roof (D.L.+L.L.) = 100 kg/m<sup>2</sup>

Horizontal reaction at A  $X_A = 4.0$  ton

Use St (37) , Bolts diameter = 24 mm Grade (10.9) , Good weld

Roof purlins are UPN 140

### **Required:**

- 1- Design and draw to scale 1:10 the frame corner at B.
- 2- Design and draw to scale 1:10 the column base at A.