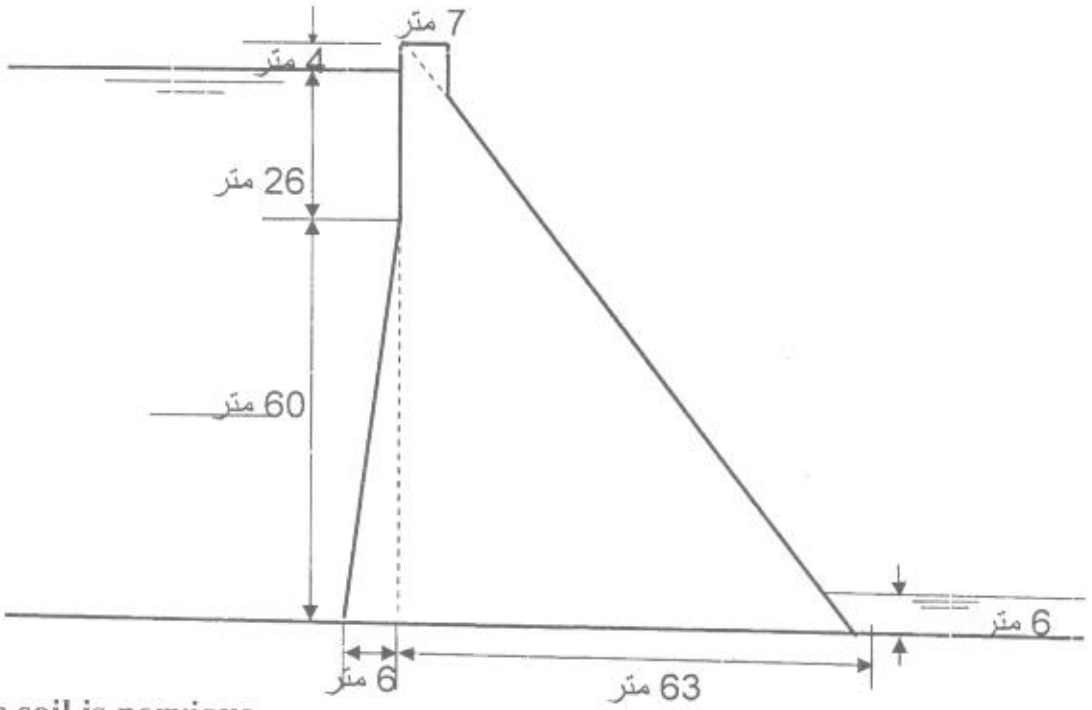
**(N.B.: Any missing data can be reasonably assumed.)**

**Question No 1:** **(30 Points)**

**A _ Answer the following:** **(10 Points)**

1. Classify the types of dams according to height - material of construction - stability – shape.
2. What are the main functions of dams ?
3. Discuss the main forces acting on Dams ?
4. Discuss the seepage through and under dams body ?
5. How the different types of dams are constructed ?
6. Name the main reasons of dams failure ?
7. Define the following terms :
   Flooding – storage - overtopping – Breaching - spillway – tunnel – turbines – pipping heaving.

**B _ Design the plain concrete dam shown in figure** **(20 Points)**




- **The soil is pervious**
- **The basin is full**

**Question No 2:** **(20 Points)**

**A _ Mention the shapes of breaching of the earth dam failure.**
**B_ Prove that the earth dam failure mechanism can be expressed with the following equations:**

$$h = H - Z = (A_s - 1)(Z - Z_o) + (H_o - Z_o)$$

Tanta University

Department: Structural Engineering
Total Marks: 75 Marks

Faculty of Engineering

| | | |
|---|---|---|
| Course Title: Design of Steel Bridges (b) | Course Code:CSE4238 | Year: 4th |
| Date: Jun 2010 (Second term) | Allowed time: 4 hrs | No. of Pages: (2) |

**Remarks:** (answer the following questions… assume any missing data… answers should be supported by sketches…etc)

The main girders of a welded truss through roadway bridge are warren trusses having a span of 56 ms and a depth of 8 ms. The bridge is provided with upper bracing, light lower bracing as well as end portal frames. An elevation of the main truss girder and plan of the upper bracing are given in the attached sheet together with a cross section of the bridge.

**DATA:**

- Thickness of floor slab equals 20 cms besides haunches of average 5 cms.
- Weight of floor covering material = 150 kgs / $m^2$.
- The stress range for the longitudinal floor beams as well as for tension truss members $f_{sr}$ = 1.26 t/$cm^2$.
- All bolts used are M24 High Strength pretensioned Bolts of the friction grip type of grade 10.9 for which $P_s$ per one friction surface = 5.55 tons.
- Material of construction is st. 44.

**REQUIRED:**

1. Using the influence lines, calculate the max. and min. forces in upper chord member $U_1$ and vertical member $V_3$ due to D.L., L.L. and impact. (Assume D.L. per main girder = 8.5 t/m). **(15%)**

2. Using a simple way calculate the force in member $L_2$ . **(5%)**

3. Design a welded I-section for vertical member $V_1$ (which is also a member in the end portal frame) if the B.M. acting on it from wind pressure = 16 m.t. (you have to calculate the N. F. from the other forces given). **(15%)**

4. Design a welded I-section for diagonal member $D_1$ and find the number of High Strength friction grip bolts required for its connection to the gusset plates. (Represent that diagrammatically). **(15%)**

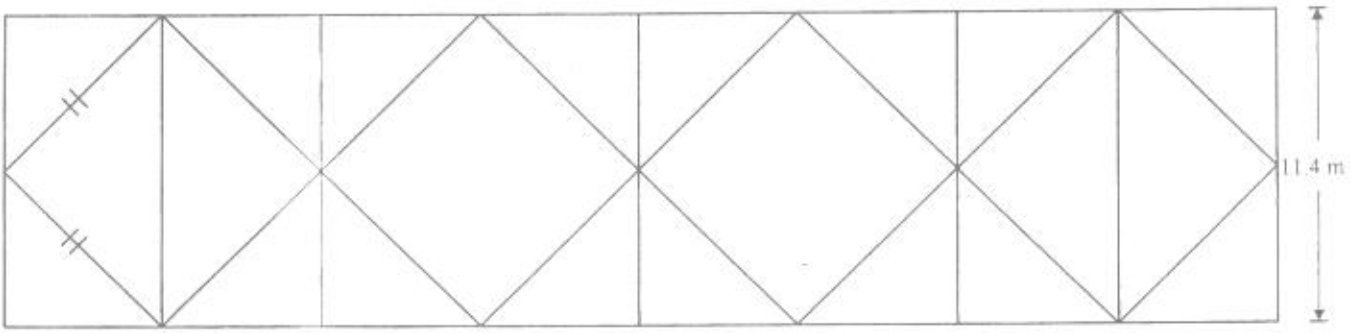
5. Design a welded box-section for diagonal member $D_2$ and show how the required number of High Strength bolts connect the box section to the gusset plates. **(15%)**

6. Calculate the forces in the first pair of upper wind bracing diagonals for the case of unoccupied bridge and design them on the conditions of stiffness. **(10%)**

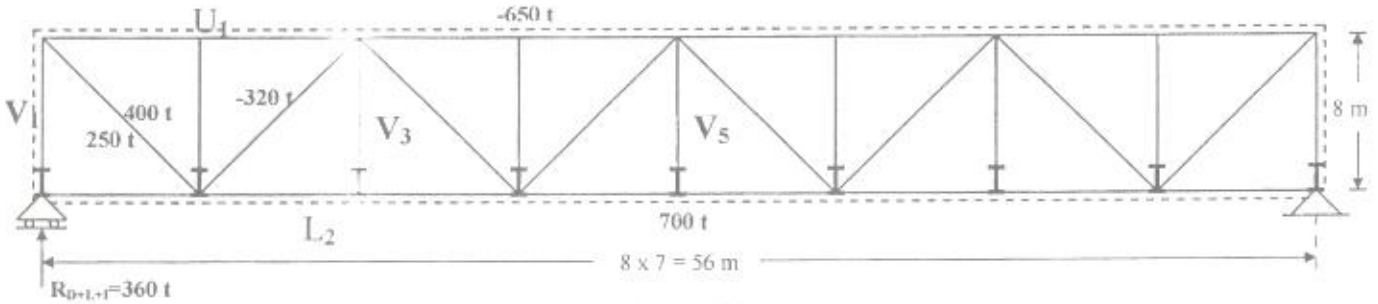
7. Design a roller bearing for the bridge if the eccentricity of half the end vertical member on the sole plate e = 7.5 cms. Consider the sole plate dimensions to be 30 x 50 cms. Use 2 forged steel rollers and plates. (R per roller = 117 dl and f = 2000 kg.cm units).
   Draw the bearing in elevation and side view with a suitable scale. **(15%)**

8. Describe with neat sketches the different modes of failure of stud shear connectors in composite girders. **(5%)**

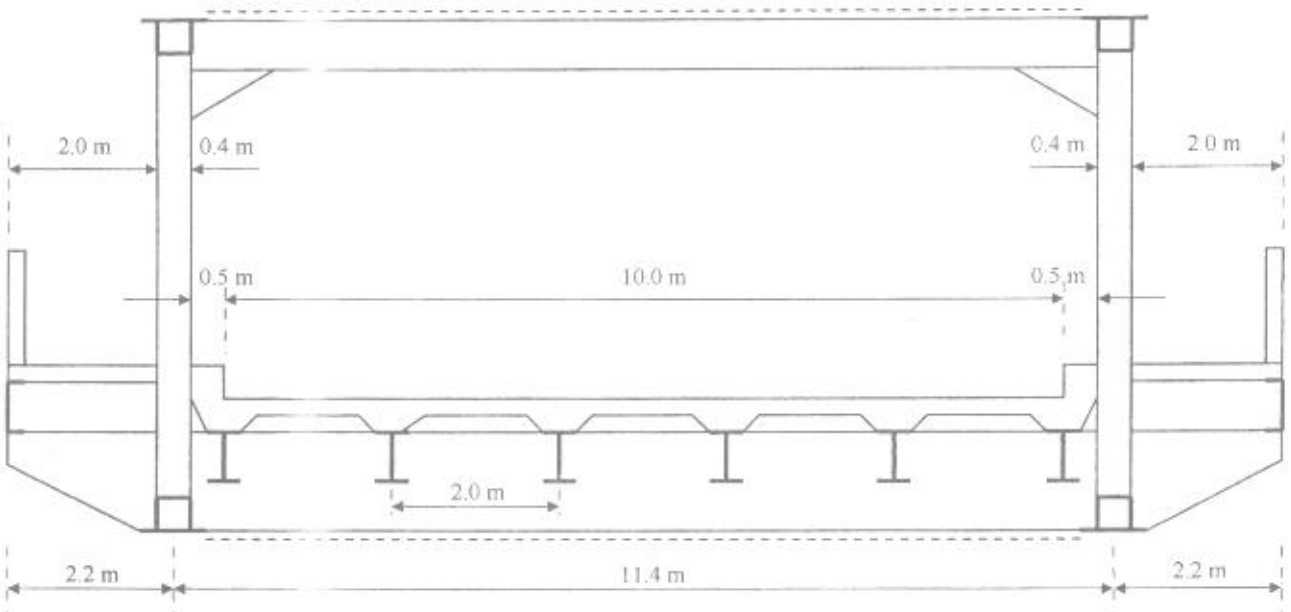
9. Write a brief essay about new construction methods of bridges from your own search and reading. **(5%)**



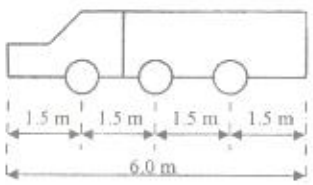

Plan of Upper Bracing

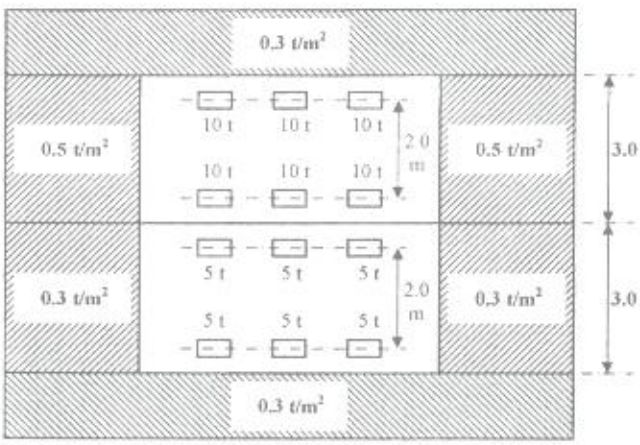



Elev. of Main Girder




Cross Sec. of Bridge




**Live Load For Roadway Bridges**

الشاشة

Tanta University

Department: Structural Engineering
Total Marks: 85 Marks

Faculty of Engineering

| | | |
|---|---|---|
| Course Title: Reinforced Concrete Design (3)-b | Course Code: CSE 4237 | Year: 4th |
| Date: June 5th 2010 (second term) | Allowed time: 4 hrs | No. of Pages: (2) |

**Remarks:** Systematic arrangement of calculations and neat drawings are essential, any missing data should be reasonably assumed , concrete characteristic strength $f_{cu}$ = 25 MPa, and grade of reinforcing steel is 36/52

**Problem # (1)** **(16 Marks)**

1- ***Indicate*** the causes for the cracking patterns of the given plan, shown in Fig. 1, of a cylindrical shell roof structure. ***Sketch*** in plan and cross section the required reinforcement for each crack pattern. **(6 Marks)**

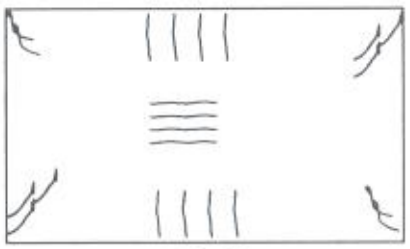


**Fig (1)**

2- "Beam-column joints' ductility can be improved using stirrups" ***Explain.***
***Draw*** net sketches for ductile and non-ductile frame's joints. **(4 Marks)**

3- For the multi-story frame shown in Fig. 2, it is required to ***draw*** net sketches for details of reinforcement for column AB and joints 1&2 showing the additional requirements proposed by the Egyptian Code of Practice for earthquake resisting frames. **(6 Marks)**

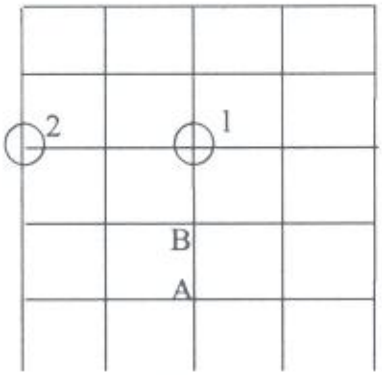



**Fig (2)**

**Problem # (2)** **(20 Marks)**

Figure 3 shows a sectional elevation of a circular water tank and pump room constructed at two levels. The tank is 6.0 m diameter and 3.0m high, for each level it is required to:

i. ***Draw***, without calculations, the concrete dimensions of all RC elements. **(8 Marks)**
ii. ***Sketch*** the load diagram for the water tank and the pump room indicating the critical sections for both structures. **(6 Marks)**
iii. ***Sketch***, without calculations, details of reinforcement for the tank and the pump room. **(6 Marks)**

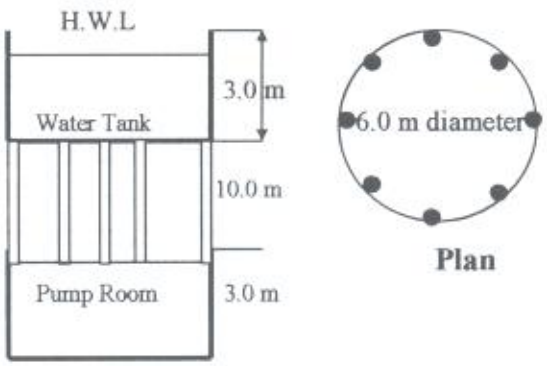



**Fig. 3**

**Problem # (3)** **(20 Marks)**

For the elevated water tank supported on four columns as shown in Fig. 4, it is required to:

i. ***Carry out*** a complete design of the tank elements(walls and floor) **(10 Marks)**
ii. ***Give*** full reinforcement details for the tank in plan and cross sections. **(10 Marks)**

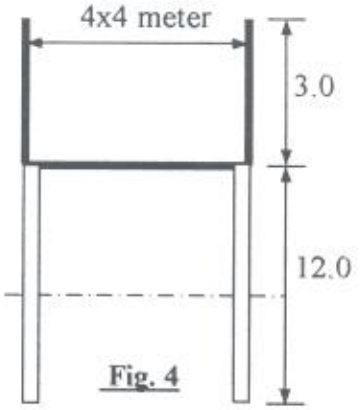



**Fig. 4**

**Problem # (4)** **(14 Marks)**

Shown in Fig. 5 is sectional elevation of RC cylindrical shell covering an exhibition hall has dimensions of 40x15m. The hall has a clear height of 6.0 m and columns are allowed only on the outer perimeter of the hall.

It is required to carry out the followings:

i. ***Calculate*** the internal forces and ***design*** the critical sections of the cylindrical shell **(8 Marks)**
iii. ***Draw*** to a convenient scale sectional elevation and plan showing the details of reinforcement of the cylindrical shell

**($\beta = 0.56$, $\varepsilon = 0.66$)**

**(10Marks)**

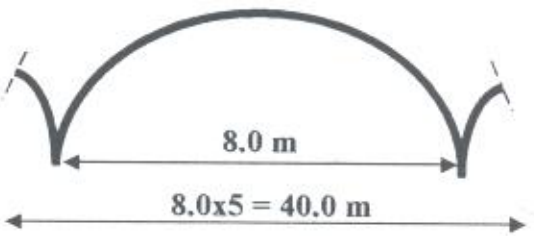



**Fig. 5**

**Problem # (5)** **(15 Marks)**

For a 10-story administrative building, shown in Fig. 6, located at earthquake zone 2, the ground floor is 4.0 m height and the typical floor is 3.0 m height where the columns are arranged at 5.0m spacing. The foundation level is (-2.50 m) with 0.4 m plain concrete mat and 1.20 m reinforced concrete raft. It is required to ***Give*** **complete design and details of reinforcement of the core**. Assume 0.35 m thickness 5.5 x 3.5 m core system under the effect of vertical gravitational load and critical lateral load effect in the specified direction shown in Fig. 6. The service axial dead and live loads are 5000 kN and 2000 kN, respectively. The working dead load is 3000 kN/floor (Note that: B.M due to lateral loads may be calculated using approximate method, Z=0.2, I=1.0, k=1.33, S=1.15, T=0.6 and C=0.084).

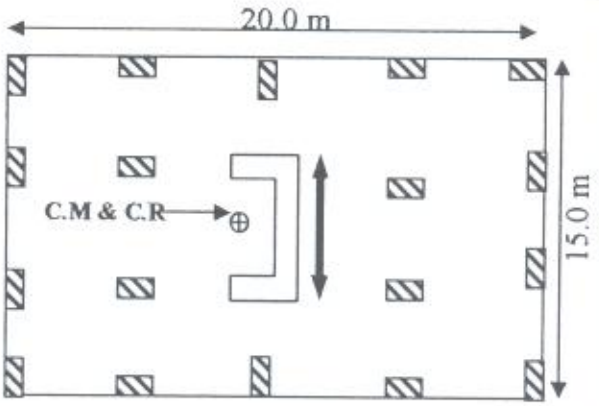



**Fig. 6**

***With best wishes***

**Course Examination Committee:**

**Prof. Tarek Mohamed Fawzy** **Prof. Abdel Hakeem Abdel Khalik Khalil**

**Dr. Mohamed Hussein**

Tanta University

Department: Structural Engineering
Total Marks: 85 Marks

Faculty of Engineering

| | | |
|---|---|---|
| Course Title: Special Topics in RC design | Course Code: CSE 4247 | Year: 4th |
| Date: June 14th 2010 (second term) | Allowed time: 3 hrs | No. of Pages: (3) |

**Remarks:** Systematic arrangement of calculations and neat drawings are essential, any missing data should be reasonably assumed , concrete characteristic strength . $f_{cu}$ = 25 MPa, and grade of reinforcing steel is 360/520

**Problem # (1) (8 Marks)**

1- **Explain** using clear sketches different methods used for bridge construction. **(4 Marks)**

2- **Draw** a net sketch for RC abutment with conventional spread footing and transition slab. **(2 Marks)**

3-**Discuss** the effect of centrifugal and breaking forces on the analysis and design of RC bridges. **(2 Marks)**

**Problem # 2 (37 Marks)**

A simply supported reinforced concrete roadway girder bridge with span 20.00 ms of the shown cross-section is subjected to the wheel loads according to Egyptian code of practice. It is required to:

1. **Draw** the influence line of the reactions for main girders G1 and G2 **(5 Marks)**
2. Draw the max. bending moment diagram of the main girder G2 **(15 Marks)**
3. Make a complete design of the main girder G2. Draw to scale 1:25 the details of reinforcement of the designed girder **(10 Marks)**
4. Without any calculations but based on reasonable estimation, draw the cross section of the bridge showing the estimated reinforcement of the slab and cross girders. **(7 Marks)**

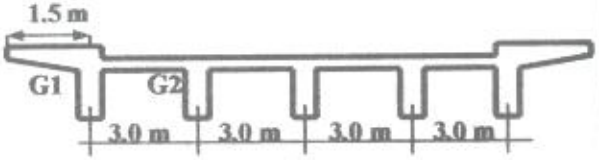


Fig. 1

**Problem # 3 (20 Marks)**

1. Define with neat sketches the different modes of failure for beam-column joints. **(5 Marks)**
2. For the Type I beam column joint shown in Fig. 2, it is required to check the joint capacity to resist the forces shown in the figure in both directions. **(15 Marks)**

**Problem # 4 (20 Marks)**

1- For buildings shown in Fig. 3, it is required to choose the suitable method for seismic analysis for each building. **(5 Marks)**

2- For the plan shown in Fig. 4, is the wind effect more critical compared with the seismic effect for a 11 story residential building located in Tanta, the ground floor is 4.0 m height and the typical floor is 3.0 height. The floor system is flat slab with live load intensity 3kN/m$^2$ and total dead of 8kN/m$^2$. The soil stratum is continuous stiff clay and foundation level is (-2.5m) with 0.4 m plain concrete raft and 1.20 m reinforced concrete raft. Without any calculations, draw details of reinforcement for the RC core shown in Fig.4. **(15 Marks)**

P.T.O.

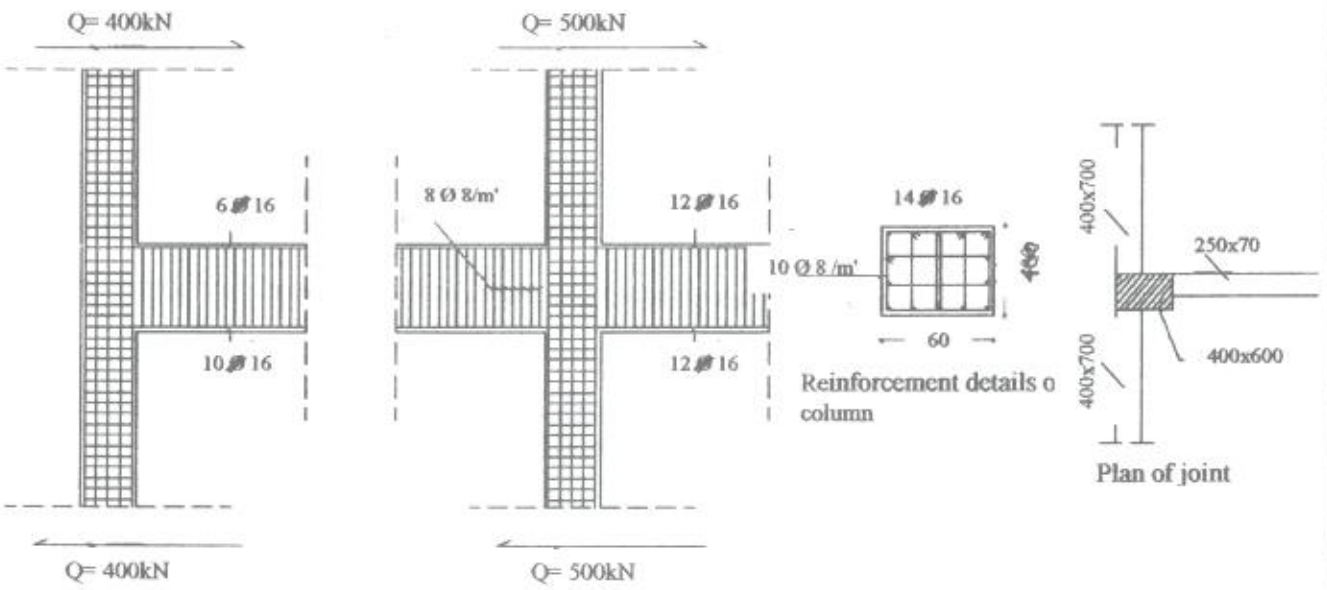



**Fig. 2**

- معامل درجة الإحاطة للوصلة

| كيفية الإتصال مع العناصر الإنشائية المحيطة | نوع الوصلة | |
|---|---|---|
| | I | II |
| ١- وصلات محصورة من أربع جهات | 2.0 | 1.6 |
| ٢- وصلات محصورة من ثلاث جهات | 1.6 | 1.2 |
| ٣- جميع الوصلات الأخرى | 1.2 | 0.9 |

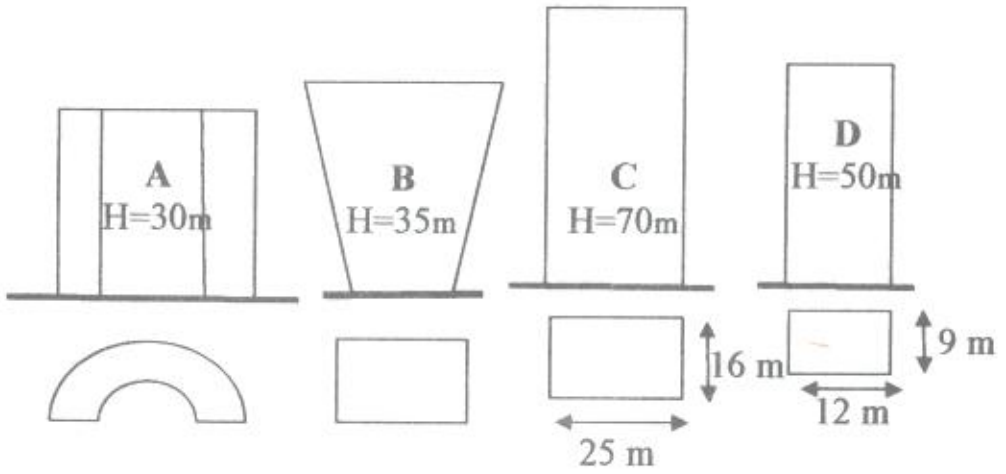



**Fig. 3**

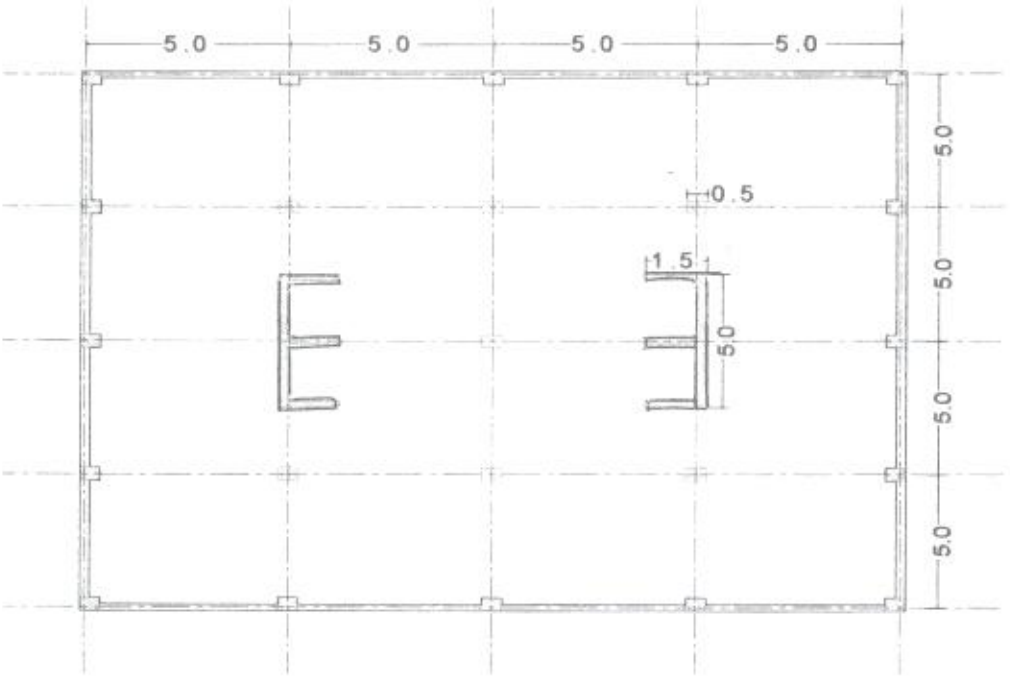



**Fig. 4**

*With best wishes*

**Course Examination Committee:**

**Prof. Tarek Mohamed Fawzy** **Prof. Abdel-Hakim Abdel-Khalik Khalil**

**Dr. Mohamed Hussein**

جدول (٧-١) ضغط الرياح الأساسى q

| الموقع | ضغط الرياح الأساسى q (كجم/م٢ كن/م٢) | |
|---|---|---|
| مرسى مطروح<br>الأسكندرية /السلوم/أبو سوير /الغردقة<br>القاهرة /أسيوط /بلبيس وباقى المناطق الساحلية<br>سيوه /الداخلة<br>الفيوم /المنيا /الأقصر /أسوان /مديرية التحرير<br>ضنطا /المنصورة /دمنهور | ٩٠<br>٨٠<br>٧٠<br>٦٠<br>٥٠ | ٠,٩<br>٠,٨<br>٠,٧<br>٠,٦<br>٠,٥ |

- (Z) هو معامل الشدة الزلزالية

ويؤخذ المعامل (Z) مساوياً ٠,١ للمنطقة الأولى و ٠,٢ للمنطقة الثانية و٠,٣ للمنطقة الثالثة.

- (I) هو معامل أهمية المنشأ ويؤخذ كالتالى:

I = ١,٢٥ للمنشآت المستخدمة لأغراض الطوارىء بعد حدوث الزلازل مثل المستشفيات ومحطات الإطفاء وأقسام الشرطة ومراكز الطوارىء والإتصالات ..... الخ.

I = ١,٠٠ غير ذلك من المبانى العامة والإدارية والسكنية.

جدول (٨-٢) معامل التربة (S)

| نوع وعمق التربة | S |
|---|---|
| صخر، تربة كثيفة أوشديدة التماسك ذات عمق يزيد عن ١٥متراً،أو تربة متوسطة الكثافة أو متماسكة ذات عمق أقل من ١٥ متراً تعلو طبقة ذات خواص أفضل. | ١,٠٠ |
| تربة متوسطة الكثافة أو متماسكة ذات عمق أكبر من ١٥ متراً-تربة سائبة أوضعيفة التماسك ذات عمق أقل من ١٥ متراً تعلو طبقة ذات خواص أفضل. | ١,٠٥ |
| تربة سائبة أوضعيفة التماسك ذات عمق أكبرمن ١٥متراً | ١,٢٠ |

جدول (٧-٢) قيمة المعامل k

| الإرتفاع z بالمتر | معامل التعرض k |
|---|---|
| ٠ - ١٠م | ١,٠ |
| ١٠م - ٢٠م | ١,١ |
| ٢٠م - ٣٠م | ١,٢ |
| ٣٠م - ٥٠م | ١,٥ |
| ٥٠م - ٨٠م | ١,٧ |
| ٨٠م - ١٢٠م | ١,٩ |
| ١٢٠م - ١٦٠م | ٢,١ |
| أكثر من ١٦٠م | ٢,٣ |

جدول (٨-١) معامل النظام الإنشائى للمنشأ (K)

| النظام الإنشائى | K |
|---|---|
| النظام الصندوقى وفيه تقاوم القوة العرضية الكلية بواسطة حوائط قص أو إطارات ملجمة. | ١,٣٢ |
| النظام الإطارى المقاوم للعزوم المصمم لتحمل القوة العرضية الكلية<br>أ- إطارات ممطولية<br>ب- إطارات غير ممطولية | ٠,٦٧<br>٠,٨٠ |
| النظام المزدوج المكون من إطارات مقاومة العزوم مع حوائط قص (أو إضارات ملجمة) ويتم تصميم النظام طبقاً لمايلى:<br>١- الإطارات وحوائط القص (أو الإضارات الملجمة) تتقاوم مشاركة بينها القوة العرضية الكلية وذلك طبقاً لجساءتها النسبية.<br>٢- حوائط القص (أو الإضارات الملجمة) تقاوم بمفردها القوة العرضية الكلية.<br>٣- الإضارات المقاومة للعزوم تقاوم بمفردها ٢٥٪ من القوة العرضية الكلية. | ١,٠٠ |

TANTA UNIVERSITY — STRUCTURAL ENGINEERING DEPARTMENT — FACULTY OF ENGINNERIN

**Computerized Structural Analysis**
**Fourth Year 2009-2010**
**Allowed time: 3 hrs** — **Total Marks: 60 Marks**

**Course Code: CSE4245**
**June 2010 (Second Term)**
**No. of Pages: (3)**

## Question I (9 Marks)

a. Using the simple theory of elasticity (direct method), derive the stiffness matrix of a typical plane frame element in the local system.

b. Using the stiffness matrix method, determine the joint displacements, the reactions at the supports and the force in each member of the plane truss shown in Figure 1 due to the given loads. EA/L = 200 t/cm for all members.

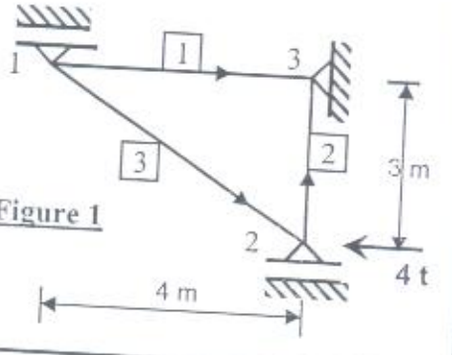


Figure 1

## Question II (15 Marks)

Fig. 2 shows two frames are subjected to concentrated loads (EI = 3000 t.m$^2$ and EA = 8000 t for all members). It is required to:

1. Use symmetry and anti-symmetry to simplify the shown frames in figures 2.a and 2.b.
2. Using the stiffness matrix method, determine the displacements of joint 3 and draw the bending moment diagram of the frame shown in **Figure 2.a**
3. Using the stiffness matrix method, determine only the displacements of joint 3 of the frame shown in **Figure 2.b**

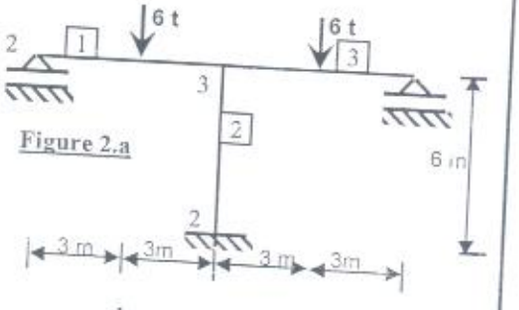


Figure 2.a

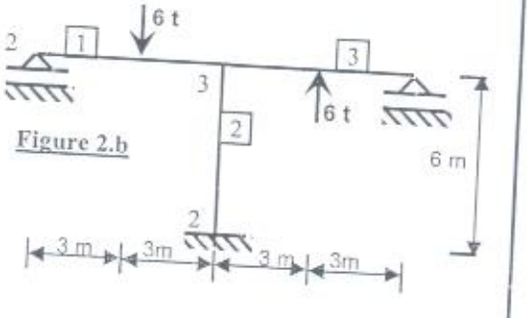


Figure 2.b

## Question III (9 Marks)

The truss element shown in Figure 3 is prismatic and has two nodes 1 and 2. The assumed axial displacement function is $u = c_1 + c_2 x^2$. It is required to:

- Find the constants $c_1$ and $c_2$ in terms of $u_1$ and $u_2$.
- Draw clear sketches for the shape functions.
- Determine the strain-displacement matrix [B].
- Determine the element stiffness matrix [K] in terms of E, A, and L.

What is the main source of error in this element?

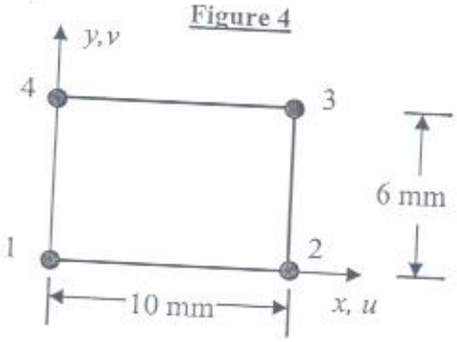
Figure 3

**Question IV (9 Marks)**

A linear quadrilateral element used for plain stress formulation is shown in Fig. 4. The nodal displacements at the four nodes of the element are known and are given below. It is required to:

(a) Write the displacement function of this element.
(b) Find the displacements ($u$ and $v$) at the center of the element.
(c) Calculate the strain components at center of the element.
(d) Calculate the stress components at center of the element.

Figure 4




*Given:*
E=2100 t/cm$^2$
ν = 0.30
t = 1 cm

*Nodal Displacements*

| | |
|---|---|
| $u_1 = 0.0 \times 10^{-3}$ mm | $v_1 = 0.0 \times 10^{-3}$ mm |
| $u_2 = 2.0 \times 10^{-3}$ mm | $v_2 = -2.0 \times 10^{-3}$ mm |
| $u_3 = 1.0 \times 10^{-3}$ mm | $v_3 = 0.0 \times 10^{-3}$ mm |
| $u_4 = 0.0 \times 10^{-3}$ mm | $v_4 = -1.0 \times 10^{-3}$ mm |

**Question V (9 Marks)**

a. Transformation is not necessary in beams; right or wrong and why?

b. For the beam element, it is required to write the displacement function in terms of the nodal degrees of freedom assuming a polynomial displacement function. Draw only sketch (without plotting calculations) the variation of shape functions along the beam element.

c. If the 2D-wall shown in Fig. 5 is modeled three times using the same number of CST elements but with variable element dimensions L*9L, 3L*3L, and 2L*4.5L. What is the most accurate case? Why?

d. For the structure shown in Fig. 5, suggest a number of finite elements that are required to model the structure showing the type of each element. Explain briefly (without calculation) the steps of the solution that are required to get the deformations and stresses.

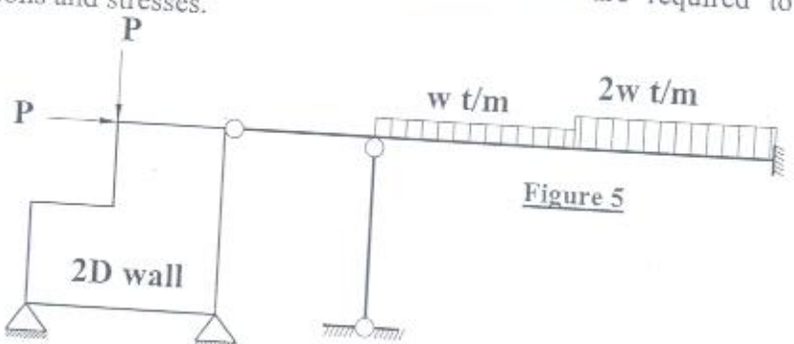



Figure 5

**Question VI (12 Marks)**

Consider the two-dimensional 3-element system shown in Fig. 6. Element 1 is a constant-strain triangle while elements 2 and 3 are truss elements. The structure is completely supported at nodes A and C. The stiffness matrix of Elements 1 is given below.

1. Assemble the global system stiffness matrix, $K$ considering all possible degrees of freedom.
2. Solve to get the displacements.
3. Find the stress at the center and at the middle point of side AC of the element 1. Are they equal or not? Why?.
4. Find the normal force of Element 2.
5. Without calculations, find the normal force in Element 2 and 3 if the thickness of the CST approaches zero.

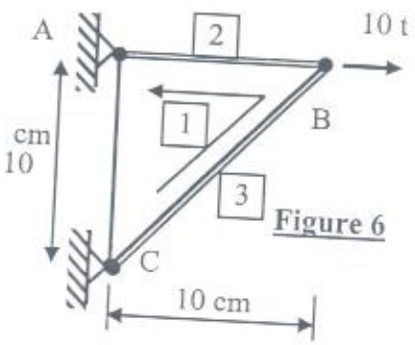



**Figure 6**

Connectivity Table

| Element | i | j | k |
|---|---|---|---|
| 1 | C | B | A |
| 2 | A | B | |

For Truss Element
EA=1000 t
For CST
E = 250 t/cm$^2$
t = 1.5 cm
$\nu$ = 0.25

$$k^{(1)} = \begin{bmatrix} 75 & 0 & 0 & -75 & -75 & 75 \\ 0 & 200 & -50 & 0 & 50 & -200 \\ 0 & -50 & 200 & 0 & -200 & 50 \\ -75 & 0 & 0 & 75 & 75 & -75 \\ -75 & 50 & -200 & 75 & 275 & -125 \\ 75 & -200 & 50 & -75 & -125 & 275 \end{bmatrix} \text{ t/cm}$$

***The Global Stiffness Matrix of a Truss Element***

$$K = \frac{EA}{L}\begin{bmatrix} c^2 & cs & -c^2 & -cs \\ cs & s^2 & -cs & -s^2 \\ -c^2 & -cs & c^2 & cs \\ -cs & -s^2 & cs & s^2 \end{bmatrix}$$

$c = \cos\theta$ *and* $s = \sin\theta$

***The Global Stiffness Matrix of a Fixed-Fixed Frame Element***

$$K = \begin{bmatrix} a_1 & a_2 & -a_3 & -a_1 & -a_2 & -a_3 \\ & a_4 & a_5 & -a_2 & -a_4 & a_5 \\ & & a_6 & a_3 & -a_5 & a_6/2 \\ & & & a_1 & a_2 & a_3 \\ & & & & a_4 & -a_5 \\ & & & & & a_6 \end{bmatrix}$$

where

$a_1 = (EA/L)\,c^2 + (12EI/L^3)\,s^2$

$a_2 = (EA/L - 12EI/L^3)\,cs$

$a_3 = (6EI/L^2)\,s$

$a_4 = (EA/L)\,s^2 + (12EI/L^3)\,c^2$

$a_5 = (6EI/L^2)\,c$

$a_6 = 4EI/L$

$c = \cos\theta$ *and* $s = \sin\theta$

***For a CST*** (case of plane Stress)

***{ε}=[B]{d}*** ***{σ}=[D]{ε}***

$$[D] = \frac{E}{1-\nu^2}\begin{bmatrix} 1 & \nu & 0 \\ \nu & 1 & 0 \\ 0 & 0 & (1-\nu)/2 \end{bmatrix}$$

$$[B] = \frac{1}{2A}\begin{bmatrix} \beta_1 & 0 & \beta_2 & 0 & \beta_3 & 0 \\ 0 & \gamma_1 & 0 & \gamma_2 & 0 & \gamma_3 \\ \gamma_1 & \beta_1 & \gamma_2 & \beta_2 & \gamma_3 & \beta_3 \end{bmatrix}$$

*where* $\beta_1 = y_2 - y_3$, $\beta_2 = y_3 - y_1$, $\beta_3 = y_1 - y_2$ *and* $\gamma_1 = x_3 - x_2$, $\gamma_2 = x_1 - x_3$, $\gamma_3 = x_2 - x_1$

***The Global Stiffness Matrix for Fixed-Hinged Frame Element***

$$K = \begin{bmatrix} a_1 & a_2 & -a_3 & -a_1 & -a_2 \\ & a_4 & a_5 & -a_2 & a_4 \\ & & a_6 & a_3 & -a_5 \\ & & & a_1 & a_2 \\ & & & & a_4 \end{bmatrix}$$

where

$a_1 = (EA/L)\,c^2 + (3EI/L^3)\,s^2$

$a_2 = (EA/L - 3EI/L^3)\,cs$

$a_3 = (3EI/L^2)\,s$

$a_4 = (EA/L)\,s^2 + (3EI/L^3)\,c^2$

$a_5 = (3EI/L^2)\,c$

$a_6 = 3EI/L$

| | | |
|---|---|---|
| Tanta University<br>Final Term Exam<br>Date: 12/06/2010 | Faculty of Engineering<br>Fourth Year | Structural Eng. Department<br>Planning and Control<br>Time allowed: 3.0 hours |

Answer all questions. Use sketches whenever possible. Any missing data may be reasonably assumed.

Total Marks: 70

*Question #1: (10 Marks)*

a. Compare briefly between: *(7.5 Marks)*

1- LOB and Summary diagram.
2- Resource Leveling and Resource Scheduling
3- Total Float and Free Float
4- CPM and LOB
5- Overlap and Lag

b. Choose only the **most correct** answer: *(2.5 Marks)*

1. Total float equals:
   a. Late Finish (LF) - Early Finish (EF)
   b. LF - (ES + duration)
   c. Late Start (LS) - Early Start (ES)
   d. All of the above
2. Which is NOT a scheduling resource:
   a. Labour
   b. Equipment
   c. Money
   d. Time
3. Project duration is equal to the sum of:
   a. durations of all activities
   b. durations of activities on a critical path
   c. durations of critical activities
   d. Other (specify)
4. Budget Cost of Work Scheduled (BCWS) measures:
   a. What is paid in terms of the actual cost of work that has actually accomplished
   b. What is planned in terms of budget cost of the work that should to done
   c. What is done in terms of the budget cost of work that has actually accomplished
5. Project controlling can be done for:
   a. schedule
   b. cost.
   c. Both a and b
   d. Neither a nor b

*Question #2: (15 Marks)*

The construction plan for a single house is as given in the following table. It is required to construct 21 repetitive houses in 123 days. Assume 6 8-hour days per week and a minimum buffer time of one day, it is required to:

a. Draw LOB diagram for this project. *(11 Marks)*

b. Show graphically effect of increasing number of crews for activity B ONLY. *(2 Marks)*

c. Given a desired rate of output of four units per week, what is the number of crews to be used for activity E. *(2 Marks)*

| Activity | Predecessors | Unit Duration (days) |
|---|---|---|
| A | --- | 4 |
| B | A | 6 |
| C | B | 2 |
| D | B | 4 |
| E | C, D | 6 |

*Question #3: (15 Marks)*

The program for a small project is given in the table below. Each activity requires the continuous usage of **a single resource** throughout its duration. What will be the minimum contract duration if no more than **two resources** are available for the work?

| Activity | Predecessors | Duration |
|---|---|---|
| A | --- | 1 |
| B | A | 2 |
| C | A | 2 |
| D | A | 3 |
| E | B | 4 |
| F | C | 5 |
| G | D | 4 |
| H | C, E | 1 |
| I | G | 3 |
| J | F, H, I | 1 |

*Question #4: (15 Marks):*

The activities involved in the construction of a project are given in the table below, as well as budget of work contained in each activity. It is required to:

1. Draw BCWS curve for the contract. *(11 Marks)*
2. At the end of week 12, the following performance measures are recorded: BCWP=110,000, and ACWP=116,000. Comment on the project progress. *(4 Marks)*

| Activity | Predecessors | Duration (weeks) | Budget (LE) |
|---|---|---|---|
| A | --- | 3 | 24,000 |
| B | A | 5 | 35,000 |
| C | B | 8 | 24,000 |
| D | A | 3 | 12,000 |
| E | D | 4 | 12,000 |
| F | A | 2 | 5,000 |
| G | F | 3 | 6,000 |

السؤال الخامس: (١٥ درجة)

١. ماهى أنواع المناقصات التى يمكن استخدامها فى مشروعات التشييد. (١,٠ درجة)

٢. قارن بين طريقتى سعر الوحدة و تقدير العمليات لحساب التكلفة المباشرة. (٢,٠ درجة)

٣. ما المقصود بتسعير دفتر الكميات. هل يعتبر تحميل الأسعار الغير متوازن خطر على المالك. (٢,٠ درجة)

٤. المطلوب تسعير دفتر الكميات التالى مع العلم أن اجمالى سعر العطاء ٥ مليون جنيه. (١٠ درجات)

| البند | الوصف | الوحدة | الكمية المقدرة | التكلفة (١٠٠٠ جنيه) |
|---|---|---|---|---|
| ١ | إدارة الموقع | مقطوعية | مقطوعية | ٥٠٠ |
| ٢ | حفر | م٣ | ٢٠٠٠٠ | ٣٠٠ |
| ٣ | ردم١ (تربة عادية) | م٣ | ٥٠٠٠ | ٢٠٠ |
| ٤ | ردم٢ (كسر حجارة) | م٣ | ٣٠٠٠٠ | ٢٠٠٠ |
| ٥ | رصف | م٢ | ١٠٠٠٠ | ١٥٠٠ |
| | | الاجمالى | | ٤٥٠٠ |

*Best Wishes*

*Dr. M. Ammar*