انشاءات

TANTA UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENG. DEPT.

B. SC. EXAM JAN. 2009
METALLIC CONSTRUCTION
TIME: 3 HOURS

QUESTION (I):

A double-track open timber floor railway pony bridge has a span of 28 m divided into 6 equal panels 4.667 m each. The main girders are welded plate girders having a depth of 280 cm and a flange width of 55 cm. The main girders are provided with vertical stiffeners every 1.556 m together with a horizontal stiffener at 1/5 the depth from the compression side. The bridge is provided with a lower K-system bracing and with a U-frame at every cross girder.
Material of construction is St. 44 with a yield stress F_y = 2.8 t/cm^2 and Young's modulus E=2100 t/cm^2. Live load is train type D.

REQUIRED:

1. Draw with a suitable scale the general layout of the bridge including the required systems of bracing (elevation, plans, side view, … etc.).

2. Calculate the max. B.M. and max. S.F. acting on an intermediate stringer due to dead load, live load and impact, then design a suitable section for it.

3. State the different modes of failure of the main girder web using clear sketches.

4. Design a welded plate girder section for the main girder if: f_{sr} = 1.26 t/cm^2.
M_D = 280 m.t, M_L = 880 m.t, I = 24 / 24+nl, Q_D = 40 t, Q_L = 140 t.
Plates of thicknesses 12, 14, 22, 36 & 50 mm only are available for the construction of the main girder.

5. Design the intermediate stiffener at the connection with the cross girder (at 4.667 m from support). You have to calculate the max. S.F. at the position of the stiffener.
$C_s = 0.65\left(\frac{0.35F_y}{q_b} - 1\right)Q_{act}$ cm t units; q_b = 0.729 t/cm2.

6. It is required to make curtailment for the flange plate at 1/6 of the span. Find the dimensions of the reduced flange plate which resists the reduced B.M. therein.

7. Comparing a square web panel to a rectangular one with the same area in elevation, what is the worst shape for buckling under pure shear stresses and why.

(Assume Any Missing Data)

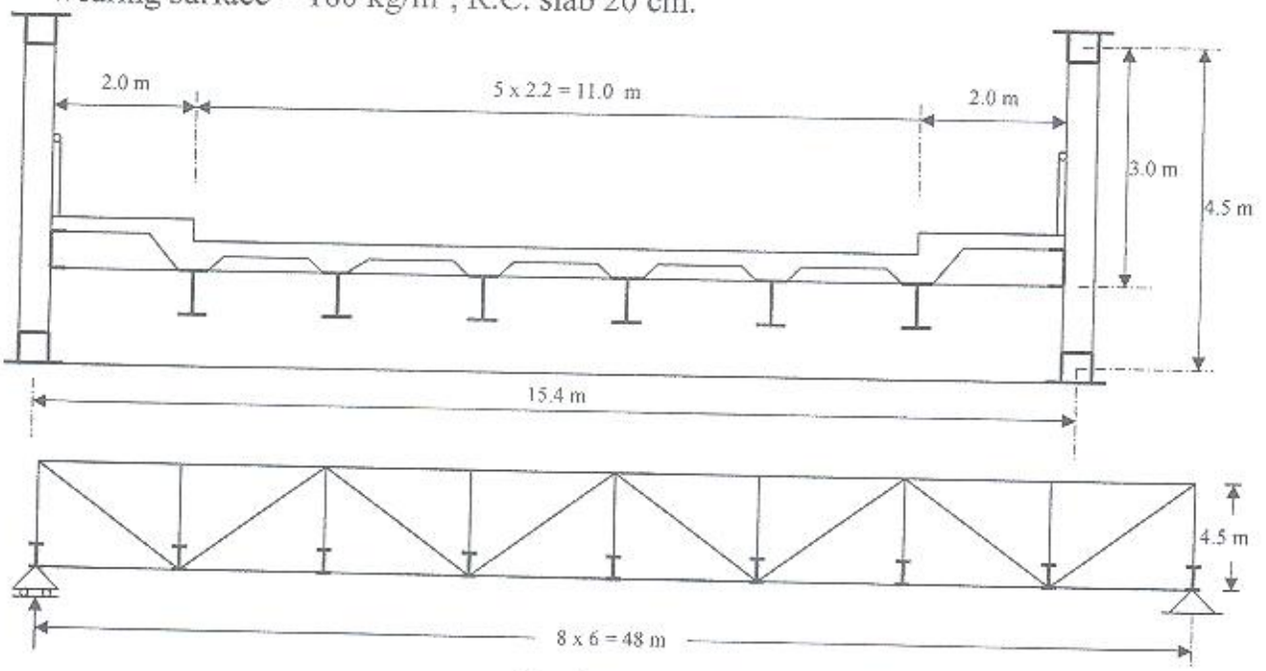
QUESTION (II) :

The main girders of a roadway pony bridge are parallel chord warren trusses having a span of 48 ms divided into 8 equal panels 6.0 ms each. The depth of main girder equals 4.5 ms. An elevation of the main truss girder together with a cross section of the bridge are shown in the attached sheet.

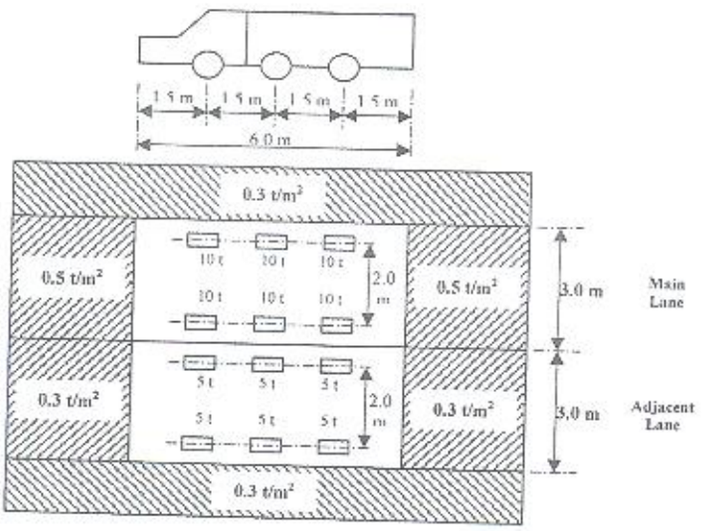
- Material of construction is St. 44.
- Live load according to Egyptian Code of Practice for Roadway Bridges.
- Spacing between gusset plates is constant and equals 400 mms.

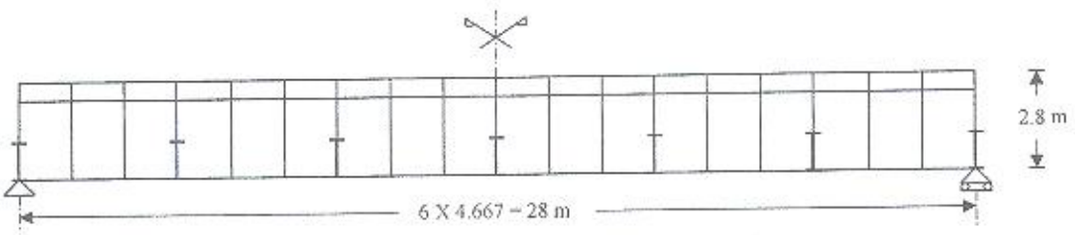
REQUIRED :

1. Calculate the max. B.M. and max. S.F. acting on an intermediate cross girder, take wearing surface = 180 kg/m^2, R.C. slab 20 cm.

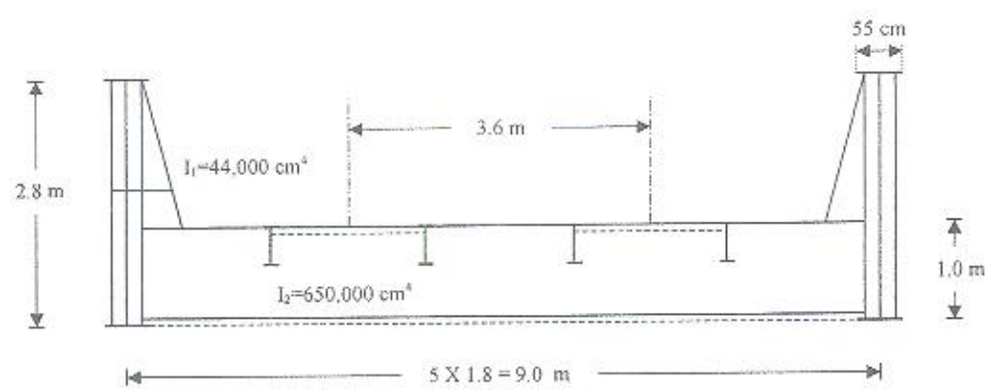


Elev. of Main Girder

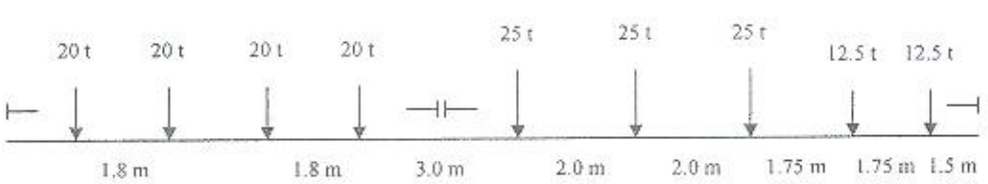




Elevation of Main Girder



Cross Section of Bridge



Train Type "D" (Axle Loads)

Tanta University
Faculty of Engineering
Structural Engineering Department

Foundations Engineering (2), CS4104
4th year, Term Exam, Jan. 2009
Allowable time: 3 hours

(هندسة إنشائية – لائحة قديمة)

Answer all the following questions.

Question No. (1)

a) What is the importance of site exploration?

b) What are the different techniques of subsurface investigation?

c) Describe a method to determine in site bearing capacity of sandy soils.

d) Discuss with clear sketches the penetration testing of the soil in the field, what are the applications of such tests in engineering practice.

e) Some precautions have to be taken in site exploration in the case of problematic soils..... Discuss with clear sketches.

f) How to find the free swell experimentally in the laboratory.

g) Mention a simple method in the field to confirm the presence of collapsing soils.

Question (2)

(a) Explain with clear sketches the different types of anchorage systems.

(b) Discuss in details the main information required to design a sheet piling retaining walls.

(c) For the anchored sheet pile wall shown in figure (1) calculate the followings:-

1) The minimum depth of embedment, d, to provide stability.
2) The required section modulus of the steel sheet pile.

Data :

The allowable stress of steel is 2000 kg/cm^2

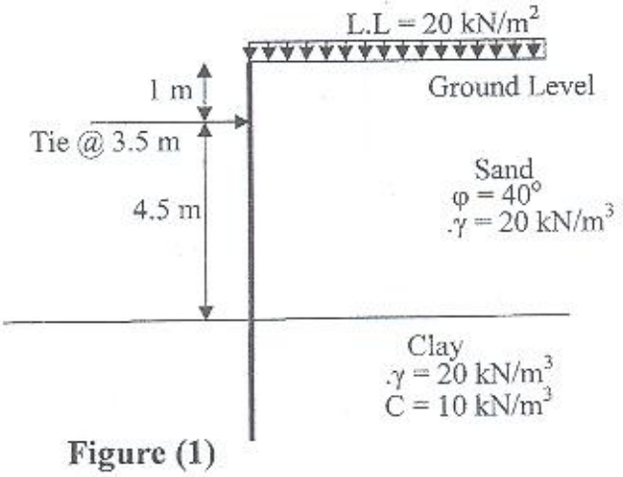


Figure (1)

Question (3)

(a) Using clear sketches, illustrate the different types of caissons.

(b) Using clear sketches show the details of the cutting edges of the caissons.

(c) A circular caisson with inner diameter of 11.0 m and reinforced concrete wall of 1.0 m thick was constructed. It is required to sink the caisson to a depth of 14.0 m to rest on gravelly soil (γ = 20 kN/m^3, $\varphi = 40^o$). Assuming that the ground water level is located at the ground level.

Calculate the followings:-

1) The thickness of the concrete seal to prevent the water interring the caisson.
2) Check the stability of the caisson against the uplift.

Question (4)

(a) Using clear sketch define the artesian flow and prove a formula to determine its discharge.

(b) Using clear sketch illustrate the difference between the sectional and plan flow nets.

(c) Discuss in details how to design a machine foundation illustrating the main points which should be considered in the design.

(d) Using clear sketch suggest a method of dewatering for a site consist of medium sand if the required water drop = 8.0 m

(e) Using clear sketch, describe how to check the stability of an excavation bottom against piping and heave illustrating what to do if the excavation bottom is unsafe.

(f) Using clear sketch explain how an engineer guarantee the safety of an adjacent old building if:

(i) The proposed foundation level is much lower than that of the existing building

(ii) The proposed foundation construction necessitates drop of water level by dewatering process

Question (5)

The section of an excavation is rectangular (20 x 60) m in plan and 7.0 m in depth. The site profile consists of 8.0 m medium to stiff silty clay overlying 3.0 m fine to medium sand on intact granite bedrock. The initial ground water table is (-2.0 m). The nearest waterway is parallel to the long side of the excavation and is far 250 m. The coefficient of permeability for sand layer = 0.01 m/sec and the radius of influence of wells R = 100 m. The available wells are 50 cm in diameter and 9.5 m in length with discharge capacity = 0.007 m^3/sec.

(i) Design the pressure relief system ,

(ii) Estimate the draw down of water at wells and at the center of site.

(iii) Determine the water height at midpoint between wells

Question (6)

A recently graduate engineer was asked to design and check the stresses under raft foundation of eleven floors residential building to resist the **lateral loads due earthquakes and wind loads** and he was given the following data:

- The thickness of plane concrete = 0.40 m
- The thickness of reinforced concrete = 1.20 m
- The unit weight of soil = 1700 kg/m^3
- The raft dimension is 20 x 20 m
- The total load of the structure = 4500.0 t acting in the right top quarter with e_x=0.2 m and e_y=0.25 m
- The maximum lateral load due to earthquake in (x) direction = 90.0 t and the acting moment on the raft due to it = 1000.0 tm.
- As the owner of the proposed project was hesitated to construct a basement floor or not, the geotechnical consultant report suggested the following recommendations:

  The allowable net pressure =1.25 kg/cm^2 at foundation level = 2.0 m

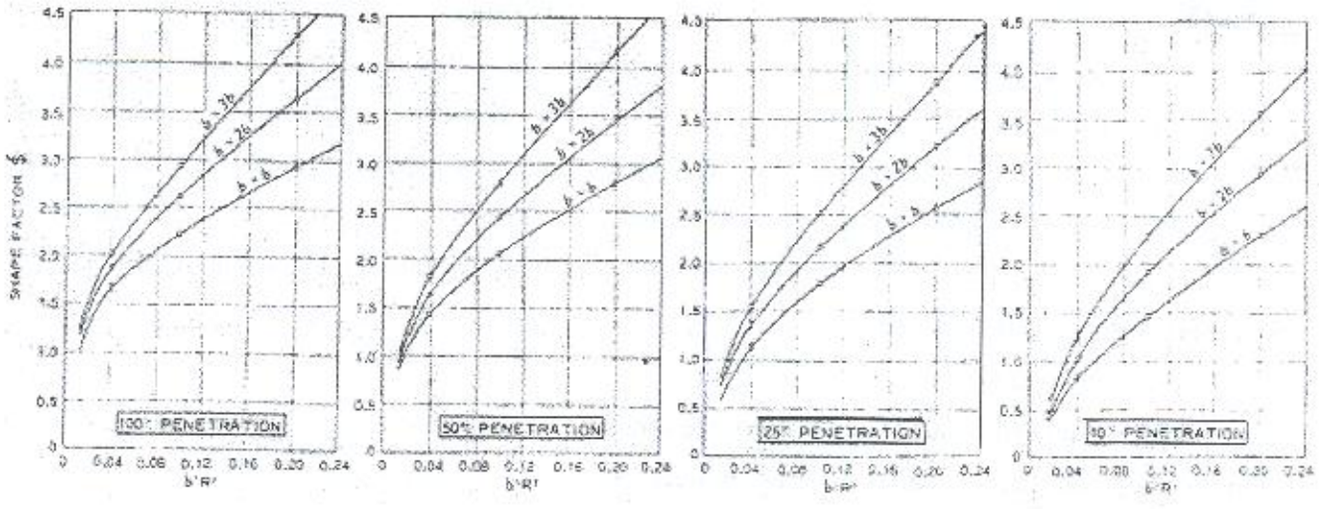
  The allowable net pressure =1.50 kg/cm^2 at foundation level = 4.0 m

- If the owner let the decision of constructing basement floor or not to the engineer who was confused;

(a) Using detailed calculations of stresses under the raft for the case of vertical loads only and the case of both vertical and lateral loads, show the owner that he has to construct the basement floor

(b) If the owner chose the foundation to be raft over piles to avoid basement construction and the engineer told him that the number of 0.5 m in diameter piles required was 100 piles to be constructed in 10 rows and ten columns at 2.0 m spacing, determine the maximum and the minimum loads in the piles for the case of both vertical and lateral loads.

(c) If the engineer was worried about the ability of the piles to resist the 90 ten lateral load, advice him how to do the check and if not safe show the engineer how to design them if the pile length and diameter are known and the soil profile is clay.



REINFORCED CONCRETE III
FOURTH YEAR STRUCTURES
FIRST SEMESTER 08-09
Time Allowed: 3.00 hours

TANTA UNIVERSITY
FACULTY OF ENGINEERING
STRUCTURAL ENGINEERING DEPT.
FINAL EXAM (لائحة قديمة)

الامتحان فى ثلاث ورقات

1/3

- Systematic arrangement of calculations and neat drawings are essential
- Concrete characteristic strength $f_{cu} = 25$ N/mm^2
- Grade of reinforcing steel is 360/520 N/mm^2
-Any Missing data should be reasonably assumed.

مسموح باستخدام الجداول المعتمدة المسلمة داخل لجان الامتحان

Problem One (30%)

a. ***State*** which sentence is **right or wrong**, then ***correct*** the wrong sentence:

i. For pre-stressed concrete members, the same concrete grades can be used as reinforced concrete members.
ii. The core is preferably positioned around the staircase mid-centered in symmetrical buildings
iii. Structural integrity is considered as one of main design basics for reinforced concrete structures
iv. Structural irregularity in vertical direction such as recess can affect the structural behavior under the vertical loads only.
v. Reinforced concrete water tanks are classified as class four.
vi. For a dome supported on its lower edge, the meridian stresses are always compressive stresses.
vii. Short term losses due to friction can affect both pre- and post-tension prestressing.

b. For the shown sheds in Fig. 1, it is required to ***choose*** the proper probable cracking pattern of the slab at failure and ***comment.***

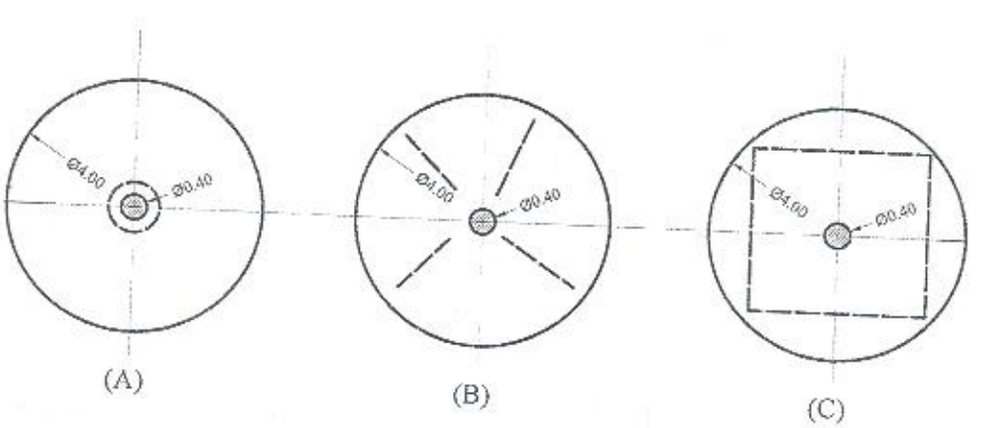
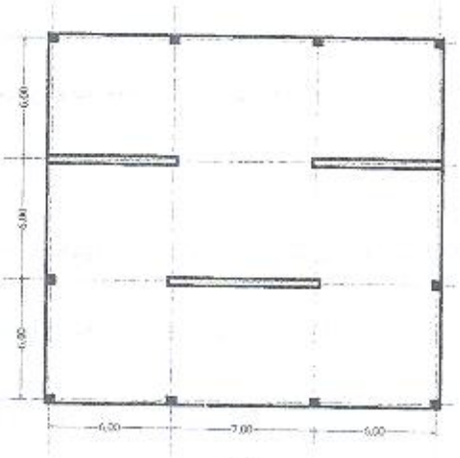


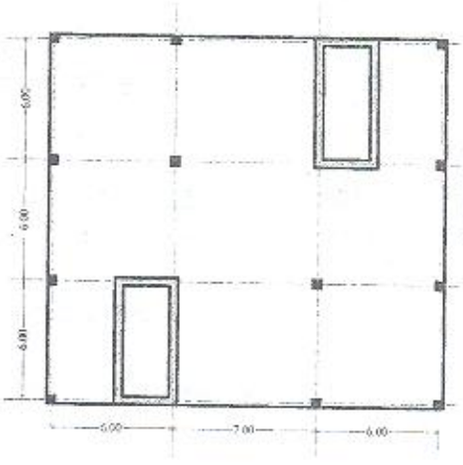
Fig. 1

c. For the following floor plans in Fig.2, it is required to ***choose*** which system is preferable from the lateral load resisting system viewpoint for tall buildings, ***comment.***

P.T.O



(A)



(B)

Fig.2

Problem Two (40%)

a- For the shown frame in Fig. 3, it is required to carry out the following:-

- ***Suggest*** suitable cable profile and the prestressing technique.
- ***Check*** of stresses for the most critical section of the girder at service stage.
- If the horizontal load H is alternating its direction (right and left direction), how would you modify the cable profile.

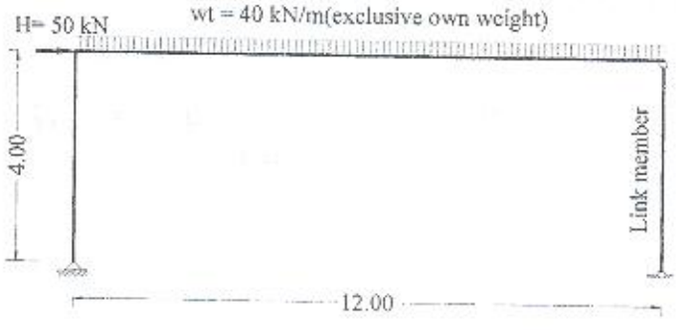


Fig.3

Data

- Girder cross section is 300 mm x 1000 mm,
- Initial prestressing force = 1000 kN,
- Total prestressing losses = 15%,
- Concrete characteristic strength = 50 MPa.

b. It is required to ***derive*** an expression for the hoop stresses, N_θ, for a reinforced concrete dome supported on its lower edge under the action of its own weight. Then ***determine*** the angle at which such stresses reverse its sign.

c. It is required to suggest a general ***layout*** along with ***complete design*** of reinforced concrete dome covering a square area of 32 m side length. The clear height equals to 6 m. The ventilation and natural lighting are very essential.

P.T.O

d. For the three deformed modes of tall buildings under the effect of lateral loads shown in Fig.4, it is required to match the following three options with the three modes.

1- Dominant mode for cantilever shear wall
2- Dominant mode for framed structures
3- Dominant mode for coupled shear wall

Explain your selection for each case.

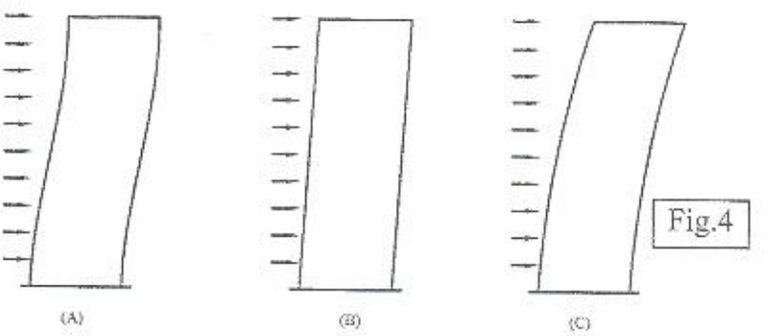


Fig.4

Problem Three (40%)

a. Given a reinforced concrete cantilever shear wall of total height of 22 m supporting an ultimate vertical load of 25000 kN and an ultimate horizontal top load of 2000 kN. It is required to carry out the following considering square box section for the shear wall of outer side of 5 m and inner side of 4 m:-

- Draw N.F.D, S.F.D and B.M.D.
- Design the reinforced concrete shear wall under the given loads.
- Calculate the top drift of the wall.

b. It is required to allocate the center of mass and center of rigidity for the shown plan in Fig. 2A (**Problem One**). Assume the wall thickness 400 mm.

c. It is required to discuss the different details for various types of the joint between the wall and floor in case of elevated rectangular tank.

d. For the shown cross section of elevated open conduit in Fig. 5 supported on columns spaced every 5 m in the longitudinal direction, it is required to conduct complete ultimate design for the conduit showing details of reinforcement.

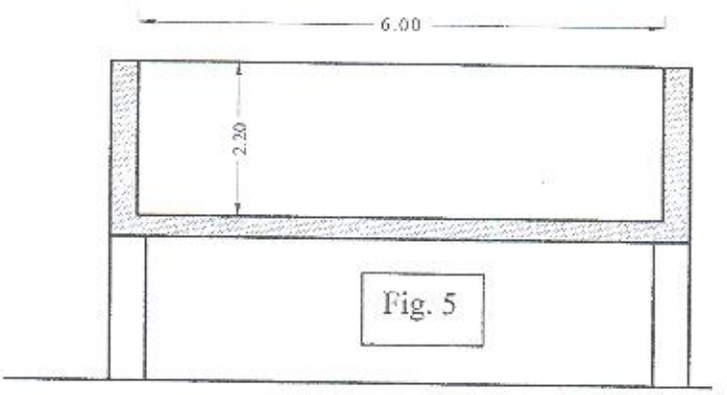


Fig. 5

مع اطيب الامنيات بالتوفيق
أ.د. صلاح الدين فهمى طاهر
د. حمدى محى الدين عفيفى

Answer All Questions. Any missing data may be reasonably assumed. Max. Grades=85

Question No. 1 (11 marks)

a. Choose only the **most correct** answer (***copy ONLY the mark in the answer sheet***):

1. Critical Path Method usually specified as:
   a. Deterministic technique
   b. Probabilistic technique
   c. Both deterministic and probabilistic
   d. Neither deterministic nor probabilistic
2. Project controlling can be done for:
   a. Schedule
   b. Cost.
   c. Both a and b
   d. Neither a nor b
3. Periodical progress reports usually contain data regarding to:
   a. Completed activities
   b. Underway activities
   c. Future activities
   d. All of the above
4. S-curve is a graph showing relation between
   a. Time and Schedule
   d. Price and Cost
   c. Time and Cost
   e. None of a, b, and c
5. Most construction projects:
   a. Completed following the original schedule and estimates
   b. Suffered from delays and work changes
   c. Both a and b

b. Differentiate between the following terms:

1. Normal cost and crash cost.
2. Cost and Expense.
3. Cost and Price.
4. Pessimistic and optimistic durations.
5. Primary critical path and secondary critical path.

c. 1. What is the primary disadvantage of using CV and SV as control indicators? How this limitation can be overcome.

2. Does a contactor need to minimize contract negative cash flow. Explain your answer. Discuss the different options available to minimize the contactor's negative cash flow?

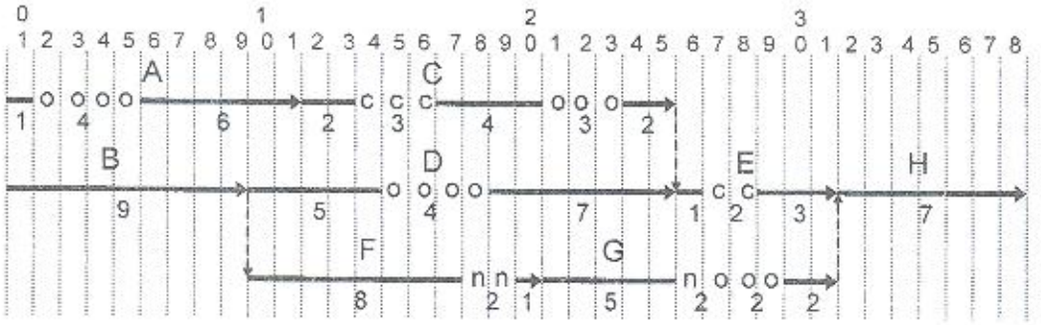
Question No. 2 (20 marks)

Perform the Monte Carlo Simulation calculations for two iterations (at random numbers of 0.25 and 0.65 only) assuming uniform distribution for all activity duration. Specify project duration and critical activities in each iteration. Comment on the results of the two iterations.

Activity Code	Predecessors	Duration (days)	
		Minimum	Maximum
A	---	3	5
B	---	4	9
C	---	2	4
D	A	5	10
E	D	3	6
F	B	7	12
G	B	12	20
H	F	7	10
I	E,H	3	9
J	C	5	8
K	G,J	8	14

Question No. 3 (20 marks)

The as-built schedule of a small project is given in the figure below. If as-planned project duration is 32 weeks, site overheads amounts LE250/week, and liquidated damages amounts LE200/week, specify delay responsibility of each party and hence determine delay compensations for owner and contractor using **But-For method**.



Question No. 4 (25 marks)

The activities involved in the construction of a small project are given in Table 1, as well as budget of work contained in each activity.

a- Draw project cash flow (BCWS) based on a 4-week basis.

b- At the end of week 16, the project status is given in Table 2, whereas actual cumulative cost is given in Table 3. Draw BCWP and ACWP curves. Comment on the progress of the project.

Table 1: Project planning data

Activity	Predecessors	Duration (wks)	Overlap (wks)	Budget (LE)
A	---	5		5,000
B	A	8		12,000
C	B	2	1	1,000
D	B	6		3,000
E	A	6		4,500
F	C & D	6		2,400
G	E & D	5		2,500
H	E	5		2,000
K	G & H	6	-2 with H	3,000

Table 2: Progress data

Activity	Actual Start	Projected Completion
A	0	6
B	6	14
E	6	11
H	11	16
C	14	16
D	15	20

Table 3: Actual cost

Week #	Cumulative Cost
4	5,000
8	13,000
12	20,000
16	24,000

Question No. 5 (14 marks)

a. If the cost slope of an activity equals 200/day, its crashability is 5 days, and its crash cost is 4000, calculate its normal cost?

b. A typical competitor has a B/C ratio of 1.15 with a standard deviation of 0.095. Calculate the probability of beating 5 typical competitors at a markup value of 10% using both Friedman and Gates models. Comment on the results.

c. Discuss the basic assumptions of PERT?

d. Develop a flow chart for Monte Carlo Simulation technique?

Best Wishes *Dr. M. Ammar*

Tanta univ.
Faculty of Eng.
Public works Eng.Dept

First term Exam
jan.2009

Sanitary Eng.
4th year civil Eng
Time: 3 hrs.

1 - For a waste water treatment plant of 10,000 m^3/d design discharge,determine the grit chamber dimensions according to the following data :

- channel depth = 1.5 width
- horizontal flow through velocity = 0.3 m/s
- particles settling velocity = 0.02 m/s

It is also required to design a primary sedimentation tank to remove approximately 65% and 35 % of suspended solids and BOD respectively , with retention period of 2.5 hrs .

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2 – a) Fig . (1) illustrates dimensions of a typical slow mixing unit installed to apply tapered flocculation of average G value of 35 sec^{-1} and GT value of 4×10^4, with typical Alum.dose of 40 mg / lit (According to jar test analysis).
If two units are used to handle 12,000 m^3 /d of raw water, it is required to determine :
Unit dimensions, power requirements, paddles configuration and rotational speed (ω).

2- b) For the discharge in (a) , its required to determine :

- the rate of dosing of Alum. solution in lit / min
- if Alum concentration in solution C = 10 %
- the required amount of Alum . per day.
- the required capacity of the alum. solution tank Sufficient for one day .

Hint : $P = G^2\mu V$ $\mu = 1.139\times10^{-3}$ N.S / m^2 $\rho = 999.1$ kg/m^3
$C_D = 1.8$
$P = C_D A_p \rho V_P^3 / 2$ $V_P = 0.67$ m /sec x 0.75 = 0.5m/s

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3-a- A City has present population p_{2000} of 33,000 capita and estimated future population P_{2020} of 50,000 capita . If the city present water consumption is 10,000 m^3 / d determine at what year a 14,000 m^3 / d , design discharge water treatment plant will reach its full capacity . Assume an arithmetic rate of population growth and constant per capita water consumption .

3-b- A Conventional Activated Sludge WWTP is to treat 15,000 m^3/d wastewater, the raw wastewater has BOD_5 of 1080mg/lit that required to be reduced to 200mg/lit. Primary and final sedimentation tanks is 500 , 750 m^2 effective surface area respectively. Analysis indicates a mean cell residence time of 5 days maintaining Mixed Liquor Suspended Solids of 4000PPM will produce the design results. The value of Y is 0.7 and K_d is found $0.03d^{-1}$.
You are required to determine the mass of solids, and volume, of activated sludge to be wasted daily, the sludge recirculation ratio (Knowing that X_u = 12000 mg/lit), also determine S.L.R for the edimentation tanks.

Hints : $P_n = P_o + K_a(t_n - t_o)$ $V = QY\theta_c(S_o - S_e)/X(1+Kd\theta_c)$

good luck
Dr. Ahmed Elmarsafy

- Working period of treatment plant — 20hours/day
- Surface loading rate — $\geq 30\ m^3/m^2/d$
- Suspended solids — 120 mg/L
- Efficiency of sedimentation Tank — 85 %
- Water content in sludge — 96 %

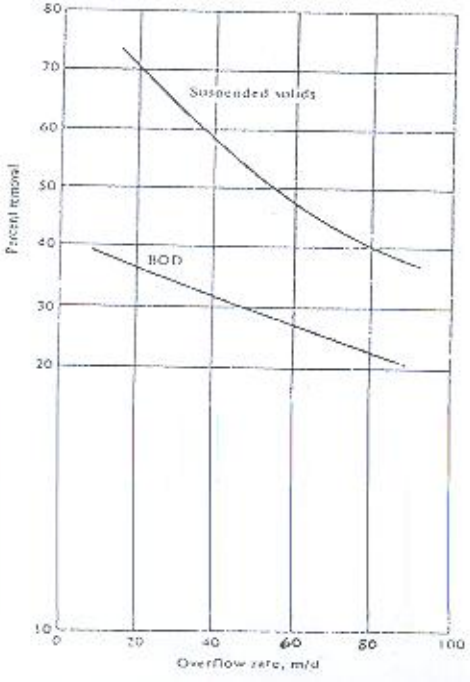
5- c- If is previous census of the city was as follows :

year	population
1975	195,000
1985	205,000
1995	220,000
2005	240,000

Assume the population increase in future will follow the geometric method ($\ln P_t = \ln P_o + K_g (t_n - t_o)$) , what would be the number and dimensions of the required additional clari-flocculators after 30 years . Assume the same design data regading water consumption , retention periods , surface loading rate and working period.

6- a- Give short notes for the different types of filters according the following items : direction of flow , filtration rate , filter media .

6- b- A rapid sand filter unit 6 x 8 m . After filtering 10,000 m^3/d in a 24 hr period , the filter is backwashed at a rate 500 $m^3/m^2/d$ for 12 min. Calculate the average rate of filtration , the quantity and percentage of treated water used in washing.



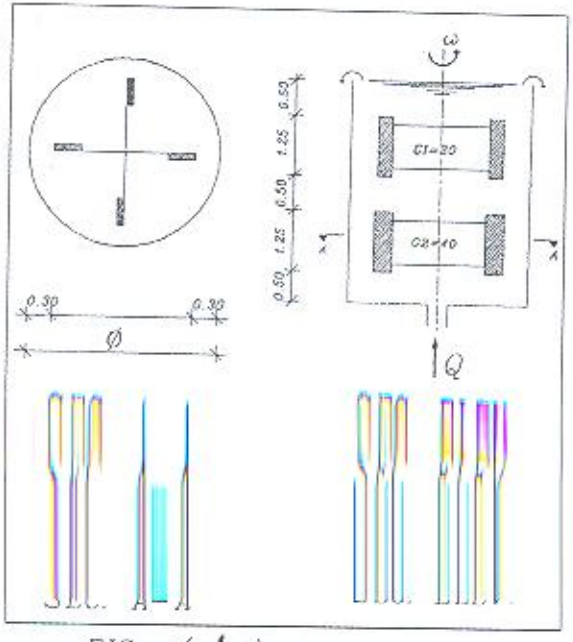


FIG. (1)

Tanta University Faculty of Engineering Structural Engineering Department	Time Allowed: 3 hours January 20, 2009 4th Year Civil Engineering

Advanced Structural Analysis

Question I (20%)

a) What type of triangular elements (CST or LST) should be used for modeling the two cantilevers shown in Figures 1(a) and 1(b)? Explain.

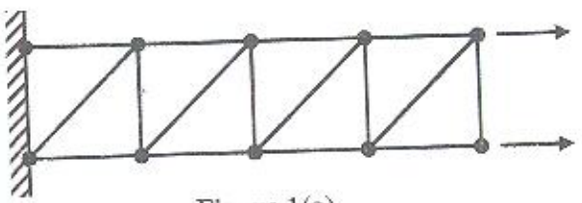


Figure 1(a)

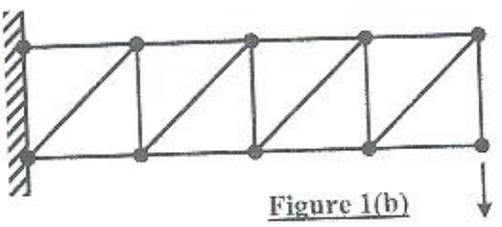


Figure 1(b)

b) Figure 1(c) shows a multistory concrete frame. The size of all beams is 0.4×1.0 m while the size of all columns is 0.4×0.8 m. The frame is subjected to horizontal and vertical loads as shown in Fig. 1(c). A finite element model was developed using the gross moment of inertia of beams and columns ($I = bt^3/12$). Can you rely on this model to obtain correct results? If required, what would you do to correct this model?

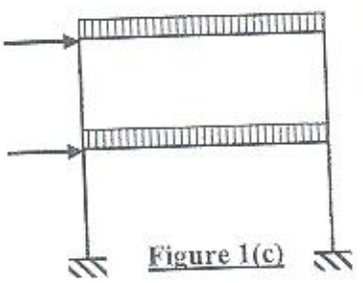


Figure 1(c)

c) Figure 1(d) shows the finite element model of a beam connected to a shear wall. The shear wall is modeled using CST's while the beam is modeled using two one-dimensional 2-node beam elements. Sketch the shape of the bending moment diagram in the beam element you get from this model? Explain your answer. If the hinged support is removed, sketch the bending moment in the beam.

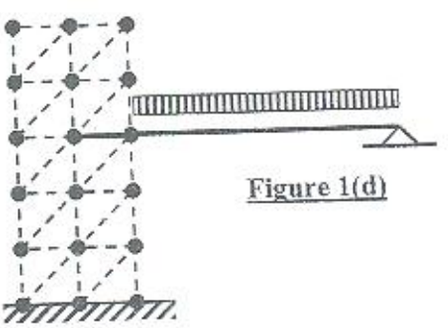


Figure 1(d)

d) Which stress or strain components approach zero in the following two-dimensional problems: (i) plane stress problems and (ii) plane strain problems.

Question II (10%)

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

- Find the constants c_1 and c_2 in terms of q_1 and q_2.
- 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 2

Question III (15%)

A constant strain triangle is shown in Fig. 3. The nodal displacements at the three nodes of the element are known and given below. It is required to:

1. Find the value of the displacements (u and v) at the centroid of the element.
2. Find the value of the displacements (u and v) at the mid-point of the line connecting Node 1 and Node 2.
3. Determine the strains ($\varepsilon_x, \varepsilon_y, \tau_{xy}$) at the centroid of the element.
4. Calculate all the stresses at the Node 1.

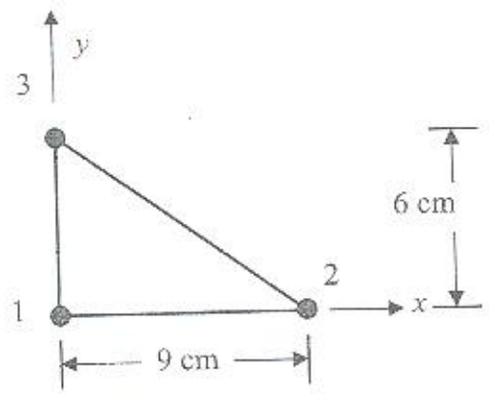


Figure 3

Given:
E=2100 t/cm^2
$\mu = 0.3$
t = 10 cm

Nodal Displacements

$u_1 = 0.0$ mm	$v_1 = -2.0$ mm
$u_2 = 8.0$ mm	$v_2 = -4.0$ mm
$u_3 = 2.0$ mm	$v_3 = 0.0$ mm

Question IV (10%)

- A three-node bar element is defined as shown in Figure 4. The element is of cross-sectional area A, Young's Modulus E, and length L. A local axial coordinate, x, has its center origin at the centre nodes. Use a suitable polynomial displacement function to proof that the shape functions are as given below and draw clear sketches for the shape functions.

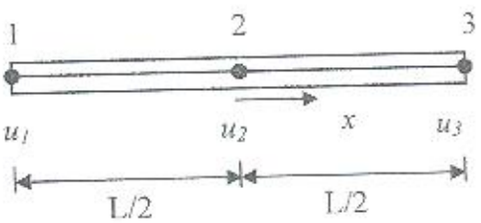


Figure 4

$$n_1(x) = \frac{x}{L}\left(\frac{2x}{L} - 1\right), \quad n_2(x) = \left(1 - \frac{4x^2}{L^2}\right) \quad \text{and} \quad n_3(x) = \frac{x}{L}\left(\frac{2x}{L} + 1\right)$$

- If u_1=2.0 mm, u_2 = 2.5 mm and u_3 = 4.0 mm, find the **strain** of a point located at x=0.75L

Question V (20%)

Figure 5 shows a bar element subjected to an axial uniform distributed loads with intensity b t/m. Assuming that EA is a constant, it is required to:

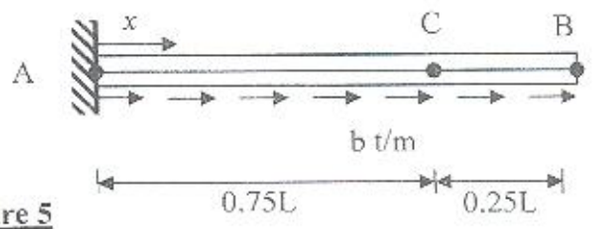


Figure 5

- Prove that the exact value of the horizontal displacement at a point located at $x=0.75L$ (Point C) is $u_c = \frac{15bL^2}{32EA}$ and that the stress σ_c = bL/4A.
- Using the finite element method, find the horizontal displacement and stress at Point C and compute the amount of error in each of the following cases if:
  a) The beam is modeled using a single 2-node uniform bar element.
  b) The beam is modeled using two 2-node uniform bar element of equal length
  c) A single 3-node uniform bar element.(Hint: the equivalent nodal forces are 2bL/3 at center and bL/6 at ends)

Question VI (25%)

Consider the two-dimensional 2-element system shown in Fig. 4. Element 1 is a constant-strain triangle while elements 2 is a frame element. The structure is completely fixed 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 for the displacement matrix, q.
3. Compute the stress matrix, σ, for the CST Element.
4. Draw the normal force, shearing force and bending moment diagrams for Element 2.
5. Without calculations, draw the normal force, shearing force and bending moment in Element 2 if the thickness of the CST approaches zero.

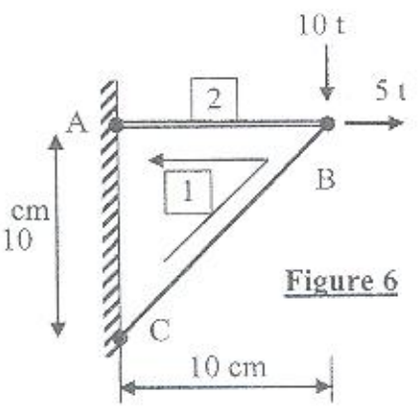


Figure 6

Connectivity Table

Element	i	j	k
1	C	B	A
2	A	B	

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

For Frame Element
EI = 8000 t.cm^2
EA=1000 t
For CST
E = 250 t/cm^2
t = 1.5 cm
ν = 0.25

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 Local Stiffness Matrix of a Fixed-Hinged Beam Element

$$k = \begin{bmatrix} \frac{3EI}{L^3} & \frac{3EI}{L^2} & \frac{-3EI}{L^3} \\ \frac{3EI}{L^2} & \frac{3EI}{L} & \frac{-3EI}{L^2} \\ \frac{-3EI}{L^3} & \frac{-3EI}{L^2} & \frac{3EI}{L^3} \end{bmatrix}$$

For a CST

{ε}=[B]{d} {σ}=[D]{ε}

$$[D] = \frac{E}{1-\nu^2}\begin{bmatrix} 1 & \nu & 0 \\ \nu & 1 & 0 \\ 0 & 0 & (1-\nu)/2 \end{bmatrix} \qquad [B] = \frac{1}{2A}\begin{bmatrix} \beta_1 & 0 & \beta_2 & 0 & \beta_3 & 0 \\ 0 & \gamma_1 & 0 & \gamma_2 & 0 & \gamma_3 \\ \gamma_1 & \beta_1 & \gamma_2 & \beta_2 & \gamma_3 & \beta_3 \end{bmatrix}$$

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 Local Stiffness Matrix for a 3-Node Bar Element

$$K = \frac{EA}{L}\begin{bmatrix} 7/3 & -8/3 & 1/3 \\ -8/3 & 16/3 & -8/3 \\ 1/3 & -8/3 & 7/3 \end{bmatrix}$$

The Local Stiffness Matrix for a Fixed-Fixed Beam Element

$$k = \begin{bmatrix} \frac{12EI}{L^3} & \frac{6EI}{L^2} & \frac{-12EI}{L^3} & \frac{6EI}{L^2} \\ \frac{6EI}{L^2} & \frac{4EI}{L} & \frac{-6EI}{L^2} & \frac{2EI}{L} \\ \frac{-12EI}{L^3} & \frac{-6EI}{L^2} & \frac{12EI}{L^3} & \frac{-6EI}{L^2} \\ \frac{6EI}{L^2} & \frac{2EI}{L} & \frac{-6EI}{L^2} & \frac{4EI}{L} \end{bmatrix}$$

كلية الهندسة – جامعة طنطا
الفرقة الرابعة
أختبار نهاية الفصل الدراسي الأول

لائحة قديمة
٢٠٠٩/١/١٥

قسم هندسة الإنشاءات
مقرر تخصصى اختيارى٣
إصلاح و تقوية المنشآت

أجب عما يلي من خلال ما درست من محتوي علمي لهذه المادة:

السؤال الأول ١٠درجات

لكل عنصر من العناصر المعيبة التالية؛ اقترح ما يناسبها من مواد الترميم من خلال توصيفك للمنتجات التى سيتم استخدامها وشرح مختصر لطريقة تطبيق تلك المواد:

١- عمود مستطيل به شروخ طولية نتيجة زيادة الأحمال.
٢- عمود دائرى قصير (Short Column) به شروخ عرضية نتيجة صدأ الكانات.
٣- شرخ انحناء رأسى فى منتصف كمرة بسيطة الارتكاز.
٤- شروخ صدأ فى باطن بلاطة خرسانية مسلحة.
٥- شروخ مائلة فى الحوائط دلالة على حدوث هبوط بالأساسات وعيوب بالسملات.

السؤال الثاني ١٥درجة

١. يعتبر نيترات الأمونيوم و كبريتات الأمونيوم مركبين من مجموعة كيميائية واحدة و لكن تأثيرهما على الخرسانة يوحى بأنهما من مجموعتين مختلفتين. اشرح ذلك.
٢. لحدوث أى شرخ يجب أن يتوافر عاملين أساسيين. أذكر هذين العاملين.
٣. الكبريتات ضارة على الخرسانة؛ أذكر أهم العوامل التى تؤثر على مدى الضرر الناتج منها وكيفية حدوث الضرر الناتج من الخرسانة.
٤. الماء المقطر ضار بالخرسانة – وضح ذلك.

السؤال الثالث ٢٥درجة

١. كمرة من الخرسانة المسلحة ذات قطاع ٣٠٠ × ٦٠٠ مم وتسليحها الرئيسي ١٩٥٠ مم^2 ترتكز ارتكازا بسيطا بطول ٧,٥٠ متر ويؤثر عليها حمل تشغيل كلى ميت قدره ١٥ كن/م.ط و حمل تشغيل كلى حى قدره ١٨كن/م.ط ؛ ونتيجة لتغير الاستخدام سيتم زيادة الأحمال الحية بنسبة ٥٠%. وقد أظهر التحليل الإنشائى أن قطاع الكمرة كاف لمقاومة القص ويفى بمتطلبات الكود فيما هو وارد بشأن حدود التشرخ و الترخيم تحت تأثير الأحمال الزائدة ولكنه لا يفى بتحمل عزوم الإنحناء الإضافية الناتجة عن تلك الأحمال.

المطلوب عمل تدعيم للقطاع باستخدام ألواح ألياف البوليمرات المسلحة بالكربون إذا علمت الآتى:

$f_{cu}=35N/mm^2, f_y=400N/mm^2, f_{fu}=620\ N/mm^2, \varepsilon_{fu}0.019, E_f=37kN/mm^2$ and $t_f=1.1mm$

$$\varepsilon_{fe} \prec k_m \varepsilon^* f_u \qquad C_E=0.95$$

$$k_m=\frac{1}{60\varepsilon^* f_u}\left(1-\frac{nE_f t_f}{360000}\right) \le 0.90 \quad for \quad nE_f t_f \le 180000$$

$$k_m=\frac{1}{60\varepsilon^* f_u}\left(\frac{90000}{nE_f t_f}\right) \le 0.90 \quad for \quad nE_f t_f \succ 180000$$

For ductile failure: for $\varepsilon_s \ge 0.0065 \Rightarrow \gamma_c=1.5,\ \gamma_s=1.15,\ \gamma_f=1.4$ (St. 400/600)

For brittle failure: for $\varepsilon_{sy} \prec \varepsilon_s \prec 0.0065 \Rightarrow \gamma_c=1.5\eta,\ \gamma_s=1.15\eta,\ \gamma_f=1.4\eta$ (St. 400/600)

$\eta=1+0.15[0.0065-\varepsilon_s]/[0.0065-\varepsilon sy]$ (St. 400/600)

السؤال الرابع ٢٠درجة

١- يراد تدعيم أعمدة أحد العمارات حتى يمكن تحمل خمسة أدوار إضافية. إذا علمت أن أحد الأعمدة الأصلية ذو قطاع دائرى يقع عليه ١٠٠ طن وأن المبنى يتكون من أربعة أدوار قبل التدعيم فالمطلوب تصميم هذا العمود ليتحمل ١٨٠ طن. $f_{cu}=25N/mm^2, f_y=360N/mm^2$

٢- أذكر موضحا إجابتك بالرسم خطوات تنفيذ القميص الخرسانى للأعمدة مع ذكر الإحتياطات الواجب مراعاتها أثناء التنفيذ وتحديد عناصر نقل القوة.

جامعة طنطا – كلية الهندسة
قسم هندسة الإنشاءات

الفرقة الرابعة لائحة قديمة
مقرر تخصصي اختياري(٣)
خرسانة الألياف

الفصل الدراسي الاول ٢٠٠٨/٢٠٠٩
الأسئلة في صفحتين
مدة الامتحان ثلاث ساعات

السؤال الأول ٢٥%:

١. اذكر أهم مزايا وعيوب الخرسانة التقليدية كمادة إنشائية محدداً كيف يمكن الاستفادة من مزاياها وكيف يمكن التغلب على بعض هذه العيوب. ثم اشرح باختصار ومبتدءا بمكونات الخرسانة التقليدية وعن طريق تغيير واحد أو أكثر من مكونات الخلطة أو بتغيير نسب الخلط أو إضافة مركبات جديدة أو بتغيير طرق الصناعة ...الخ وضح كيف يمكن الحصول على أنواع خاصة من الخرسانة ذات خواص مميزة محدداً التطبيق الأمثل لاستغلال تلك الخواص المميزة المصاحبة لكل نوع.

٢. فرق باختصار بين كل من:

أ. اختبار مخروط الهبوط العادي واختبار مخروط الهبوط المقلوب.

ب. طرق قياس متانة خرسانة الألياف في الانحناء.

السؤال الثاني ٢٥%:

١. ضع العلامة المناسبة (صواب) امام العبارة الصحيحة و (خطأ) امام العبارة الخطأ مع اعادة كتابة العبارة الخطأ بعد تصحيحها:

أ. يفضل استخدام خرسانة الالياف فى صب الكمرات مقارنة بالاعمدة.

ب. تعد مادتي السيليكافيوم والرماد المتطاير من الإضافات الكيميائية الهامة في صناعة خرسانة الألياف.

ج. مقاومة الشد لليفة واحدة من نوع معين من الألياف أكبر من مقاومة الشد لحزمة من نفس نوع الألياف عند اختبارهما في الشد عند نفس الظروف.

د. لخلطة خرسانة ألياف تحتوى على ١% من ألياف البولى بروبلين يكون وزن الألياف = ٨ كجم.

ه. يمكن استخدام أي من اختباري مخروط الهبوط العادي أو مخروط الهبوط المقلوب لتعيين تشغيلية الخرسانة التقليدية.

و. في طريقة قياس متانة خرسانة الألياف (ASTM C1018) فان I_5 = 5 تعنى سلوكاً تام المرونة للمادة المختبرة.

ز. تؤثر نسبة نحافة الألياف على القابلية للتشغيل للخرسانة الطازجة.

ح. لنفس خلطة خرسانة الألياف فان زمن في بي يساوى زمن مخروط الهبوط المقلوب.

٢. عرف كل من المواد Isotropic و Orthotropic و Anisotropic و كيف يمكن تحقيق ذلك فى خرسانة الالياف.

٣. استخدمت الياف حديدية لها مقاومة شد ١٠٠٠٠ كجم/سم^2 و معاير مرونة ٢١٠٠ طن/سم^2 فاحسب مقاومة المادة المركبة فى الحالات الثلاثة Isotropic و Orthotropic و Anisotropic اذا كانت المادة اللاحمة لها مقاومة شد ٣٠ كجم/سم^2 و معاير مرونة ٢٠٠ طن/سم^2 و ذلك بافتراض ان الطول اكبر من الطول الحرج.

السؤال الثالث ٢٥%:

١. عرف طول الألياف الحرج لخرسانة الألياف المحتوية على ألياف قصيرة ثم اذكر العوامل التي تؤثر علية ومن ثم استنتج كيف يمكن حسابه.

٢. تم اختبار مجموعتين من عدة عينات متماثلة المجموعة الأولى عبارة عن كمرات من الخرسانة التقليدية والأخرى من نفس الخلطة بعد إضافة ١% بالحجم من نوع معين من الألياف القصيرة بطول ٣٠مم وكانت العينات بمقاس ١٠٠*١٠٠*٣٥٠مم حيث تم اختبارهما في الانحناء بحملين عند نقطتي الثلثين فإذا علمت أن متوسط أحمال حد التناسب كانت ١٤ ، ١٧ ك. ن للخرسانة التقليدية وخرسانة

الألياف على الترتيب وان متوسط قيم ترخيم حد التناسب كانت ٠,٠٤ ، ٠,٠٤٨٣مم لكلا المجموعتين على الترتيب.

المطلوب:

أ. احسب كل من متوسط معاير المرونة في الانحناء ومقاومة الشد في الانحناء للمجموعتين.

ب. أحسب محتوى الألياف المستمرة من نفس نوع الألياف المستخدمة والتي تعطى نفس قيم معاير المرونة و مقاومة الانحناء للحالة المختبرة سابقاً.

السؤال الرابع ٢٥%:

١. ارسم العلاقة البيانية التى توضح كل من الآتى :

أ. تأثير استخدام نسب مختلفة من الياف الحديد على سلوك كل من الخرسانة عالية المقاومة و الخرسانة عادية المقاومة فى الضغط

ب. تأثر استخدام الياف الحديد على مقاومة الشد للخرسانة

ج. تأثير كل من نسبة النحافة و محتوى الالياف على سلوك الخرسانة فى الانحناء

د. تأثير استخدام الالياف على مقاومة الصقيع

٢. اجرى اختبار الضغط على اسطوانات قياسية من الخرسانة وطول القياس المستخدم ١٠٠مم وكانت قراءات الحمل (طن) والانضغاط ($X١٠^{-٢}$ مم) المقابل كما يلى:

الحمل (طن)	٩	١٨	٢٧	٣٦	٤٥	٥٤	٥٧,٦	٤٥	٤٠,٥	٣٦	٣٢,٤	٣٠,٦
خرسانة عادية	٢,٥	٥	١٠	١٥	٢٢,٥	–	–	–	٢٧	٢٨,٥	٣٠,٠	٣٠
الياف بولى بروبلين ٠,٥%	٢,٥	٥,٥	٩	١٣	٢٠	–	–	–	٣٣	٣٩	٦٠	٧٥
الياف حديد ٠,٥%	٢,٣	٤,٧٥	٨	١٢	١٦	٢٥	٣٩	٥٠	–	٥٥	٧٠	٩٠

– ارسم منحنى الاجهاد و الانفعال للثلاث انواع من الخرسانة – احسب قيمة معاير المرونة للثلاث انواع من الخرسانة.

٣. عدد الاستخدامات المختلفة للالياف ثم اشرح بالتفصيل تطبيق لاستخدام الالياف فى مجال من المجالات المعملية مع التوضيح بالرسم كلما امكن .

مع تمنياتى بالتوفيق ،،،

د/ مريم فاروق غازى