Tanta University
Faculty of Engineering
Public Works Engineering Dept.

First Term Exam
January 2019
Time: 3 hrs.

4th Year Structural Engineering
لائحة قديمة
Sanitary Engineering

Please answer the following questions with neat sketces if it is possible and assume any missing data **No. of pages: 3** **Date: 12 January 2019**

Question (1)

1-a) Define the following abbreviations: WHO – EPA – HCWW – NOPWASD.

1-b) The water source has water level of 45.0 m, and bed level of 41.0 m. The distance between water source and the served community is 4.0 km, and the delivery pipe carries discharge of 0.5 m^3/s to the rapid mixing tank at water level of 15.0 m. It is required to:

- Determine diameter of the delivery pipe ($v \geq 1.5$ m/s)
- Design the pumping unit if it is required ($f = 0.02$)

Hints: $HP = \frac{\gamma Q_P H_T}{75\eta_1\eta_2}$, $h_{fl} = \frac{fLv^2}{2gD}$

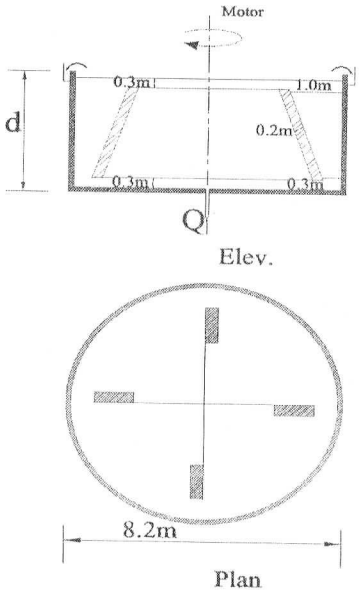
Question (2)

1-a) Write about inline mixing for coagulation, explaining its importance in reducing operating costs of water treatment.

2-b) State the advantages and disadvantages of hydraulic flocculation comparing with mechanical powered flocculation.

2-c) The discharge influent to the sketched flocculator is 10000 m^3/d of water. The slow mixing is operated with rotational speed of 2 rpm and retention time of 30 minutes. The water density (ρ_w) is 999.3 kg/m^3 and the dynamic viscosity is (μ) = $1.02*10^{-3}$ Kg/ sec/m. It is required to:

- Complete the missing dimensions of the flocculator
- Determine the average power dissipated into water
- Determine the governing value of velocity gradient in the flocculator



Hints: P (watt) = $\mu V G^2 = 0.5 C_d * \rho_w * A_p v_p^3$

Question (3)

3-a) Explain with simplified sketches the different zones in the sedimentation tanks.

3-b) What are the functions of under drainage system and wash water gutter in rapid sand filters?

3-c) A water treatment plant treats 42000 m^3/d of water. The settling basins with 4 m side water depth operate with surface loading rate of 28.8 $m^3/m^2/d$. Determine number and dimensions of rectangular settling basins (L= 4B). Check the retention time, horizontal velocity, and the over flow weir. It is also required to estimate the net water production from the treatment plant if the suspended solids (S.S) = 300 mg/L, removal efficiency = 90%, water content = 95%, and sludge density (γ_s) = 1.05 t/m^3.

3-d) A rapid sand filter with size of 6m x 8m after filtering 10000 m^3/d of water in 24 hrs. The filter is backwashed with rate of 500 $m^3/m^2/d$ for 12 minutes. Calculate the rate of filtration, the quantity and percentage of treated water used in washing.

Hints: $V_{SL} = \dfrac{S.S * E * Q}{\gamma_S (1 - W.C)}$

Question (4)

4-a) write about the different disinfectants used in water treatment.

4-b) Mention the different purposes of the ground storage.

4-c) What is the meaning of water hammer? Explain the function of elevated storage to reduce its effect in water distribution network.

4-d) The future population for a community is expected to be 120,000 capita and the water consumption per capita is 240 L/c/d. Design the elevated storage tanks for the following two cases:

Case (1): The working hours are 24 hrs.

Case (2): The working hours are 16 hrs (from 4.00 A.M to 8.00 P.M).

The characteristics consumption data during the day are given as the following:

TIME INTERVAL	CONSUMPTION (L/2h)
12 M.N – 2 A.M	2.4
2 - 4	5.6
4 - 6	8.0
6 - 8	16.0
8 - 10	36.0
10 A.M -12 N	42.4
12 N – 2 P.M	36.0
2 - 4	32.0
4 - 6	32.0
6 - 8	16.0
8 - 10	8.0
10 P.M - 12 M.N	5.6

Question (5)

5-a) Discuss the importance of wastewater treatment. Draw a simplified flow diagram for the consecutive stages of the treatment.

5-b) Explain and outline the relationship between food utilization and bacterial growth in biological treatment of wastewater.

5-c) A Grit removal chamber has a flow through velocity of 0.33m/s and settling velocity of 0.02 m/s. Determine the grit chamber dimensions to receive 15000 m^3/d of wastewater, knowing that the water depth equal to 1.50 of the grit chamber width (d=1.5w).

5-d) A wastewater treatment plant with discharge of 20000 m^3/d. The surface over flow rate is 30 m/d and retention time of 2 hrs. Determine the number and dimensions of the primary settling basins if it is:

i- Circular
ii- Rectangular (L=4B)

Question (6)

6-a) Explain with sketch the different operational stages of sequencing batch reactor (SBR) system for wastewater treatment.

6-b) Write about anaerobic digestion of sewage sludge, explaining its importance in reducing capital and operating costs of wastewater treatment.

6-c) Prove that the recycle sludge flow rate in the activated sludge systems can be calculated from the following equation: $Q_r = \frac{QX - Q_w X_u}{X_u - X}$

6-d) An activated sludge system is to be used for secondary treatment of 20,000 m^3/d of municipal wastewater. BOD_5 in raw wastewater is 300 mg/L, and it is desired to have not more than 30 mg/L of soluble BOD_5 in the effluent. Oxidation ditches system is to be used, and pilot plant analyses has established the following kinetic values; yield coefficient (y) =0.5, endogenous decay rate (K_d) =0.05 d^{-1}, the mean cell residence time (θ_c) is 20 days, assuming a MLSS concentration of 3000 mg/L and under flow concentration of 10,000 mg/L from the secondary clarifier, it is required to determine:

- Volume of the reactor
- Volume of solids that to be wasted daily
- Mass of solids that to be wasted daily
- Sludge recycle ratio
- Aeration period

Hints: $V = \frac{QY\theta_c(S_o - S_e)}{X(1 + k_d\theta_c)}$, $\theta_c = \frac{VX}{Q_w X_u}$

Good luck and best regards,

Dr/ Mohamed Ayoub

Tanta University

Department: Structural Engineering
Total Marks: 70 Marks

Faculty of Engineering

Course Title: Reinforced Concrete III
Date: January 9th 2019 (First term)

Course Code: CSE 4137
Allowed time: 3 hrs

Year: 4th
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) (17 Marks)

1- The Egyptian Code, ECP 203-2007, stipulates that for the ductile frame, if the axial compression load of the column exceeds 0.04 times the concrete cross-section multiplied by the concrete characteristic strength, the ultimate moment capacities of columns must satisfy the following relation : $\Sigma M_c \geq 1.2\ \Sigma M_g$. ***Discuss*** the effect of ignoring this condition on the multi-story frames' mechanism of failure. **(4 Marks)**

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

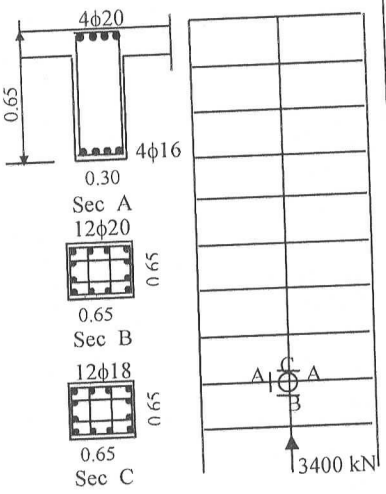


Fig. 1

3- For the multi-story frame shown in Fig. 2, it is required to ***check*** the week-girder strong-column concept at the marked joint. **(6 Marks)**

4- Figure 2 shows a building damaged by the earthquake in Haiti (2010). ***Discuss*** from structural integrity point of view the shown failure case. **(3 Marks)**

Fig. 2

Problem # (2) (14 Marks)

1. Shown in Fig. 3 is sectional elevation of RC Cantilever Frame and RC Beam subjected to the shown loads. ***Discus*** the possibility of using P.S system in both structures. If this system can be used ***Draw*** the most suit able cable profile. **(6 Marks)**

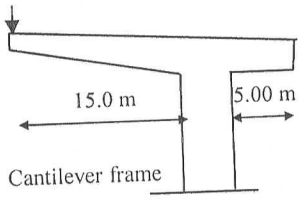


Fig. 1-a

2- A prestressed concrete beam of section 200 mm wide by 300 mm deep is used over an effective span of 5 m to support an imposed load of 4 kN/m(Fig. 4). The density of concrete is 24 kN/m^3. ***Find*** the magnitude of:

i. The concentric (e=0) prestressing force necessary for zero fiber stress at the soffit when the beam is fully loaded, and **(4 Marks)**

ii. The eccentric prestressing force located 100 mm from the bottom of the beam, which would nullify the bottom fiber stresses due to loading. **(4 Marks)**

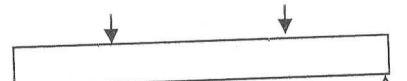


Fig. 1-b

Fig. 3

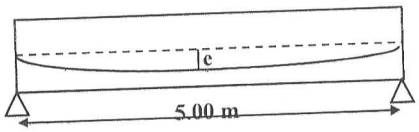


Fig. 4

P.T.O.

Problem # (2) **(16 Marks)**

1. For the curved elevated conduit supported on frames composed of central column with double cantilevers as shown in Fig. 5, it is required to

i. ***Draw*** to scale 1:100 structural plan showing the statical system, arrangement of the supporting frames and all concrete dimensions, **(8 Marks)**

ii. ***Carry out*** complete design of the conduit elements(walls and floor) ,and **(5 Marks)**

iii. ***Give*** full reinforcement details in plan and cross sections. **(8 Marks)**

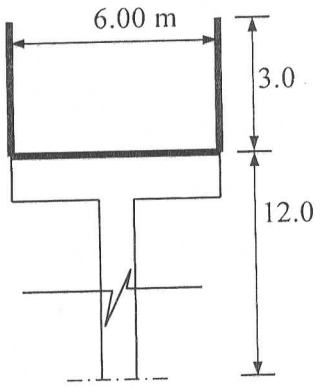


Fig. 5

Problem # (3) **(13 Marks)**

1- Shown in Fig. 6 is sectional elevation of RC dome with 30 m diameter covering an exhibition hall. The hall has a clear height of 10.0 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 dome. **(6 Marks)**

ii. ***Draw*** to a convenient scale a half elevation and a half plan showing the details of reinforcement of the hall. **(7Marks)**

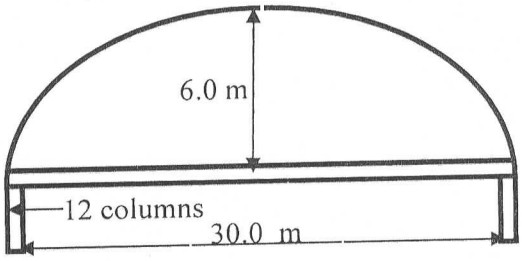


Fig. 6

Problem # (4) **(10 Marks)**

2- For the plan shown in the Fig.7 ***calculate*** the center of rigidity then ***calculate*** the force acting on each wall if the building is subjected to 1600 kN as base shear force. **(10 Marks)**

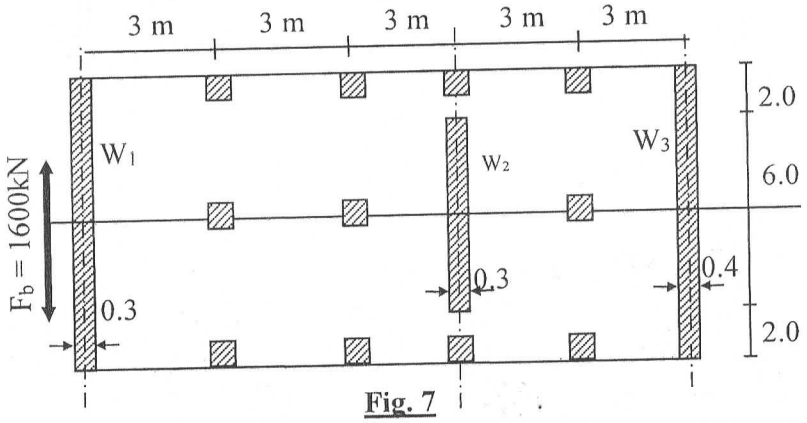


Fig. 7

With best wishes

Course Examination Committee:

Prof. Dr. Mohamed Hussein

Tanta University

Department: Structural Engineering
Total Marks: Marks

Faculty of Engineering

Course Title: Design of Steel Bridges	Course Code: CSE	Year: 4th
Date: Jan 2019 (First term)	Allowed time: 3 hrs	No. of Pages: (2)

Remarks: Answer the following questions and assume any missing data

A double-track, open timber floor, railway, plate girder deck bridge has a span of 30 m divided into 6 equal panels 5.0 m each. The main girders which are welded plate girders are provided with vertical stiffeners every 2.5 m together with a horizontal stiffener at 1/5 the depth from the compression side.

Material of construction is St. 44 with yield stress $F_y = 2.8$ t/cm^2 and Live Load is Train Type "D".

Plates of thickness 8, 12, 24 and 32 mm only are available for the construction of the bridge.

Maximum width of compression flange $\leq$ 60 cm.

For the Main Girder, use: $M_D = 300$ m.t, $M_{D+L+I} = 1600$ m.t, $Q_{D+L+I} = 240$ t, $f_{sr} = 1.26$ t/cm^2.

REQUIRED:

1. Draw with a suitable scale the general layout of the bridge including the required systems of bracing (elevation, plans, side view, … etc.). **(10%)**
2. Calculate the max. B.M. and max. S.F. acting on an intermediate cross-girder due to dead load, live load and impact, then design a suitable built-up section for it. **(15%)**
3. Design a welded plate girder section for the main girder, and check the stresses by the moment of inertia method. **(15%)**
4. It is required to make two step curtailment for the flange plate at 1/9 and 1/4 of the span. Find the dimensions of the reduced flange plate to resist the reduced B.M. therein. **(15%)**
5. Check the web plate for buckling under pure bending stresses in the critical sub-panel only at mid-span. (For upper sub-panel k = 5.00 and for lower sub-panel k = 42.6). **(15%)**
6. Design a built-up double T-section for the load bearing stiffener at the support. **(15%)**
7. Design a bolted field splice for the main girder at 10.25 m from support. Consider the actual S.F. at position of splice to be 80 t. Draw elevation, plan and side view for the splice to scale 1:10. Use M24 Bolts of Grade 10.9 (P_s =5.55 t per one friction surface). **(15%)**

P.T.O.

Guide Equations:

$$\frac{1380 \cdot A_f \cdot C_b}{d \cdot F_y} \qquad \frac{20 \cdot b_f}{\sqrt{F_y}}$$

$$f_{ltb1} = \frac{800 \cdot A_f \cdot C_b}{d \cdot L_u} \leq 0.58 F_y$$

$$f_{ltb2} = 0.58 F_y \qquad \textbf{for} \qquad L_u / r_t < 84\sqrt{C_b / F_y}$$

$$f_{ltb2} = \left(0.64 - \frac{(L_u / r_t)^2 F_y}{1.176 \times 10^5 C_b}\right) F_y \leq 0.58 F_y \qquad \textbf{for} \qquad 84\sqrt{C_b / F_y} \leq L_u / r_t \leq 188\sqrt{C_b / F_y}$$

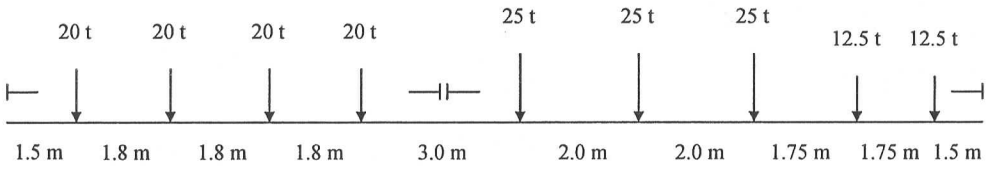
$$f_{ltb2} = \left(\frac{12000 \cdot C_b}{(L_u / r_t)^2}\right) \leq 0.58 F_y \qquad \textbf{for} \qquad L_u / r_t > 188\sqrt{C_b / F_y}$$

$$\lambda_q = \frac{d / t_w}{57}\sqrt{\frac{F_y}{K_q}} \qquad q_b = \frac{0.9}{\lambda_q}(0.35 F_y) \qquad f_c = K\left[1898\left(\frac{t}{b}\right)^2\right]$$

$$C_s = 0.65\left(\frac{0.35 F_y}{q_b} - 1\right) Q_{act} \qquad R = 95 dl$$

$$K_q = 4.00 + \left(\frac{5.34}{\alpha}\right) \qquad \textbf{for} \qquad \alpha \leq 1.0$$

$$K_q = 5.34 + \left(\frac{4.00}{\alpha}\right) \qquad \textbf{for} \qquad \alpha \geq 1.0$$



Train Type "D" (Axle Loads)