University of Asia Pacific
Department of Civil Engineering
Final Examination – Fall 2024
Program: M.Sc. Engineering (Civil)

Course Title: Irrigation and Drainage Engineering | Course Code: CE 6608
Time: 2 hours | Credit Hour: 3:00 | Full Marks: 50

There are five (5) questions. Answer All questions.

1 Write the function of 'under sluices', 'divide wall', 'cross regulator' and 'fish ladder'. (10)

2 (a) What are the different types of cross drainage works and explain differences between Syphon Aqueduct and Syphon. (6)

(b) Write short notes on Watershed canal and contour canal. (4)

3 (a) Estimate the leaching requirement when the EC value of soil extract is 9 mmohs/cm at the 25% reduction in the field of a crop. The EC of irrigated water is 1.3 mmohs/cm. What will be the required depth of water to be applied to the field if the consumptive requirement of the crop is 80 mm. (3)

(b) What are the principal causes and effects of water logging in an irrigated land? (7)

4 (a) Draw a typical layout of different tile drainage system. (3)

(b) In a tile drainage system, the drains are laid with their centers 1.5 m below the ground level. The impervious layer is 9.0 m below the ground level and the average annual rainfall in the area is 80 cm. If 1% of the annual rainfall is to be drained in 24 hours to keep the highest position of the water table 1 m below the ground level, determine the spacing of the drain pipes. Coefficient of permeability may be taken as 0.001 cm/sec. (7)

5 What is meant by 'saline' and 'alkaline' soils? If you irrigate the land with the saline water, what problems will arise and what precautions you can take? (10)

University of Asia Pacific
Department of Civil Engineering
Final Examination (Fall 2024)
Program: M.Sc. Engineering (Civil)

Course Title: Principles of Earthquake Engineering
Credit Hour: 3.0
Time: 1 Hour

Course Code: CE 6701
Full Marks: 60

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1. Estimate the SDE and SSE based on cumulative intensity-frequency relation determined at the site for the following data
   - ❖ Annual intensity-frequency relation, $\log(\nu) = a - bI$ which are defined by co-efficient a and b.
   - ❖ Maximum possible epicentral macro-seismic intensities, I_{max}.
   - ❖ Attenuation values ΔI of intensities for distance of the seismoactive zones to the site. **(15)**

Seismic zone	a	b	I_{max}	ΔI
1	1.57	0.516	X	1.0
2	0.055	0.335	X	1.3
3	0.387	0.372	XI	2.2
4	0.392	0.326	X	0.5
5	1.203	0.506	IX	1.3

2. Measure the factor of safety and liquefaction potential index at a depth of 6 meter for the site soil of a proposed construction for a 7.5 magnitude earthquake producing a PGA of 0.2g. The soil is coarse sand with a saturated unit weight of 20 kN/m^3. The field SPT-N and D_{50} values with depth are given below. **(15)**

Depth (m)	N - value	D_{50}
1.5	2	0.8
3	3	0.9
4.5	4	1.1
6	6	0.5

3. What is 'Critical Void Ratio'? Explain the reasoning behind 'Flow liquefaction' with graphical representation of stress paths and Steady State Line (SSL). **(10)**

4. How does the local site condition affect the propagation of seismic waves? Show evidence of local site effects by theoretical analysis and measured ground motion. **(10)**

5. Define 'Tsunami' and 'Seiche' with description of their mechanisms. What are the lifeline hazards associated with earthquakes? Explain the extent of such hazards with examples. **(10)**

Appendix

$$L = \frac{\tau_{max}}{\sigma_{v'}} = \frac{\alpha_{smax}}{g} \frac{\sigma_v}{\sigma_{v'}} r_d$$

for $0.04\,\text{mm} \leqslant D_{50} \leqslant 0.6\,\text{mm}$

$$R = 0.0882\sqrt{\frac{N}{\sigma_v' + 0.7}} + 0.225 \log_{10} \frac{0.35}{D_{50}}$$

for $0.6\,\text{mm} \leqslant D_{50} \leqslant 1.5\,\text{mm}$

$$R = 0.0882\sqrt{\frac{N}{\sigma_v' + 0.7}} - 0.05$$

$$r_d = 1.0 - 0.015Z$$

$$F_L = \frac{R}{L}$$

$$F = 1 - F_L$$

$$W(Z) = 10\text{-}0.5Z \ (Z \text{ in metres})$$

$$I_L = \int_0^{20} FW(Z)\,\mathrm{d}Z$$

$I_L = 0$: Liquefaction risk is very low

$0 < I_L \leqslant 5$: Liquefaction risk is low

$5 < I_L \leqslant 15$: Liquefaction risk is high

$15 < I_L$: Liquefaction risk is very high

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2024
Program: MSc in Civil Engineering

Course Title: Analysis and Design of Tall Buildings — Course Code: CE 6111
Time: 3 hours — Credit Hour: 3.00 — Full Marks: 100

Answer all the questions

QUESTION 1 [10 MARKS]
Wind load could be critical for skyscrapers of Dhaka city. As structural engineer, propose suitable structural system (with structural model /plan) of proposed 100 stories skyscrapers at city centre of Dhaka. Justify your proposal through critical analysis in terms of design requirements of tall building.

QUESTION 2 [30 MARKS]

a. The conceptual structural model of a 40 storeyed office building (2.4 kN/m^2) and wall / column grid spacing are shown in **Figure 1**. The structure is critical for wind load (average wind pressure is 3 kN/m^2 for 1- 20th floor, and 4 kN/m^2 for 21-40th floor). Analyze the frame of **grid 3** (shown in **Figure 2**) using portal method due to wind load to obtain maximum bending moment and shear force at ground floor of shear wall **W1**. Assume that the shear force would be sustained by the shear wall only. [15]

b. Analyze the shear wall (W1) for P-Delta effect to obtain maximum bending moment at ground floor. The maximum lateral sway at top of the shear wall (W1) could be considered as 80% of allowable lateral sway (0.8*h/500) with linear variation. [15]

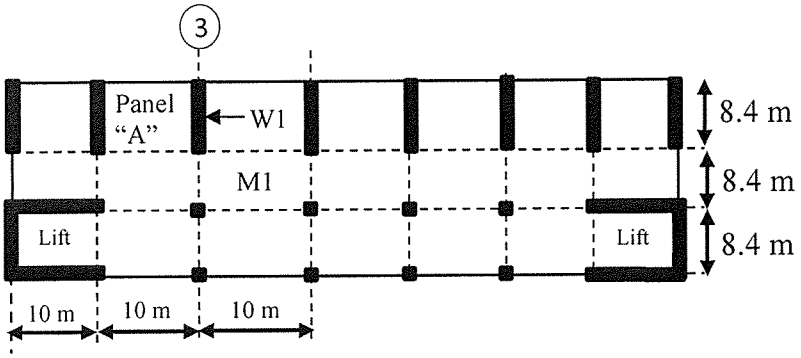


Figure 1. Structural model (floor plan) of tall building

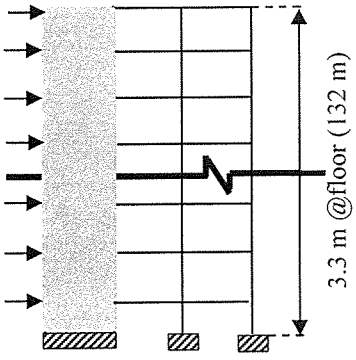


Figure 2. Frame of grid 3

QUESTION 3 [20 MARKS]
The floor of the structure as discussed in **Question 2** would be constructed using one way joist slab. Design the interior joist for the slab panel "A" as shown in **Figure 1**.

QUESTION 4 [20 MARKS]
Design the shear wall (W1) for ground floor loads obtained in **Question 2** (compression, shear, bending moment due to wind, P-Delta moment).

QUESTION 5 [20 MARKS]

The foundation of the structure **(Question 2)** would be mat with pile. In accordance to compressive load and capacity of pile, show the layout plan of piles. Design the interior panel of mat (M1) for long span only as shown in **Figure 1**. Assume design parameters to design the mat.

Fall 2024
Final Exam
CE 6315: Faecal Sludge Management
Marks: 50
Time: 3:00 hour

(The index mentioned in the parenthesis indicates marks)

Instruction: Please assume any data/information if missing.

1. A municipality treats faecal sludge and septage through different solid and liquid treatment units. The municipal authority wants to develop a sanitation safety plan (SSP) to secure public health. They have identified all the actors for developing the SSP within the boundary of the Faecal Sludge Treatment Plant. The following table depicts the information of the actors/exposure groups associated with that municipality's treatment plant.

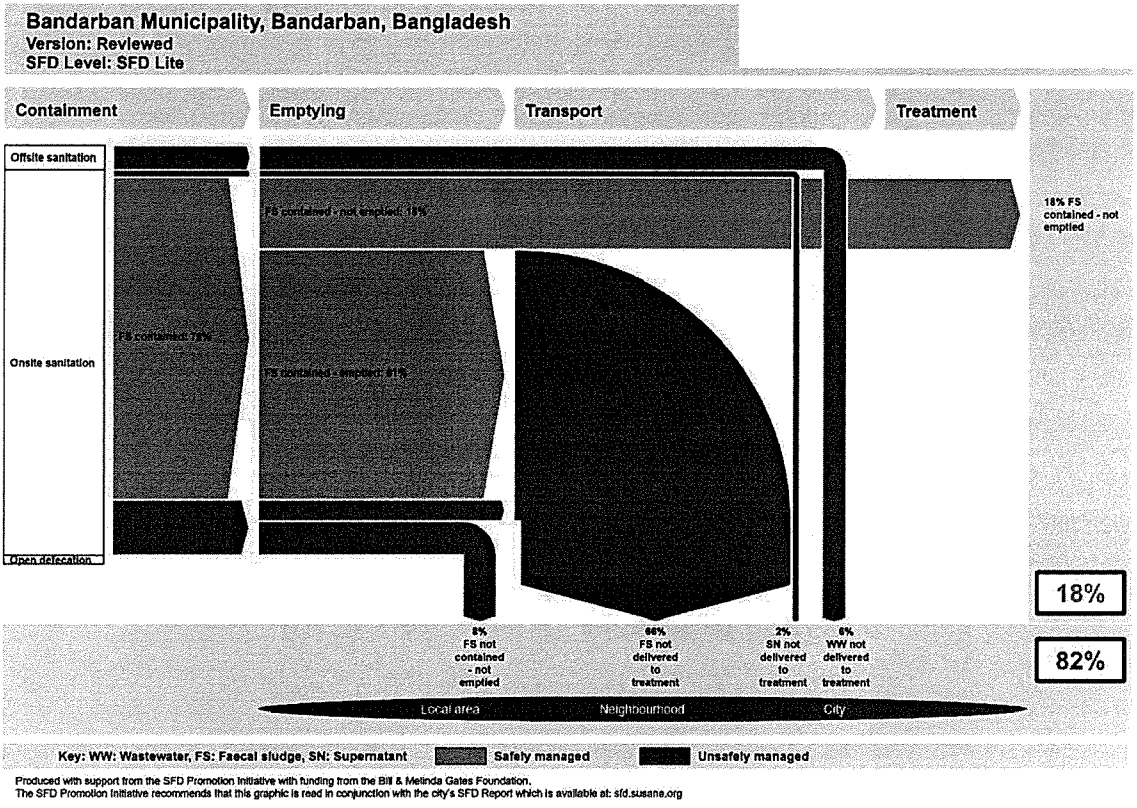
Exposure Groups		
Expsoure Group: Workers (W)		
No.	**Exposoure sub-category - Those who:**	**No. of Individuals**
W1	Maintain the sewer systems	20
W2	Collect and transfer faecal sludge	12
W3	Operate the plant	10
Expsoure Group: Farmers (F)		
No.	**Exposoure sub-category - Those who:**	**No. of Individuals**
F1	Informally use the drains to grow crops	50 + families
F2	Pump the water from drains to irrigate fruit trees	50 + families
F3	Farmers using the Treatment Plant effluent	25 + families
Expsoure Group: Community (LC)		
No.	**Exposoure sub-category - Those who:**	**No. of Individuals**
LC1	Live adjacent to the open drains	5,000
LC2	Live adjacent to farms using Treatment Plant effluent	2,000
LC3	Live adjacent to Treatment Plant	500
Expsoure Group: Consumers (Con)		
No.	**Exposoure sub-category - Those who:**	**No. of Individuals**
Con1	Consume crops grown in wastewater by F1 farmers	> 5,000
Con2	Consume fruit irrigated with wastewater by F2 farmers	> 5,000
Con3	Consume products irrigated with wastewater by F3 farmers	>> 100,000

   (a) Prepare the process flow diagram of SSP based on the information presented in the above table.
   (b) Prepare the risk assessment table mentioning hazard, hazardous event, route of exposure, exposure groups with the analyzed risks as high (H), Medium (M) and Low (L) to prepare the SSP of the municipality with the stated process flow diagram. Assume any relevant data for analyzing the risks, if missing here. **(5+5=10)**

2. Bandarban Municipality is hilly areas and is located in the South-East of Bangladesh. The Municipaility has the following containment system.

Containment type	Percentage of Population
Septic Tank	27
Single Pit	60
Double Pit	6
Damaged and collapsed pits/septic tank	2
No Containment	5

The Municipality has prepared the Shit Flow Diagram (SFD) based on the above containment system which is presented below:



Now, the Municipality wants to improve overall Safely Managed Sanitation from 18% to at least 50% within the next 2 years, and you are assigned to make decisions regarding such sanitation improvement. Prepare your judgment on selecting technologies for improving the target of safely managed sanitation.

(8)

3. A small community produces $5m^3$ of faecal sludge per week with an average solids concentration of 4%. The sludge is to be dewatered on unplanted drying beds until the solids concentration reaches 20%. If the loading rate of dry solids onto the drying beds is limited to $100kg/m^2$ per drying cycle, and each cycle takes approximately 14 days, calculate the minimum area required for the drying beds to manage the weekly sludge production. Assume the density of the initial sludge is $1020kg/m^3$. **(8)**

4. 7 days a week 250 m^3/day of faecal sludge is discharged into a faecal sludge treatment plant. The treatment plant is open 8 hours a day, and has a peak flow of 20 m^3/h. The faecal sludge is discharged into the settling-thickening tank during one working week (7 days). The incoming faecal sludge has an average TSS of 6 g TSS/L, and thickened TSS concentration of 60 g TSS/L. The Sludge Volume Index (SVI) is calculated as 35.1 mL/g. The settling efficiency is 85% and the settling velocity is 0.5 m/h. Calculate the required surface area and tank dimensions for the settling-thickening tank. [The design scum layer is 0.4m. Assume any data if missing]. **(8)**

5. **Answer any four questions from the following** **(4X4=16)**

   a) What are the differences between Faecal Sludge and Septage?
   b) What is the Sanitation Safety Plan? Depict different transmission routes of Helminth egg with associated risks and control measures.
   c) Mention the advantages and limitations of the deep row trench method of FSM.
   d) What is a decentralized wastewater treatment system? Enumerate the main functions of each component of the decentralized wastewater treatment system with figure.
   e) Describe the Hybrid Flow in designing a constructed wetland to treat faecal sludge.
   f) Where and why would the Planted Drying Bed be preferred over the Unplanted Drying Bed while selecting the technologies to treat faecal sludge?