

B.Sc. Egg. (CEE)/ 2nd Sem.

22 August, 2019(Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION

SEMESTER: 2018-2019

COURSE NO. : CEE4201

TIME : 1.5 Hours

COURSE TITLE: Analytical Mechanics

FULL MARKS: 100

There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

1. (a) Determine internal forces at section C of the beam shown in Fig. 1. (13.33)

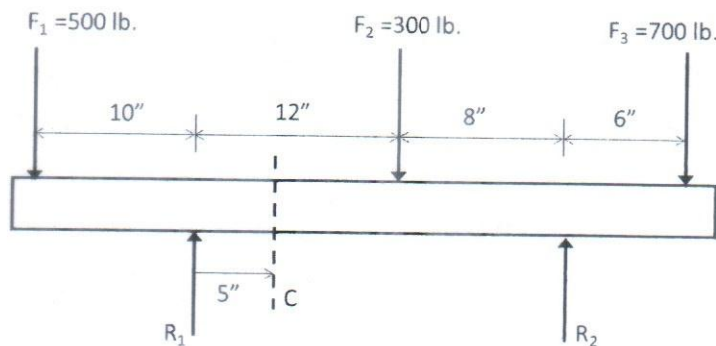


Fig. 1

- (b) A load of $F = 1000$ lb. is applied to a frame, as shown in Fig. 2. Find the horizontal and vertical components of the reactions at A and H and the forces on the members BE and CF. (20)

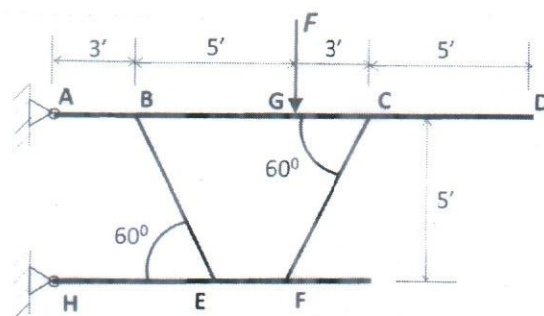


Fig. 2

2. (a) Determine the maximum uniform distributed loading that the cable (Fig. 3) can support if it is capable of sustaining a maximum tension of 12000 lb. (13.33)

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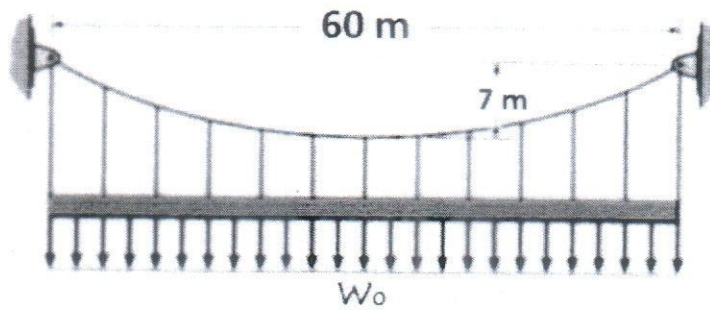


Fig. 3

- (b) If a body is relatively tall and slender, it may tip over instead of sliding. (20)
 Suppose $W = 100$ lb., $Q = 50$ lb., $f = 0.4$, and the inclination of the plane is 30° as shown in Fig. 4. At what maximum distance a , from the inclined plane, the force Q can be applied so that body slides but does not tip over?

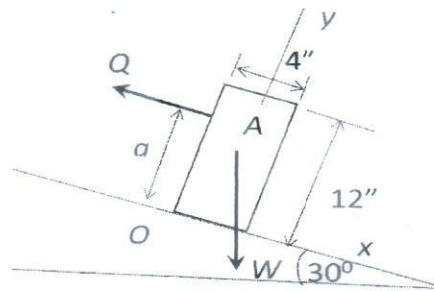


Fig. 4

3. (a) A 60-ft. long cable weighs 300 lb. and is suspended from two points at the same elevation. If the span is 50 ft., how much is the sag? (13.3)
 (b) Determine forces in bars NH, ND and NF of the truss shown in Fig. 5. (20)

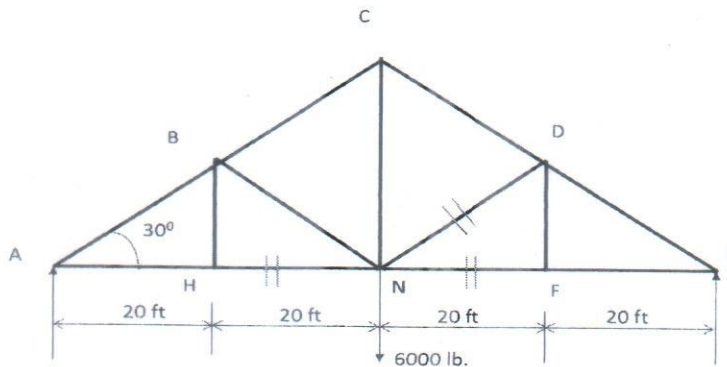


Fig. 5

4. (a) In a Hollywood movie, Tom Cruise is attempting to jump his motorcycle (13.33) over a line of buses parked end to end by driving up a 30° ramp at a speed of 45 m/s (Fig. 6). How many buses can he clear if the top of the takeoff ramp is at the same height as the bus tops and the buses are 15 m long?

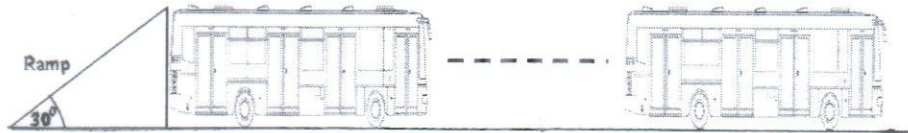


Fig. 6

- (b) In Fig. 7, let $W_A = 1000$ lb. and $f_A = 1/3$. The speed of A changes from $v_{A1} = 10$ fps to $v_{A2} = 35$ fps during 20 sec. Determine (a) the weight W , (b) the distance moved by W during 20 sec., and (c) the tension in the cable. The pulleys are weightless and frictionless.

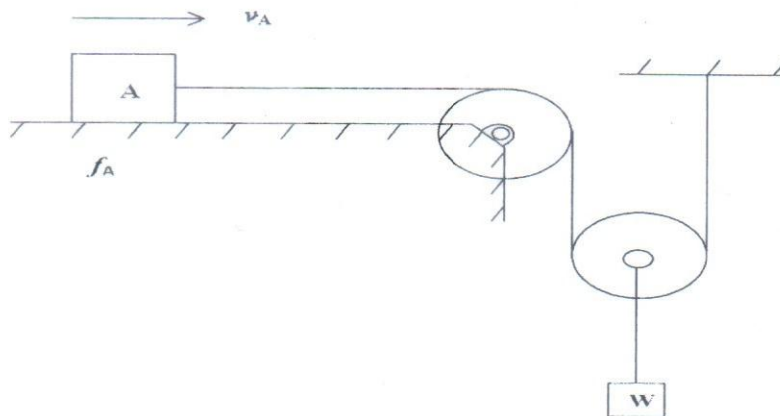


Fig. 7

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 DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION

SUMMER SEMESTER: 2018-19

COURSE NO: **Math 4253**

TIME : 1.5 Hours

COURSE TITLE: Vector Algebra, Vector Calculus and ODE

FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

- 1.(a) \vec{a}, \vec{b} and \vec{c} being non-coplanar vectors, examine whether the following four points $-\vec{a} + 4\vec{b} - 3\vec{c}$, $3\vec{a} + 2\vec{b} - 5\vec{c}$, $-3\vec{a} + 8\vec{b} - 5\vec{c}$ and $-3\vec{a} + 2\vec{b} + \vec{c}$ are coplanar or not. (8)
- (b) If \vec{a}, \vec{b} and \vec{c} are mutually perpendicular vectors of equal magnitude, show that $\vec{a} + \vec{b} + \vec{c}$ is equally inclined to \vec{a}, \vec{b} and \vec{c} . (8)
- (c) A line makes angles $\alpha, \beta, \gamma, \delta$ with the diagonal of cube. Find the value of $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma + \cos^2 \delta$. (9)
2. (a) Find the area of a triangle whose vertices are $A(1, 2, 3)$, $B(2, 5, -1)$ and $C(-1, 1, 2)$. (8)
- (b) Show that (9)
- $$\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$$
- (c) Let $\vec{a} = (1, 1, 1)$, $\vec{b} = (2, -1, 3)$, $\vec{c} = (1, -1, 0)$ and $\vec{d} = (6, 2, 3)$. Express \vec{d} in terms of $\vec{a} \times \vec{b}$, $\vec{b} \times \vec{c}$, $\vec{c} \times \vec{a}$. (8)
3. (a) Form the differential equation from the equation $y = Ae^{2x} + Be^{-x} + C$ (7)
- (b) Solve: $\cos y \ln(\sec x + \tan x) dx + \cos x \ln(\sec y + \tan y) dy = 0$ (9)
- (c) Solve: $\frac{dy}{dx} = \frac{x + 2y - 3}{2x + y - 3}$ (9)
4. (a) Solve $(y^3 - y^2 \sin x - x) dx + (3xy^2 + 2y \cos x) dy = 0$ (9)
- (b) Find the integrating factor of $(\tan y - 3x^4) dx - (x \sec^2 y - x^2 \cos y) dy = 0$ and hence solve it. (8)
- (c) If the population of a city gets doubled 2 years and after 3 years the population is 15000, find the initial population of the city. (8)

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Term Examination**Course No.: Chem 4253****Course Title: Chemistry of Engineering Materials****Summer Semester: 2018-2019****Full Marks: 75****Time: 1.5 Hours**

There are 4 (EIGHT) questions. Answer any 3 (THREE) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

- Q.1 (a) What are the main sources of natural water? Water from which source you consider most suitable for industrial use. Explain your answer. (6)
- (b) What do you understand by hardness of water? Classify hardness water into different classes. Give example of each class. Discuss ion exchange method of removal of hardness of water. (12)
- (c) Discuss the effect of rocks and minerals as the source of impurities of underground water. (7)
- Q.2 (a) Define corrosion and distinguish between corrosion and erosion with suitable examples. Discuss economic aspects of corrosion. (7)
- (b) Discuss the electro-chemical mechanism of corrosion. What do you understand by spontaneity of corrosion reaction? Explain with suitable examples. (8)
- (c) With suitable diagrams discuss briefly the effects of different factors on the rate of under-water corrosion. (10)
- Q.3 (a) Discuss the preparation and application of vitreous porcelain enamel. (6)
- (b) Discuss the importance of metal surface for the application of protective coatings. How the metal surface is being prepared properly for the application of protective coating? (7)
- (c) Define paint. Write the names of different ingredients of paint. Mention the functions of each ingredient of paint. (12)
- Q.4 (a) Write down the Bogue's compounds in cement clinker. Explain the role of gypsum in cement. (4)
- (b) Describe the manufacturing procedure of ordinary Portland cement (OPC) clinker in Bangladesh with mentioning all the possible reactions. (8)
- (c) Discuss the setting and hardening of cement. (3)
- (d) Write down the possible physical properties of cement. Describe the procedure to measure the compressive strength of cement. (6)
- (e) What are the differences between ordinary Portland cement (OPC) and composite Portland cement (CPC) and discuss the saline resistance nature of composite Portland cement. (4)

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TERM : MID SEMESTER EXAMINATION

SUMMER SEMESTER: 2018-2019

COURSE NO. : PHY 4253

TIME: 1.5 Hours

COURSE TITLE: Physics II

FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

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1. (a) Explain the statement "like charges repel and unlike charges attract". (04)
 - (b) (i) A metallic ring of radius 'a' consists of charge q. Calculate electric field E for points on the axis of the ring a distance x from its center and also discuss the value of E when $x=0$ and $x \gg a$. (16)
 - (ii) If a dipole \vec{P} is placed in a uniform electric field \vec{E} , then show that electric potential energy stored in the field is $U = -\vec{P} \cdot \vec{E}$.
 - (c) Show that in a hydrogen atom the Coulomb force is about 10^{39} times greater than the gravitational force. (05)
 2. (a) What do you understand by electric field intensity and electric flux? (04)
 - (b) i) Find the electric potential for points on the axis of a uniformly charged circular disk a distance x from its center, having surface charge density σ . (16)
 - ii) Obtain the expression of electric potential due to a dipole.
 - (c) Two metal spheres are 3.0 cm in radius and carry charges of $+1.0 \times 10^{-8}$ C and -3.0×10^{-8} C, respectively, assumed to be uniformly distributed. If their centers are 2.0 cm apart, calculate the potential of the point half way between their centers. (05)
 3. (a) State and explain Gauss's law in electrostatics. (04)
 - (b) (i) Deduce Gauss's law in a dielectric medium. (16)
 - (ii) What is an RC circuit? In case of an RC circuit, obtain expressions for the growth and decay of charge and current with time and show these variations with graphs.
 - (c) A parallel-plate capacitor has circular plates of 8.0-cm radius and 1-mm separation. What charge will appear on the plates if a potential difference of 100 V is applied? (05)
 4. (a) Define magnetic field in terms of a moving charge of velocity v and its side-ways deflecting force F. Write down the expression of Lorentz Force. (04)
 - (b) (i) Show that the side-ways force \vec{F} on a current carrying conductor of length l placed in a magnetic field B is expressed by: $\vec{F} = i\vec{l} \times \vec{B}$, where i is current flowing through the conductor. (16)
 - (ii) Derive expressions of resistivity and resistance in case of a metal.
 - (c) A wire 1.0m long carries a current of 10 A, and makes an angle of 30° with a uniform magnetic field with $B = 1.5 \text{ W/m}^2$. Calculate the magnitude and direction of the force on the wire. (05)

B.Sc. Engg. (CEE)/ 2nd Sem.

August 23, 2019 (Morning)

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TERM : MID SEMESTER EXAMINATION

SUMMER SEMESTER: 2018-2019

COURSE NO. : GS 4253

TIME : 1.5 Hours

COURSE TITLE: Ecology and Environment

FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

1. (a) What do you understand by engineering ecology? Why is it necessary to have the knowledge of ecology for the civil engineers? Give two practical examples. (07)
- (b) Suppose, some ecology explorers have paid a visit to your locality for exploring different organisms where they have identified greenish-blue like organisms in the pond as shown in **Figure 1** (enlarged view) and **Figure 2** (microscopic view). Write down the possible name of these organisms. How these organisms gain energy and carbon from their sources and how they utilize these for their subsistence? (10)



Figure 1

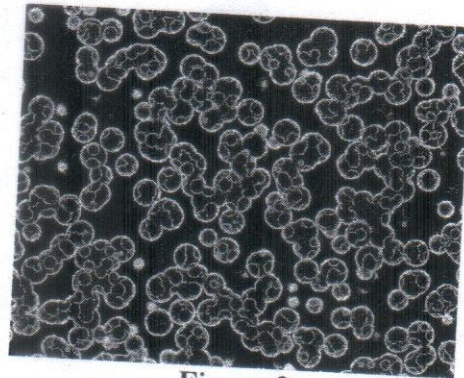


Figure 2

- (c) Differentiate among aerobic respiration, anaerobic respiration and fermentation with examples and their corresponding reactions. (08)
2. (a) What is the statement of Shelford's law of tolerance? Discuss about the typical shapes of range of tolerance curve. In a neat sketch explain the range of tolerance curve for *Homo sapiens*. At present there are almost 7.7 Billion people living in this earth. Which stage can be referred for this population? Briefly explain how humans have extended their carrying capacity. (10)
- (b) Population of *Axis axis* in the Sundarbans at the end of 2015 was 258. Births and Deaths of *Axis axis* till 2018 are shown in the table below. Also note that, importation of 8 animals of this species have been done in the year of 2016 and 3 animals of this species have been exported abroad in the year 2017. Considering three years as a unit, if per capita population density is assumed to

be decreased by 20% of the current density in the next three years, then what will be the population of *Axis axis* in the Sundarbans in 2021 (i.e., at the end of 2020)?

Year	No. of Births	No. of Deaths
2016	51	61
2017	54	57
2018	56	51

- (c) Write down the differences between grazing food chain and detritus food chain. (05)
3. (a) Give the formal definition of hydrologic cycle. In a neat sketch, draw and explain the hydrologic cycle including all natural and man-made processes. Specify two significant man-made progressions which have negatively influenced the hydrologic cycle in Dhaka city. (13)
- (b) Define food chain and food web. Why these two terms are significant in ecology? Write down the similarities and dissimilarities between food web and food chain. From the food web shown in **Figure 3**, identify all food chains associated with it. (12)

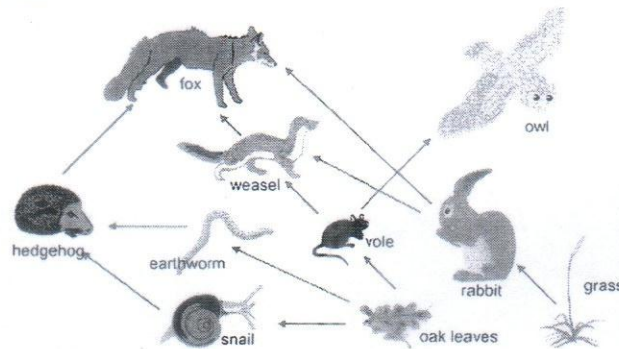


Figure 3

4. (a) What is ecological pyramid? Specify the rules for forming an ecological pyramid. Classify different types of ecological pyramids based on their functions. What is meant by ecological succession? Why succession takes place in different areas? (08)
- (b) What are the types and characteristics of a lake ecosystem? Classify the zones of a lake ecosystem and show them in a figure. A zone of the lake is the warmest zone during the daytime. Mention the name and other features of that zone. (08)
- (c) As a civil engineer, you have been offered to design an 8 (eight) storied residential building in an area of 6 Katha by one of your clients. The location is situated in Dhaka Metropolitan area adjacent to a 4 lane highway. The site is currently being a small water retaining pond, which will be filled up by sands before construction according to the intent of your client. In such circumstances, write down your approach with proper justifications from ecological point of view. Also mention some alternative approaches which you can suggest to your client. What regulations do you think local authority could establish regarding this kind of instances? (09)

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B. Sc. Engg. (CEE)/ 4th Sem.

30 August, 2019 (Afternoon)

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ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION SUMMER SEMESTER: 2018-2019
 COURSE NO. : CEE 4411 TIME : 1.5 Hours
 COURSE TITLE: Engineering Materials FULL MARKS: 100

There are 4 (Four) questions. Answer any 3 (Three) questions including **Question 1 and Question 2**. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The symbols have their usual meaning.

1. The sieve analysis data of a coarse aggregate sample of a construction project are summarized below: 40

ASTM Sieve	Material Retained (g)
3 inch	0
1.5 inch	0
1 inch	1500
¾ inch	2900
½ inch	10
3/8 inch	10
#4	1500
#8	0
#12	0
#16	0
#30	0
#40	0
#50	0
#100	0
#200	40
Pan	40

- (i) Calculate FM of the aggregate sample,
- (ii) Draw grading curve of the aggregate sample,
- (iii) Calculate the amount of fine aggregate, silt and clay in the sample,
- (iv) Make a brief discussion on FM, sieve analysis data, and grading curve,
- (v) What measures are necessary to improve the grading of the sample?
- (vi) If the required FM of the aggregate is 6.6, in what ratio the aggregate sample is to be mixed with another aggregate sample of FM = 6.0 to get the required FM?

- (vii) Assume all particles of a coarse aggregate sample are passed through 3 inch sieve and retained on 1.5 inch sieve. What is the FM of the sample?
- (viii) Assume all particles of a fine aggregate sample are passed through #50 sieve and retained on #100 sieve. What is the FM of the sample?
- (ix) What sieve is used to separate fine aggregate from coarse aggregate? What is the opening of this sieve?
- (x) What do you mean by 1 inch sieve and #4 sieve.

2. A mixture proportion of mortar for a plaster work is to be prepared based on the following data: 35

Water to cement ratio	0.50
Sand to cement ratio	2.50
Specific gravity of cement (CEM Type I)	3.10
Specific gravity of sand	2.65
Amount of air in mortar (%)	1.50

- (i) Calculate the amount of cement, sand, and water necessary for a cubic meter of mortar,
- (ii) Calculate the volumetric mixture proportions of mortar,
- (iii) Calculate the compaction factor,
- (iv) Calculate the unit weight of mortar,
- (v) Calculate the cost of materials for 1 cubic meter of mortar,
- (vi) Mention the other possible cost items in addition to the materials (as considered in (v)) to fix the unit cost of mortar,
- (vii) If sand to cement ratio is changed from 2.50 to 3.00, what change will occur in compressive strength of the mortar?
- (viii) Write the disadvantages of volumetric mixture proportions,
- (ix) If CEM Type II B-M cement is used instead of CEM Type I cement. What changes will occur in fresh and hardened properties of mortar.
- (x) "Plaster works are very sensitive to curing"- Why?

Given: Unit weight of SSD sand with void 1450 kg/m^3 , Unit weight of cement with void = 1400 kg/m^3 , Price of 1 bag cement = 450 Tk, Price of 1 cft sand = 40 Tk, Price of 1 liter water = 0.5 Tk. Assume reasonable data, if necessary.

- 3. (a) Define hydration of cement. Explain hydration of cement with chemical reactions. Explain morphology of hydration products. 7
- (b) Write the names of some mineral admixtures. Explain the importance of utilization of these materials in cement. 4
- (c) Compare CEM Type I, CEM Type II A-S cement with respect to composition, cost, initial setting time, early strength, long-term strength, and environmental 3

- benefits.
- (d) Draw typical stress-strain curves of steel with different grades. How do you calculate the Young's modulus of steel for a high grade steel? 4
- (e) Explain the properties of good quality aggregate. 4
- (f) Compare creep and relaxation. 3
4. (a) Discuss the functions of silica, alumina and lime in brick earth. 3
- (b) Write some field tests of bricks. 3
- (c) Explain the impacts of brick production in our environment. 4
- (d) "High grade steel is not preferable in severe earthquake zone" – Why? 5
- (e) The following data were recorded during specific gravity test of a coarse aggregate sample: 10

Weight of SSD sample in air	2000 g
Weight of SSD sample in water	1000 g
Weight of OD sample in air	1800 g

Calculate the following:

- (i) Absorption capacity (in %),
- (ii) Bulk specific gravity (SSD basis),
- (iii) Bulk specific gravity (OD basis),
- (iv) Apparent specific gravity,
- (v) If weight per cubic meter of SSD sample is 1200 kg. Calculate the amount of void (%) in the sample.

Table Traditional American and British Sieve Sizes

Aperture mm or μm	Approximate Imperial equivalent in.	Previous designation of nearest size	
		BS	ASTM
125 mm	5	—	5 in.
106 mm	4.24	4 in.	4.24 in.
90 mm	3.5	3½ in.	3½ in.
75 mm	3	3 in.	3 in.
63 mm	2.5	2½ in.	2½ in.
53 mm	2.12	2 in.	2.12
45 mm	1.75	1¾ in.	1¾ in.
37.5 mm	1.50	1½ in.	1½ in.
31.5 mm	1.25	1¼ in.	1¼ in.
26.5 mm	1.06	1 in.	1.06
22.4 mm	0.875	7/8 in.	7/8 in.
19.0 mm	0.750	3/4 in.	3/4 in.
16.0 mm	0.625	5/8 in.	5/8 in.
13.2 mm	0.530	1/2 in.	0.530 in.
11.2 mm	0.438	—	7/16 in.
9.5 mm	0.375	3/8 in.	3/8 in.
8.0 mm	0.312	5/16 in.	5/16 in.
6.7 mm	0.265	1/4 in.	0.265 in.
5.6 mm	0.223	—	No. 3½
4.75 mm	0.187	7/16 in.	No. 4
4.00 mm	0.157	—	No. 5
3.35 mm	0.132	No. 5	No. 6
2.80 mm	0.111	No. 6	No. 7
2.36 mm	0.0937	No. 7	No. 8
2.00 mm	0.0787	No. 8	No. 10
1.70 mm	0.0661	No. 10	No. 12
1.40 mm	0.0555	No. 12	No. 14
1.18 mm	0.0469	No. 14	No. 16
1.00 mm	0.0394	No. 16	No. 18
850 μm	0.0331	No. 18	No. 20
710 μm	0.0278	No. 22	No. 25
600 μm	0.0234	No. 25	No. 30
500 μm	0.0197	No. 30	No. 35
425 μm	0.0165	No. 36	No. 40
355 μm	0.0139	No. 44	No. 45
300 μm	0.0117	No. 52	No. 50
250 μm	0.0098	No. 60	No. 60
212 μm	0.0083	No. 72	No. 70
180 μm	0.0070	No. 85	No. 80
150 μm	0.0059	No. 100	No. 100
125 μm	0.0049	No. 120	No. 120
106 μm	0.0041	No. 150	No. 140
90 μm	0.0035	No. 170	No. 170
75 μm	0.0029	No. 200	No. 200
63 μm	0.0025	No. 240	No. 230
53 μm	0.0021	No. 300	No. 270
45 μm	0.0017	No. 350	No. 325
38 μm	0.0015	—	No. 400
32 μm	0.0012	—	No. 450

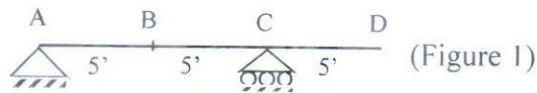
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Semester: Mid Semester Examination
Course No.: CEE 4413
Course Title: Mechanics of Solids II

Summer Semester: 2018-2019
Full Marks: 75
Time: 1.5 hours

There are 4 (Four) Questions. Answer any 3 (Three) questions. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning. Assume reasonable values for any missing information.

- 1(a) Find deflection of point B and D along with rotation at point C for uniformly distributed load of 1 kip/feet over the beam (Figure 1). EI constant. Use direct integration method. (15)

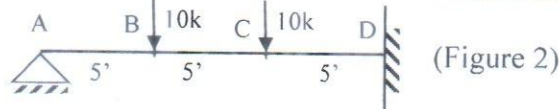


- (b) Develop the equations for finding normal and shear stresses in any inclined plane. Consider 2D case only. Write down the equations for maximum and minimum normal force and shear using the concept of Mohr circle. (10)

- 2(a) A square column of 18-ft length has two fixed ends. $E=30 \times 10^6$ psi and proportion limit is 28 ksi. Find minimum size of column if it buckles at proportional limit. (10)

- (b) A cantilever beam of 18-ft span has 1 kip/feet uniformly distributed load. If another concentrated load is applied at the mid-span, what should be the magnitude and direction of that load so that the net deflection at the cantilever free end is zero? $EI=5000$ k-ft². Use any method. (15)

- 3(a) For beam shown in Figure 2, find deflection at point C. Use moment-area method. $EI=$ constant. (15)



- (b) In what scenario, a beam will have perfectly round-arc deflected shape (i.e. part of a larger circle)? Prove that for a thin-walled pressure cylinder, hoop stress is twice of longitudinal stress. (10)

- 4(a) A sphere of 1m dia has wall thickness of 2.5mm. It holds gas at 5 MPa pressure. The sphere is made of two half-spheres. 10 bolts of 6mm dia holds two parts together. Find stress in the bolts. (10)

- (b) A beam (shown in Figure 3(a)) is loaded with 15 kip concentrated load acting at 15 degree inclination with the vertical at the mid-span (clockwise when looking from C to B, Figure 3(b)). Find stresses at four corners (D, E, F, G) at the mid-span beam section along with horizontal and vertical deflection of the mid-span. $EI=8000$ k-ft². (15)

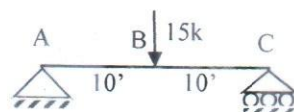


Figure 3(a)

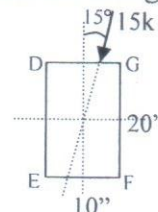


Figure 3(b): Section at B

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Semester Examination

Course No.: CEE 4431

Course Title: WATER SUPPLY ENGINEERING

Summer Semester: 2018-19

Full Marks: 75

Time: 1.5 hours

There are 4 (FOUR) Questions. Answer any 3 (THREE) questions. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning.

- 1 (a) What is potable water and palatable water? List the impurities that needs to be removed in order to make water potable. (05)
- (b) What are the important characteristics of an indicator organism? If coliforms are detected in a water supply, will the water cause diseases to those who drink it? Explain your answer. (04)
- (c) The population data of an urban area is given below: (10)

Year	1960	1970	1980	1990	2000	2010
Population (Thousand)	30	35	44	52	65	76

If the per capita water consumption is 450 lpcd, estimate the design capacity of the treatment plant and the distribution network for water supply in the area for 2040. Using the least square parabolic method for population projection.

- (d) What are the factors to be considered in selecting a water source for water supply? Why most of the water supply systems in Bangladesh are based on groundwater? Show the essential elements of a surface water based water supply system in a neat sketch. (06)
- 2 (a) What is the effect of surface overflow rate (SOR) on the performance of plain sedimentation process? Explain with diagram. Why the performance of a radial circular basin is better than a long rectangular basin? (05)
- (b) A water treatment plant has a flow rate of $0.6 \text{ m}^3/\text{sec}$. The settling basin is 20m long, 3m deep and 6m wide. Will particles that have settling velocities of 0.4 cm/sec and 0.25 cm/sec be completely removed? If not, what percent of these particles will be removed? (06)
- What should be the length of the basin to remove 100% of the particles that have a settling velocity of 0.4 cm/sec?
- (c) What are recommended treatment methods for removal of the following impurities from raw water? (05)
- i. Dissolved substances
 - ii. Fe/Mn/As
 - iii. Bacteria/viruses
 - iv. Taste and odor
 - v. Suspended solids in water

- (d) What information is obtained from Jar test and why is it important to the operation of a water treatment plant? Following are the result of a Jar test experiment: (09)

Alum dosage (mg/L)	5.0	7.0	10.0	12.0	15.0	20.0
Turbidity remaining (NTU)	14.0	9.5	5.0	4.5	6.0	13.0

Find the optimum coagulant dosage and determine the theoretical amount of alkalinity that would be consumed at the optimal alum dose.

- 3 (a) What are the environmental significance of TDS? Classify water in terms of TDS. (07)
 A city must treat about 15000 m³/day of water. Flocculation particles are produced by coagulation and a column analysis indicates that an over flow rate of 20 m/day will produce satisfactory removal at a depth of 3.5m. Determine the size of (i) required rectangular settling tanks, and (ii) required diameter of the circular settling tanks.
- (b) What are the allowable limit of turbidity, Fe, nitrate, fluoride, arsenic and cadmium in drinking water according to WHO guideline and Bangladesh standard? (03)
- (c) What are the causes of alkalinity in water? Explain the type of hardness present in water under the following conditions: (07)
- i. When alkalinity = hardness
 - ii. When alkalinity > hardness and pH < 8.3
 - iii. When alkalinity < hardness.
- (d) A settling analysis is run on a Type 1 suspension in a laboratory column with a port 1.8m below the suspension surface. The data obtained are shown below. (08)

Time (min)	0	3	5	10	20	40	60
TSS Conc. (mg/L)	220	116	98	75	35	10	2

What will be the theoretical removal efficiency in a settling basin with an SOR of 432 m³/m².day?

- 4 (a) What are the objectives of coagulation and flocculation process? State the design criteria of rapid and slow mixing chamber. (03)
- (b) What are the advantages of ion exchange softening process over chemical precipitation process? What are the limitations of ion exchange softening process? In ion exchange softening process, some raw water is by-passed and then added to the treated water-explain why? (05)
- (c) Why groundwater softening by ion exchange process should be done immediately after extraction? (02)
- (d) State the design parameters for both type-I and type-II settling basin. (04)
 An engineer has proposed to add coagulants to improve the Type I solids removal in the clarification zone of a sludge thickener and thereby increase the overall solids removal. Is this a good idea-explain?
- (e) What are the various types of water demand and their average percentage wise distribution in an urban area? (03)
- (f) A city of 60,000 residents has an average water demand of 350 lpcd. The institutional and commercial/industrial areas of the city are 200 and 300 hector, respectively and water demand expected is 20 and 23 m³ per hector per day. The public water use and unaccounted water are 10 and 6 percent of total municipal water demand, respectively. Calculate total municipal water demand and each component as percent of total municipal water demand. (08)

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ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Semester Examination
Course No.: CEE 4441
Course Title: Soil Mechanics

Summer Semester: 2018-2019
Full Marks: 100
Time: 1.5 Hours

There are 4 (Four) questions. Answer any 3 (Three) questions. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

- 1 (a) Briefly describe the classification of glacier transported soil. (5 $\frac{1}{3}$)
- (b) Describe the determination process of the shrinkage limit. (5)
- (c) Table 1 shows the results of sieve analyses of soil A and soil B. Answer the followings for both soils- (23)
- (i) Plot grain-size distribution curves.
- (ii) Determine the group symbols and group names according to the Unified Soil Classification System for both Soil A and Soil B. (Use, **Table A**).
- (iii) Which soil of Table 1 is better for subgrade material in constructing Road?

Table 1. Results of sieve analyses

Sieve No.	Sieve Opening (mm)	Mass retained on each sieve (g)	
		Soil A	Soil B
#4	4.75	0	0
#6	3.35	2	1
#10	2.00	14	10
#20	0.85	60	116
#40	0.425	170	20
#60	0.25	140	88
#100	0.15	56	170
#200	0.075	40	90
Pan	-	18	5

- 2(a) Define the term soil compaction. Describe the benefits of soil compaction. (7 $\frac{1}{3}$)
- (b) Briefly describe the Modified Proctor Compaction Test process for obtaining the maximum dry unit weight and optimum moisture content of the soil. Write down the usage of the Modified Proctor Compaction Test. (8)
- (c) Compaction tests are carried out of a borrow pit for constructing an earth dam of volume 8,000 m³. Soil characteristics of the pit are: $G_s = 2.75$, $e = 1.2$, $w = 9\%$, $w_{opt} = 14\%$, $\gamma_{d(max)} = 17.5$ kN/m³. The dry density of the dam, $\gamma_d = 17.5$ kN/m³. Use $\gamma_w = 9.81$ kN/m³. Answer the following questions- (18)
- (i) Determine S_r and γ_d for the borrow pit.
- (ii) Determine the volume of the soil required for the construction of the dam.
- (iii) How much water needs to be added for getting the maximum dry density of the dam?

- 3(a) What is the principle of effective stress? Write down the importance of the principle of effective stress in designing geotechnical structures. (5 $\frac{1}{3}$)
- (b) Derive the expression of the critical hydraulic gradient? (8)
- (c) Determine the dry unit weight of sand having relative density of 60%. Properties of the sand are: $e_{max}=1.10$, $e_{min}=0.45$, $G_s=2.70$. Use $\gamma_w = 9.81 \text{ kN/m}^3$. (6)
- (d) Draw total stress, pore water pressure and effective stress distributions for the ground shown in Fig.1 for - (i) immediately after applying the surcharge, and (ii) after complete dissipation of the excess pore water pressure. Use $\gamma_w = 9.81 \text{ kN/m}^3$. (14)

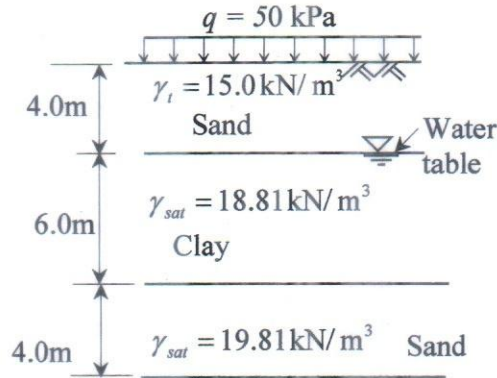


Fig. 1 for Q.3(d)

- 4(a) Derive the expressions of the coefficients of permeability for the vertical and horizontal directions in anisotropic soil. (8 $\frac{1}{3}$)
- (b) Answer the following questions considering one-dimensional flow through soils shown in Fig.2. Here, $A_1=10 \text{ m}^2$, $k_1=2 \times 10^{-4} \text{ m/s}$, $A_2=10 \text{ m}^2$, $k_2=1 \times 10^{-3} \text{ m/s}$, $A_3=5 \text{ m}^2$, $k_3=5 \times 10^{-3} \text{ m/s}$. (25)
- Compute flow velocities,
 - Compute the amount of flow in 5 days.
 - Draw the graphs of total head and pressure head with the distance.
 - Determine the head loss in all soil layers for $k_1=2 \times 10^{-5} \text{ m/s}$ keeping other parameters fixed.
 - Write down your comments on the results of (iii) and (iv).

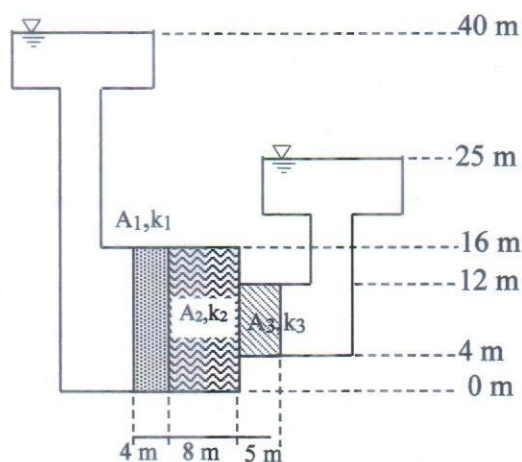


Fig. 2 - for Q.4(b)

Table A. Unified Soil Classification System for Q.1(c)

Criteria for assigning group symbols				Group symbol
Coarse-grained soils More than 50% of retained on No.200 sieve	Gravels More than 50% of coarse fraction retained on No.4 sieve	Clean gravels Less than 5% fines Gravels with Fines More than 12% fines	$C_u \geq 4$ and $1 \leq C_c \leq 3$ $C_u < 4$ and/or $1 > C_c > 3$ $I_p < 4$ or plots below "A" line $I_p > 7$ or plots on or above "A" line	GW GP GM GC
	Sands 50% or more of coarse fraction passes No.4 sieve	Clean sands Less than 5% fines Sands with Fines More than 12% fines	$C_u \geq 6$ and $1 \leq C_c \leq 3$ $C_u < 6$ and/or $1 > C_c > 3$ $I_p < 4$ or plots below "A" line $I_p > 7$ or plots on or above "A" line	SW SP SM SC
Fine-grained soils 50% or more passes No.200 sieve	Silts and clays Liquid limit less than 50	Inorganic	$I_p > 7$ or plots on or above "A" line $I_p < 4$ or plots below "A" line	CL ML
		Organic	Liquid limit (oven dried) Liquid limit (not dried)	OL
	Silts and Clays Liquid limit 50 or more	Inorganic	I_p plots on or above "A" line I_p plots below "A" line	CH MH
		Organic	Liquid limit (oven dried) Liquid limit (not dried)	OH
Highly Organic Soils	Primarily organic matter, dark in color, and organic odor			Pt

Gravels with 5 to 12% fine require dual symbols: GW-GM, GW-GC, GP-GM, GP-GC.

Sands with 5 to 12% fines require dual symbols: SW-SM, SW-SC, SP-SM, SP-SC.

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION

SUMMER SEMESTER: 2018-2019

COURSE NO. : **Math 4453**

TIME : 1.5 Hours

COURSE TITLE: **Probability and Statistics**

FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) of them. Programmable calculators are not allowed. Do not write anything on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

1. a) Write down the frequency table from the following data and hence calculate (i) (13)
 Mean, (ii) Median, (iii) Mode and (iv) Quartiles.

55 22 45 78 80 65 55 89 63 54 68 32 63 55
 45 42 33 36 33 25 46 39 41 42 61 78 58 68
 92 56 52 54 45 46 48 49 52 53 54 55 72 71
 22 46 47 75 73

- b) A factory produces two types of lamps. In an experiment on the working life of (12)
 these lamps the following results were obtained:

Length of life (in hours)	No. of Lamps	
	Type-A	Type-B
500-700	5	4
700-900	11	30
900-1100	26	12
1100-1300	10	8
1300-1500	8	6

Compare the variability using the coefficient of variation.

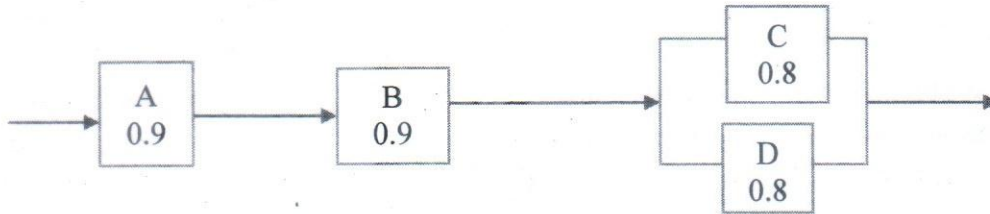
2. a) What is moment of a distribution? Establish the general relationship between raw (10)
 moments and central moments.

- b) An analysis of workers resulted in the following distribution: (15)

Earnings (tk.)	50-70	70-90	90-110	110-130	130-150	150-170	170-190
No of Employees	4	8	12	20	6	7	3

Calculate the first four moments about assumed mean. Convert the result into moments about the mean. Compute the value of skewness and kurtosis and comment on the result.

3. a) Define: (i) Random experiment, (ii) Sample space, (iii) Sample point, (iv) Event, (v) Probability with an example. (6)
- b) An electrical system consists of four components as illustrated in the following figure. The system works if components A and B work and either of the component C or D work. The reliability (Probability of working) of each component is also shown in the figure. (11)



Find the probability that (i) the entire system work and (ii) the component of C does not work, given that the entire system works.

Assume that four components work independently

- c) There are 100 fuses in a box of which 20 are defective. If a sample of 10 fuses are chosen at random without replacement, find the probability that the sample contains 4 defective fuses. (8)
4. a) Define discrete and continuous random variable with examples (4)
- b) A carton of 10 light bulbs contains 4 defective bulbs. If 3 light bulbs are selected at random without replacement, find the probability distribution for the number of defective bulbs selected. (7)
- c) Let, X denotes the length of life of an electron tube. Suppose that the p. d. f. of X is (7)
- $$f(x) = \frac{1}{100} e^{-x/100}, x > 0$$
- Find μ and σ^2
- d) Twenty percent of TVs produced in an industry are defective. If 4 TVs are put in a box for marketing. In how many boxes do you expect to have (i) one defective TV, (ii) two defective TVs, (iii) at most 2 defective TVs in a consignment of 2000 such boxes? (7)

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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester: Mid Semester Examination

Summer Semester: 2018-2019

Course No.: CEE 4461

Full Marks: 75

Course Title: Civil and Environmental Technology II

Time: 1.5 hours

There are 4 (Four) Questions. Answer any 3 (Three) questions. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning

- 1(a) Define EIA. Draw a schematic diagram showing the anticipated environmental impact of a development project and the rectification of the impacts after incorporating EIA into the project. (05)
- (b) Draw a flowchart showing the evolution of EIA in Bangladesh. (05)
- (c) Draw a flowchart showing the steps of EIA process. (10)
- (d) If the laws of a country permits hiring of consultant for conducting EIA by project proponent, what inherent risks will be associated with it? Provide suggestions for making the EIA process credible and fair in such cases. (05)
- 2(a) Write the process of obtaining Environmental Clearance Certificate in Bangladesh for a project involving Hospital waste management. (07)
- (b) What are the main reasons behind delays caused by EIA? (04)
- (c) Draw a typical project cycle and then add components of EIA at its different stages. What changes can EIA bring when it is introduced in a project cycle? (10)
- (d) State two major impacts of a coal-based thermal power plant project. List two stakeholders to be consulted during the scoping phase as a means of addressing these impacts. (04)
- 3(a) For housing society development project in an area, infrastructural baseline data is required. You have enough time and human resource in hand to conduct a baseline survey. Which method of baseline data collection will you follow? Also make an outline of the survey you are going to conduct, select the study components and make a list of information you want to collect during the survey. (10)
- (b) A 10 seat improved pit latrine is planned at a new market site and a drinking water tube well is located 12 meter away. National policy restricts the construction of pit latrine at a distance less than 10 meter from groundwater wells. Groundwater contamination has been identified as the most significant potential impact of this project in the IEE report. Discuss the significance of this impact taking context and intensity as judging factors. (05)
- (c) Write the content of ToR (Terms of Reference) for Environmental Impact Assessment of building construction, Townships and Area Development projects. (10)
- 4(a) Briefly describe different types of screening methods. (08)
- (b) Write the basic outline of IEE. What are the differences between IEE and EIA? (08)
- (c) What are the purposes of scoping? (04)
- (d) Describe how participatory approach can improve baseline assessment. (05)

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B.Sc. Engg. (CEE)/ 6th Sem.

26 August 2019 (Group-B)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
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 DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION SUMMER SEMESTER: 2018-2019
 COURSE NO. : CEE 4611 TIME : 1.5 Hours
 COURSE TITLE: **Design of Concrete Structures II** FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meanings.

1. A two-way reinforced concrete building floor system is composed of slab panels measuring 20 x 25 ft in plan, supported by column-line beams cast monolithically with the slab. The floor system is carrying following loads in addition to its self-weight: floor finish = 30 psf, partition wall = 50 psf and live load = 125 psf. Design a typical corner panel using USD method. Moment coefficients are: $C_{a(D)+} = 0.039$, $C_{a(L)+} = 0.048$, $C_a = 0.071$, $C_{b(D)+} = 0.016$, $C_{b(L)+} = 0.020$, $C_b = 0.029$. Given: $f'_c = 3$ ksi, $f_y = 60$ ksi, and size of all beams = 12 x 20 in. (25)

2. An office building is planned using a flat plate floor system with the column layout as shown in Figure 1. No beams, drop panels or column capitals are permitted. The floor system is carrying following loads in addition to its self-weight: floor finish = 30 psf, partition wall = 50 psf and live load = 60 psf. Design panel 'B' by the direct design method. Given: panel size = 14 x 20 ft., column size = 12 x 12 in., $f'_c = 3$ ksi, $f_y = 60$ ksi. Use USD method. (25)

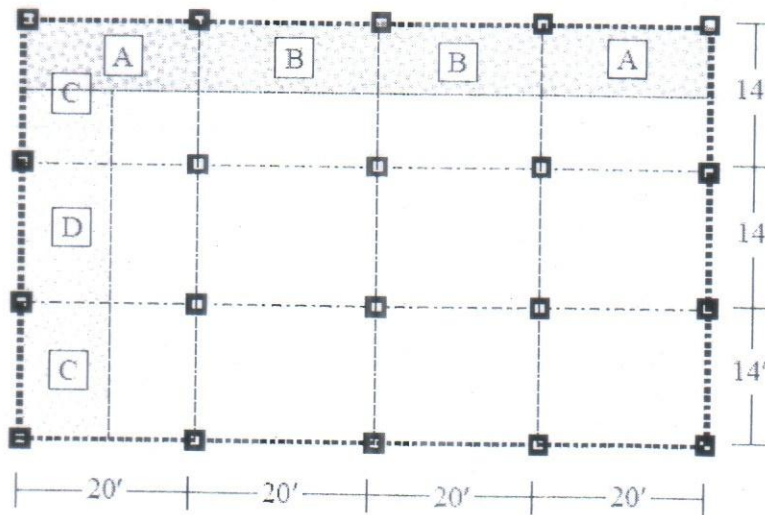


Figure 1: for Question 2

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3. Check a central column of the slab shown in Figure 2 for punching shear and calculate shear reinforcements if required. (25)
The panel size is 20'×14' c/c (without any beam). It carries following loads in addition to its self-weight: floor finish = 30 psf, partition wall = 50 psf, and live load = 60 psf. Given: $f'_c = 3$ ksi, $f_y = 60$ ksi, slab thickness = 7.0", column size = 12"×12". Use WSD method.

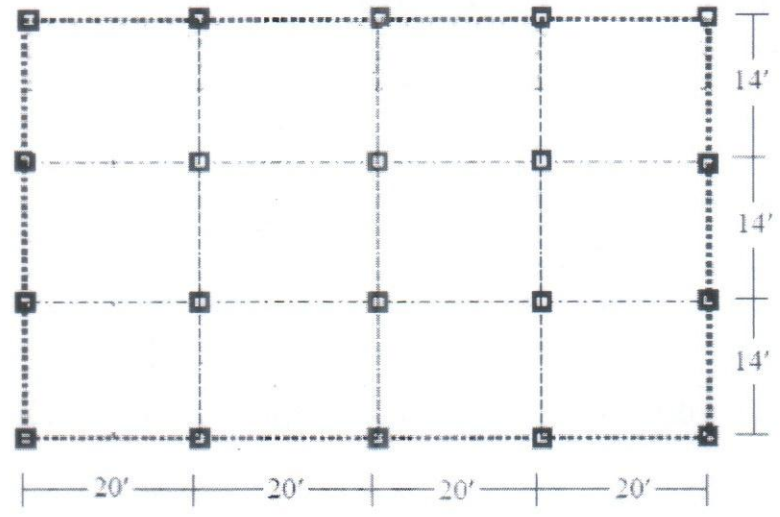


Figure 2: for Question 3

4. (a) Define yield line. Write the guidelines for establishing axes of rotation and yield lines for slab analysis. (08)
(b) Differentiate between one-way slab and two-way slab. (05)
(c) A square slab (12 ft × 12 ft) is simply supported along all sides and is to be isotropically reinforced. Determine the resisting moment per linear foot required just to sustain a uniformly distributed factored load of 225 psf. Use the yield line theory. (12)

Given Equations and Tables

$$h = \frac{l_n \left(0.8 + \frac{f_y}{200,000} \right)}{36 + 5\beta(\alpha_m - 0.2)} \geq 5.0 \text{ in.}; h = \frac{l_n \left(0.8 + \frac{f_y}{200,000} \right)}{36 + 9\beta} \geq 3.5 \text{ in.}$$

$$M_o = \frac{q_u l_n^2}{8}; \alpha_f = \frac{E_{cb} l_b}{E_{cs} l_s}; \beta_t = \frac{E_{cb} C}{2E_{cs} l_s}; C = \sum \left(1 - 0.63 \frac{x}{y} \right) \frac{x^3 y}{3}$$

$$M_u = \phi \rho f_y b d^2 \left(1 - 0.59 \rho \frac{f_y}{f'_c} \right)$$

$$A_s = \frac{M_u}{\phi f_y \left(d - \frac{a}{2} \right)}; a = \frac{A_s f_y}{0.85 f'_c b}$$

$$A_s = \left(\frac{f'_c}{f_y} \right) \left[1 - \sqrt{1 - \frac{2M_u}{\phi f'_c b d^2}} \right] b d$$

For one-way shear: $\phi V_c = \phi (2\lambda \sqrt{f'_c} b d)$ (USD); $V_c = (1.1\lambda \sqrt{f'_c} b d)$ (WSD)

For two-way shear: $\phi V_c = \phi (4\lambda \sqrt{f'_c} b_o d)$ (USD); $V_c = (2\lambda \sqrt{f'_c} b_o d)$ (WSD)

TABLE
Minimum thickness of slabs without interior beams

Yield Stress f_y psi	Without Drop Panels			With Drop Panels		
	Exterior Panels		Interior Panels	Exterior Panels		Interior Panels
	Without Edge Beams	With Edge Beams ^a		Without Edge Beams	With Edge Beams ^a	
40,000	$l_n/33$	$l_n/36$	$l_n/36$	$l_n/36$	$l_n/40$	$l_n/40$
60,000	$l_n/30$	$l_n/33$	$l_n/33$	$l_n/33$	$l_n/36$	$l_n/36$
75,000	$l_n/28$	$l_n/31$	$l_n/31$	$l_n/31$	$l_n/34$	$l_n/34$

^a Slabs with beams along exterior edges. The value of α_f for the edge beam shall not be less than 0.8.

TABLE

Distribution factors applied to static moment M_o for positive and negative moments in end span

	(a)	(b)	(c)	(d)	(e)
	Exterior Edge Unrestrained	Slab with Beams between All Supports	Slab without Beams between Interior Supports		Exterior Edge Fully Restrained
			Without Edge Beam	With Edge Beam	
Interior negative moment	0.75	0.70	0.70	0.70	0.65
Positive moment	0.63	0.57	0.52	0.50	0.35
Exterior negative moment	0	0.16	0.26	0.30	0.65

TABLE

Column-strip moment, percent of total moment at critical section

		l_2/l_1		
		0.5	1.0	2.0
Interior negative moment				
$\alpha_1 l_2/l_1 = 0$		75	75	75
$\alpha_1 l_2/l_1 \geq 1.0$		90	75	45
Exterior negative moment				
$\alpha_1 l_2/l_1 = 0$	$\beta_1 = 0$	100	100	100
	$\beta_1 \geq 2.5$	75	75	75
$\alpha_1 l_2/l_1 \geq 1.0$	$\beta_1 = 0$	100	100	100
	$\beta_1 \geq 2.5$	90	75	45
Positive moment				
$\alpha_1 l_2/l_1 = 0$		60	60	60
$\alpha_1 l_2/l_1 \geq 1.0$		90	75	45

TABLE
 Flexural resistance factor: $R = \rho f_y \left(1 - 0.588 \frac{\rho f_y}{f'_c} \right) = \frac{M_n}{bd^2} = \frac{M_u}{\phi bd^2}$ psi

ρ	$f_y = 40,000$ psi				$f_y = 60,000$ psi				$f_y = 80,000$ psi			
	f'_c psi				f'_c psi				f'_c psi			
	3000	4000	5000	6000	3000	4000	5000	6000	3000	4000	5000	6000
0.0005	20	20	20	20	30	30	30	30	40	40	40	40
0.0010	40	40	40	40	59	59	60	60	79	79	79	79
0.0015	59	59	60	60	88	89	89	89	117	118	118	119
0.0020	79	79	79	79	117	118	118	119	155	156	157	157
0.0025	98	99	99	99	146	147	147	148	192	194	195	196
0.0030	117	118	118	119	174	175	176	177	229	232	233	234
0.0035	136	137	138	138	201	204	205	206	265	268	271	272
0.0040	155	156	157	157	229	232	233	234	300	305	308	310
0.0045	174	175	176	177	256	259	261	263	335	341	345	347
0.0050	192	194	195	196	282	287	289	291	369	376	381	384
0.0055	211	213	214	215	309	314	317	319	402	412	417	421
0.0060	229	232	233	234	335	341	345	347	435	446	453	457
0.0065	247	250	252	253	360	368	372	375	467	480	488	494
0.0070	265	268	271	272	385	394	399	403	499	514	523	529
0.0075	282	287	289	291	410	420	426	430	529	547	558	565
0.0080	300	305	308	310	435	446	453	457	560	580	592	600
0.0085	317	323	326	329	459	472	479	485	589	612	626	635
0.0090	335	341	345	347	483	497	506	511	618	644	659	669
0.0095	352	359	363	366	506	522	532	538	647	675	692	703
0.0100	369	376	381	384	529	547	558	565	675	706	725	737
0.0105	385	394	399	403	552	572	583	591	702	736	757	771
0.0110	402	412	417	421	575	596	609	617	728	766	789	804
0.0115	419	429	435	439	597	620	634	643	754	796	820	837
0.0120	435	446	453	457	618	644	659	669		825	852	870
0.0125	451	463	471	476	640	667	684	695		853	882	902
0.0130	467	480	488	494	661	691	708	720		881	913	934
0.0135	483	497	506	511	681	714	733	746		909	943	966
0.0140	499	514	523	529	702	736	757	771		936	972	997
0.0145	514	531	540	547	722	759	781	796		962	1002	1028
0.0150	529	547	558	565	741	781	805	821		988	1031	1059
0.0155	545	563	575	582	760	803	828	845		1014	1059	1089
0.0160	560	580	592	600		825	852	870			1087	1119
0.0165	575	596	609	617		846	875	894			1115	1149
0.0170	589	612	626	635		867	898	918			1142	1179
0.0175	604	628	642	652		888	920	942			1170	1208
0.0180	618	644	659	669		909	943	966			1196	1237
0.0185	633	660	676	686		929	965	989				1265
0.0190	647	675	692	703		949	987	1013				1294
0.0195	661	691	708	720		969	1009	1036				1322
0.0200	675	706	725	737		988	1031	1059				1349

TABLE
 Flexural resistance factor: $R = \rho f_y \left(1 - 0.588 \frac{\rho f_y}{f'_c} \right) = \frac{M_n}{bd^2} = \frac{M_u}{\phi bd^2}$ psi

ρ	$f_y = 40,000$ psi				$f_y = 60,000$ psi				$f_y = 80,000$ psi			
	f'_c psi				f'_c psi				f'_c psi			
	3000	4000	5000	6000	3000	4000	5000	6000	3000	4000	5000	6000
0.0005	20	20	20	20	30	30	30	30	40	40	40	40
0.0010	40	40	40	40	59	59	60	60	79	79	79	79
0.0015	59	59	60	60	88	89	89	89	117	118	118	119
0.0020	79	79	79	79	117	118	118	119	155	156	157	157
0.0025	98	99	99	99	146	147	147	148	192	194	195	196
0.0030	117	118	118	119	174	175	176	177	229	232	233	234
0.0035	136	137	138	138	201	204	205	206	265	268	271	272
0.0040	155	156	157	157	229	232	233	234	300	305	308	310
0.0045	174	175	176	177	256	259	261	263	335	341	345	347
0.0050	192	194	195	196	282	287	289	291	369	376	381	384
0.0055	211	213	214	215	309	314	317	319	402	412	417	421
0.0060	229	232	233	234	335	341	345	347	435	446	453	457
0.0065	247	250	252	253	360	368	372	375	467	480	488	494
0.0070	265	268	271	272	385	394	399	403	499	514	523	529
0.0075	282	287	289	291	410	420	426	430	529	547	558	565
0.0080	300	305	308	310	435	446	453	457	560	580	592	600
0.0085	317	323	326	329	459	472	479	485	589	612	626	635
0.0090	335	341	345	347	483	497	506	511	618	644	659	669
0.0095	352	359	363	366	506	522	532	538	647	675	692	703
0.0100	369	376	381	384	529	547	558	565	675	706	725	737
0.0105	385	394	399	403	552	572	583	591	702	736	757	771
0.0110	402	412	417	421	575	596	609	617	728	766	789	804
0.0115	419	429	435	439	597	620	634	643	754	796	820	837
0.0120	435	446	453	457	618	644	659	669		825	852	870
0.0125	451	463	471	476	640	667	684	695		853	882	902
0.0130	467	480	488	494	661	691	708	720		881	913	934
0.0135	483	497	506	511	681	714	733	746		909	943	966
0.0140	499	514	523	529	702	736	757	771		936	972	997
0.0145	514	531	540	547	722	759	781	796		962	1002	1028
0.0150	529	547	558	565	741	781	805	821		988	1031	1059
0.0155	545	563	575	582	760	803	828	845		1014	1059	1089
0.0160	560	580	592	600		825	852	870			1087	1119
0.0165	575	596	609	617		846	875	894			1115	1149
0.0170	589	612	626	635		867	898	918			1142	1179
0.0175	604	628	642	652		888	920	942			1170	1208
0.0180	618	644	659	669		909	943	966			1196	1237
0.0185	633	660	676	686		929	965	989				1265
0.0190	647	675	692	703		949	987	1013				1294
0.0195	661	691	708	720		969	1009	1036				1322
0.0200	675	706	725	737		988	1031	1059				1349

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

EXAM : MID TERM EXAMINATION

WINTER SEMESTER: 2018-2019

COURSE NO.: CEE 4633

TIME: 1.5 Hours

COURSE TITLE: Wastewater Engineering and Environmental Sanitation

FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. Necessary equations are given in page 2. Use where necessary. Assume any reasonable value for missing data. The Symbols have their usual meaning.

1. (a) Define wastewater. What are the major elements of wastewater system and associated engineering tasks? (6)
- (b) Mention the objectives of sewage collection and disposal? What are the usual types of sewer system? Define them. (5)
- (c) Draw a curve for BOD exerted and remaining with respect to time for organic wastewater. In a BOD determination, 6 ml of wastewater are mixed with 294 ml of diluting water containing 9.1 mg/l of dissolved oxygen. After 5 day incubation at 20°C, the dissolved oxygen content of the mixture is 2.8 mg/l. Calculate the BOD of the wastewater. Assume that the initial dissolved oxygen of the wastewater is zero. (8)
- (d) Describe different levels of wastewater treatment. (6)
2. (a) Define Waste Stabilization Pond. What are the functions of facultative pond? (5)
- (b) Define the terms effluent, sludge, and biosolids as they pertain to wastewater treatment. Draw a flow diagram to treat a wastewater that has a high concentration of suspended solids, organic matter, pathogens, and a high concentration of ammonia-nitrogen. (7)
- (c) Draw a typical layout of a preliminary treatment process. A manual bar screen is to be used in an approach channel with a maximum velocity of 0.60 m/s, and a design flow of 300 L/s. the bars are 10 mm thick and openings are 3 cm wide, the angle of inclination is 50°. Assume head loss coefficient is 0.7. (8)
Determine the followings:
 - i. The cross section area of the channel, and the dimension needed (assume: depth of the channel = 1.5 x width of the channel)
 - ii. The number of bars in the screen
 - iii. The velocity of flow through the openings of the screen
 - iv. The head loss in meters
- (d) Compute first order reaction rate constant and ultimate BOD using least square method for the following BOD data reported for a stream receiving some treated effluent: (5)

Time (day)	2	4	6	8	10	12
BOD (mg/l)	11	18	22	24	26	29

3. (a) Discuss about the system microbiology and biofilm of secondary attached growth process. (5)
- (b) A wastewater treatment plant uses rectangular sedimentation tanks for primary clarification. The average design flow is 14,000 m³/d, with a peaking factor of 2.5. Two tanks are used. The length, width, and depth are 24 m, 7 m, and 4 m, respectively. Single effluent weirs are provided at the outlet zone. Calculate the surface overflow rate, detention time, and weir loading rates for the design flow. What happens at peak flow conditions? Country regulation is to maintain a minimum detention time of 1 h. (10)
- (c) Mention the generalized statement about the settlement of particles for type-I settling column. The settling basin for a type-I suspension is to operate at an overflow rate of 0.76 m³/m² per hr. The flow rate through the plant is 24,000 m³/day. Determine the dimensions for a long rectangular basin, using a length to width ratio of 4:1. Depth should not exceed 4 m. Use more than one tank. Determine the detention time in the tank and the horizontal velocity. (10)
4. (a) Mention the components required for basic activated sludge process with illustration. Also mention and define the operational and design parameters for activated sludge process. (5)
- (b) Why is recirculation important for trickling filter? The engineer decides to add an identical second stage filter in series to the existing one single stage trickling filter plant to increase the overall plant efficiency. The wastewater flow rate is 2000 m³/d with a BOD₅ concentration of 400 mg/L. Primary clarification removes 30% of the BOD₅. The filters are each 12 m in diameter and 1.5 m in depth. The direct recirculation ratio for each stage is 2.0. Wastewater temperature is 20°C. Calculate the hydraulic loading rate, organic loading rates, effluent BOD₅ concentration for both the stages and overall plant efficiency. Compare the changes in overall plant efficiency after using the second stage filter. (10)
- (c) What are the advantages and disadvantages of wastewater stabilization ponds? Design a waste stabilization pond to treat waste water generated by a locality of 66660 people. Water consumption of the locality is given as 250 litre per capita per day. 60% of the water consumed flow as wastewater. The wastewater has a BOD of 350 mg/L and 1x10⁶ FC per 100 ml. The effluent should contain no more than 999 FC per 100 ml and 10 mg/L BOD. The design temperature is 18°C. (10)

Necessary Equations:

First order rate constant for FC removal per day = 2.6 (1.19)^{T-20}

First order rate constant for BOD removal per day = 0.3 (1.05)^{T-20}

The permissible BOD loading for Facultative pond = 350 (1.107-0.002T)^{T-25} kg/ha.d

Design values of volumetric loading and %BOD removal in anaerobic ponds at desired temperature:

Temperature (°C)	Volumetric loading (g/m ³ d)	BOD removal(%)
10 – 20	20T – 100	2T + 20

Recirculation Factor = (1 + R) / (1 + 0.1R)² ; Recirculation Ratio = Q_r / Q

Efficiency of first stage trickling filter = 100 / (1 + 0.4432√W/VF)

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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : Mid Semester Examination
COURSE NO. : HUM 4651
COURSE TITLE: Project Planning and Management

SUMMER SEMESTER: 2018-2019
TIME: 1.5 Hours
FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions including Question No. 1. Question No. 1 is compulsory. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

- 1(a) A dam construction project can be executed in five alternative ways. The present worth (PW) of the possible costs and outcomes of each alternative are mentioned in the following table. Which alternative will be most cost-effective on the basis of delta method analysis? (12)

Alternatives	PW of costs and outcomes (in 100 million dollars)				
	Construction cost	Maintenance	Irrigation facility	Hindering of fish migration	Electricity generation
A	2	1.2	2.5	0.5	1.1
B	2.5	1.3	2	1.2	1.3
C	3	1.5	1.95	1.1	2.5
D	4	1.9	2.2	0.2	1.5
E	2.2	0.9	2.9	0.65	0.8

- (b) The X Cement Company is a successful cement manufacturer. Since it was established five years ago it has gradually increased its range in the local market. The sales director has now come to the board with a proposal to expand the range in the global market. This will involve the purchase of new machinery; the initial outlay will be 135 0000 BDT. The finance director and the sales director meet to discuss sales projections in the global market. They forecast the following net cash inflows over the five year period until the machinery will need to be replaced: (13)

Year	Amount (BDT)
1	350000
2	470000
3	520000
4	550000
5	550000

In addition to these inflows, it is expected that the machinery will be sold for scrap at the end of year five for 10 000 BDT. The company's policy is to recover the capital investment of the machinery within 3yr. Calculate the ARR for the

investment project and the payback period for the project and check whether it is feasible to buy the new machine or not.

- 2 (a) What is scheduling and controlling? Write down the steps in both phases. (5+5)
- (b) Define: (4)
 Activity PERT
 Event Bar Chart
- (c) You are a Project Engineer for a building construction project. The activities and their completion time has been given. Now draw the bar chart for this project. (11)

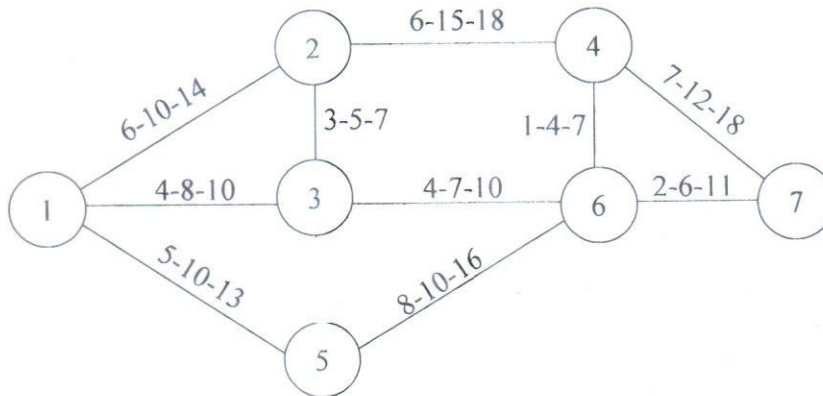
Activity	Description	Time for completion (weeks)
1	Excavation	1
2	Backfill and Compaction	2
3	Reinforced Concrete Works	7
4	Steel Works	3
5	Brick Laying	7
6	Wall Plastering	6
7	Painting	2
8	Floor Covering	2
9	Conduit Works	3
10	Cable Pulling	2
11	Plumbing Works	2
12	Fittings	2

- 3 (a) What is Successor activity, Predecessor activity and Dummy activity? (6)
- (b) For a particular activity of a Project, time estimates received from three engineers Mr. X, Mr. Y and Mr. Z are as follows: (6)

Engineer	Optimistic time	Most likely time	Pessimistic time
Mr. X	5	8	12
Mr. Y	4	7	10
Mr. Z	6	8	11

State who is more certain about the completion time of the project.

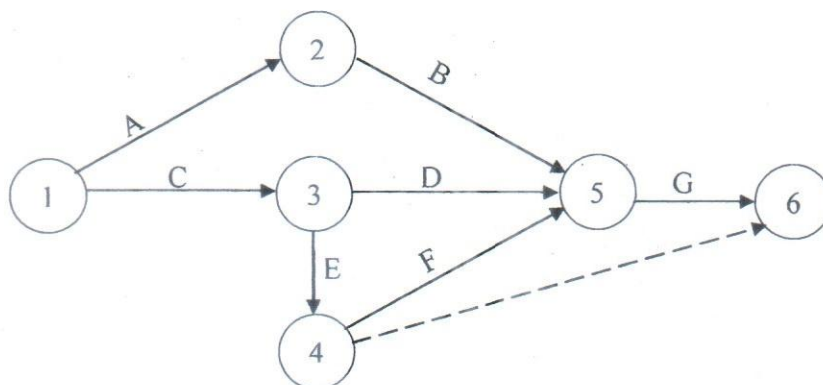
- (c) The network for a certain project is shown in the following figure. Determine the expected time for each path. Which path is critical? (13)



- 4 (a) Write down the differences between expected time and earliest expected time. (5)
 (b) Compute the earliest expected time of each event of the following network. Draw the network. (8+4)

Successor event (j)	Predecessor event (i)	Activity (i-j)	t_{E^U}
80	70	70-80	8
	60	60-80	15
	20	20-80	20
70	60	60-70	10.8
	50	50-70	3.5
60	40	40-60	11
50	40	40-50	9
	30	30-50	17
40	10	10-40	12
30	20	20-30	0
	10	10-30	13
20	10	10-20	8

- (c) From the following network diagram, find the inter-relationships among the activities. (8)



B.Sc. Engg. (CEE)/ 6th Sem.

August 30, 2019 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : Mid Semester Examination

SUMMER SEMESTER: 2018-2019

COURSE NO. : CEE 4653

TIME : 1.5 Hours

COURSE TITLE : Pavement Design and Railway Engineering

FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

-
1. (a) What is the basic difference between a preliminary survey and a final location survey? [10]
Describe briefly the instruments used in preliminary surveys and the details to be given in the project report of a final location survey.
 - (b) Explain briefly how the pressure created by wheel loads is transmitted through the ballast. Explain the functions of rails, sleepers and ballast in a railway track. [10]
 - (c) What is meant by wear of rails? Categorize the types of rail wear and enumerate the methods by which wear in rails can be measured. [5]
 2. (a) Illustrate with sketches the various fastenings used to fasten rails to sleepers. Discuss their merits and demerits. [10]
 - (b) What is a locomotive? What do you understand by a locomotive with a nomenclature 4-6-2? Calculate the maximum permissible train load that can be pulled by a locomotive with four pairs of driving wheels with an axle load of 28.42 t each on a BG track with a ruling gradient of 1 in 200 and a maximum curvature of 3° , travelling at a speed of 48.3 km/h. Assume the coefficient of friction to be 0.2. [10]
 - (c) What are the effects of creep of rails? What leads to the increase of creep? What are the limits of creep that call for immediate remedial measures? [5]
 3. (a) What are the needs for the proper maintenance of a track? Discuss the various methods that ensure that a track is well maintained. [12]
 - (b) Draw a neat sketch of a left hand turnout and show various parts on it. [13]
 4. (a) Define interlocking and state its principles. Write down the differences between ordinary (acute) crossing and double (obtuse) crossings with figures. [5+4]
 - (b) What is routing signal? Draw a layout of routing signal. Find out the maximum speed of a train on a M. G. track having a curvature of three degrees and cant of 10 cm. Assume allowable cant deficiency as 75 mm. [4+5]
 - (c) Why are marshalling yards necessary? Differentiate between junction and terminal. [3+4]

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Semester Examination

Course No.: CEE 4655

Course Title: Civil Engineering Data Analysis

Summer Semester: 2018-2019

Full Marks: 75

Time: 1.5 Hours

There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning. It's an **OPEN BOOKS** and **OPEN NOTES** exam.

- 1(a) An auditor for Health Maintenance Services of Georgia reports 40 percent of policyholders (age 55 years or older) submit a claim during the year. Fifteen policyholders are randomly selected for company records. (15)
- (i) How many of the policyholders would you expect to have filed a claim within the last year?
 - (ii) What is the probability that 8 of the selected policyholders submitted a claim last year?
 - (iii) What is the probability that 8 or more of the selected policyholders submitted a claim last year?
- (b) Recent crime reports indicate that 2 motor vehicle thefts occur each minute in the United States. Assume that the distribution of thefts per minute can be approximated by the poisson probability distribution. (10)
- (i) What is the probability there are no thefts in a minute?
 - (ii) What is the probability there is at least two theft in a minute?
- 2(a) Suppose, from historical record, that the total annual rainfall in a catchment basin is estimated to be normal $N(50 \text{ in}, 10 \text{ in})$. (08)
- (i) What is the probability that in future years the annual rainfall will be between 30 and 60 in?
 - (ii) What is the probability that the annual rainfall will be at least 40 in?
- (b) Human beings vary in the time it takes them to respond to driving hazards. In one experiment in which 100 healthy adults between age 21 and 30 years were subjected to a certain driving hazard, and the sample variance of the observed times it took them to respond was 0.0196 second squared. Assuming that the times to respond are normally distributed, estimate the variability in the time response of the given age group using a 95% C. I. (08)
- (c) Bob Nale is the owner of Nale's Texaco Gas Town. Bob would like to estimate the mean number of gallons of gasoline sold to his customers. Assume the number of gallons sold follows the normal distribution with a standard deviation of 2.30 (09)

gallons. From his records, he selects a random sample of 60 sales and finds the mean number of gallons sold is 8.60.

- (i) What is the point estimate of the population mean?
 - (ii) Develop a 90 percent confidence interval for the population mean.
 - (iii) Interpret the meaning of part (ii).
- 3(a) Find the probability density function of the random variable X whose cumulative distribution function is (15)

$$F(x) = \begin{cases} 0.00 & \text{if } x < -1 \\ 0.25 & \text{if } -1 \leq x < 1 \\ 0.50 & \text{if } 1 \leq x < 3 \\ 0.75 & \text{if } 3 \leq x < 5 \\ 1.00 & \text{if } x \geq 5 \end{cases}$$

Also find (a) $P(X \leq 3)$ (b) $P(X = 3)$ and (c) $P(X < 3)$

- (b) Sixty percent of new drivers have had driver education. During their first year, new drivers without driver education have probability 0.08 of having an accident, but new drivers with driver education have only a 0.05 probability of an accident. What is the probability a new driver has had driver education, given that the driver has had no accident the first year? (10)

- 4(a) What is the probability density function of the random variable whose cdf is (05)

$$F(x) = \frac{1}{1 + e^{-x}}, \quad -\infty < x < \infty$$

- (b) The use of cellular phones in automobiles has increased dramatically in the last few years. Of concern to traffic experts, as well as manufacturers of cellular phones, is the effect on accident rates. Is someone who is using a cellular phone more likely to be involved in a traffic accident? What is your conclusion from the following sample information? Use the 0.01 significance level. (10)

	Had Accident in the Last Year	Did Not Have an Accident in the Last Year
Uses a Cell phone	25	300
Does not use a cell phone	50	400

- 4(c) The manufacturer of the X-15 steel-belted radial truck tire claims that the mean mileage the tire can be driven before the tread wears out is 60,000 miles. The population standard deviation of the mileage is 5000 miles. Crosset Truck Company bought 48 tires and found that the mean mileage for its truck is 59,500 miles. Is Crosset's experience different from that claimed by the manufacturer at the 0.05 significance level? Also draw your conclusion based on p-value. (10)

B.Sc. Egg. (CEE)/ 6th Sem.

22 August, 2019(Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION

SEMESTER: 2018-2019

COURSE NO. : CEE 4665

TIME: 1.5 Hours

COURSE TITLE: Irrigation and Drainage Engineering

FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

1. (a) What is the difference between cropping pattern and cropping intensity? How does irrigation affect the cropping intensity? (4)
- (b) What is 'readily available water'? Show in a figure how the yield is affected by moisture contents at field capacity, readily available water and wilting point. (4)
- (c) Calculate the command area of a STW with a discharge of 15 lps and running for a maximum of 10 hrs/day for growing wheat in Raipur. If the conveyance and application efficiencies are 60% and 70% respectively, then calculate also the seasonal and scheme irrigation water requirements. Assume reasonable values of missing data. (17)

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
ET ₀ (mm/day)	3.0	5.1	5.7	6.5	5.7	4.1	4.9	5.6	4.5	4.2	3.4	2.7
Average Rainfall (mm)	10	18	34	44	168	241	390	360	152	32	0	0

2. (a) What do you mean by wilting point and hygroscopic water? Which has a higher moisture content? (3)
- (b) Write five input parameters required for CROPWAT model. How does the temperature affect the ET? (4)
- (c) Prove that if the soil is saturated then the porosity is the same as the volumetric moisture content. (2)
- (d) What is irrigation scheduling? What three growth stages are critical to water shortage for rice? (3)
- (e) Potato is to be grown in Raipur with initial moisture content, field capacity and permanent wilting point of 30%, 38% and 16% (by volume) respectively. The bulk density of the soil is 1.35 and the crop root zone is 60 cm. The 100-day growth season of potato is from January to April and climatic data of Raipur are as shown in question 1(d). If the crop coefficients for the initial (20 days), development (30 days), mid season (30 days) and late season (20 days) are 0.45, (13)

0.75, 1.15 and 0.8 respectively, then determine the amount and time of first and second irrigation.

3. (a) What soil properties are used for indirect soil moisture measurement? (2)
- (b) What is leaf area index? Explain the operation of a tensiometer for soil water measurement. (4)
- (c) Show in a figure how the evaporation and transpiration vary with crop growth stage. (2)
- (d) What is ponding method? What are the disadvantages of ponding method? (3)
- (e) What is opportunity time? Show in a figure how it varies with the distance from the inflow in a field. (3)
- (f) The water level data from a ponding test in a 265 m long canal with an inflow of 75 lps are shown in the table. If the operating level of the canal is 62 cm and the corresponding top width is 63 cm, then calculate the conveyance efficiency of the canal. (11)

Time (minutes)	3.5	5	8	12	18	32	45	60
Water level (cm)	82.4	72.8	65.1	59.3	52.1	43.8	40.2	38.4

4. (a) What is field application efficiency? Explain with a figure why is this efficiency low for surface irrigation systems? (5)
- (b) What is the difference between subsurface and micro irrigation? What is the advantage of furrow irrigation over other methods of surface irrigation? (4)
- (c) What is effective rainfall? Why is irrigation water applied to achieve field capacity? (3)
- (d) What is the difference between basin and border irrigation? Why the furrow spacing higher in clayey compared to sandy soil? (3)
- (e) How do topography and type of crop grown affect the selection of irrigation method? (3)
- (f) The soil moisture contents along the length of a farm at points 10 meters apart were measured as 20%, 18%, 15%, 13% and 10% (by weight). If the crop root zone is 60 cm and the field capacity of the soil is 15% (by volume) then compute the application efficiency. The bulk density of the soil is 1.4. (7)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester: Mid Semester Examination

Summer Semester: 2018-2019

Course No.: CEE 4831

Full Marks: 50

Course Title: Environmental and Social Impact Assessment

Time: 1.5 hours

There are 4 (Four) Questions. Answer any 3 (Three) questions and question 1 (one) is **mandatory**. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning. Assume reasonable data if needed.

1. A petroleum refinery is a large industry which plays a major role in the transportation industry activities. Separation of chemicals in the oil industry involve fractionation, hydro-treating, manufacturing, and transportation. The impact of petroleum refinery on the environment is often negative and has increased health concerns to the communities close to them. These complex processes impact the environment in a different way despite the benefit of getting the important oil.
- MJ petroleum company wants to establish a Petroleum refinery near the Meghna river. Environment was already polluted specially the water and that the quality standards of the water were not good at all. All of existing industrial units and projects and proposed units and projects must get Environment clearance certificate to continue business in Bangladesh.
- (a) Answer the following-
- i. Do you need an environmental clearance certificate? (01)
 - ii. When (at what step) do you determine the necessity of EIA? What are the approaches for conducting that process? (3 $\frac{2}{3}$)
 - iii. What type of professional will be the part of the consultancy group performing EIA? (03)
 - iv. Write down the process of getting the clearance certificate if needed. (05)
- (b) How do you characterize any project 'a major project'? (04)
2. (a) Compare between 'policy' and 'act' with example. What are the basic features of ECA'1995? (05)
- (b) The following is an example of a time dependent matrix. What are the significance of the given numbers? (Assume 5 is the maximum value) (04)

Environmental component	Time dependent matrix	
	Project action (during construction 4 years)	
	Drainage congestion	excavation
Soil	0000	5310
Air quality	5432	4421

- (c) What is scoping? Write down the steps involved during scoping. (7 $\frac{2}{3}$)

3. A tannery industry is to be constructed in an agricultural land which is next to the Turag river. Tannery waste contains mainly of BOD, lime, salt, chromium and other inorganic substances. Answer the following-
- (a) Identify and list down associated impacts from the proposed project. (6/3)
 - (b) How do you decide that impact are likely to be significant? List down the significant impact from your proposed impacts. (04)
 - (c) What are the methods available for impact identification, prediction, and evaluation? (03)
 - (d) Which will be the best method suitable for the proposed project in consideration of economy and accuracy? Justify your answer. (03)
4. (a) What do mean by '0' alternative? It is not true to assume that the '0' alternative is necessarily the best from an environmental perspective. Explain with example. (4/3)
- (b) What is the difference between 'checklist' and 'matrix' method? (03)
- (c) A team of consultants has identified the following proposed actions and environmental parameters for a Mega project. They quantitatively established a cause and effect relationship among them. (09)

Project Actions Environmental Characteristics	Blasting Drilling	Surface Excavations	Mineral Processing	River Transport	Surface Transport	Ocean Transport	River Dumping/ Loading	Pumping of Mine Pit Water
Soils	2 3.5	8.5 9	2 2.5		3 2			1.5 2
Land Forms	3 4	8 10			1 1.5			
Surface Water			6.5 6	4.5 6			3.5 4	3 4
Ground Water		7.5 7						4.5 6
Ocean Water						1.5 3		
Air	3 4	3 4	1.5 2		4.5 6			
Erosion	1.5 2	5.5 7	1 2					1 1.5
Deposition/ Sedimentation			3 3	3.5 4			3 4	2 2
Flora	2 3	7 8.5	1.5 3	2 3	2.5 3	1.5 1.5	1.5 2	
Fauna	2.5 2.5	5 6	1 1	1.5 2		1.5 1	1.5 2	
Agriculture			4 6		1.5 2.5			3 4
Noise	3.5 4	2.5 4	2 2	1.5 2	3 2.5		1.5 1.5	1.5 1.5
Asthetics		7.5 9.5			4 5.5		1 1	1.5 1.5

- i. What is the name of the matrix?
- ii. List down two most and least affected environmental parameters from the proposed action.
- iii. List down three most important project actions.

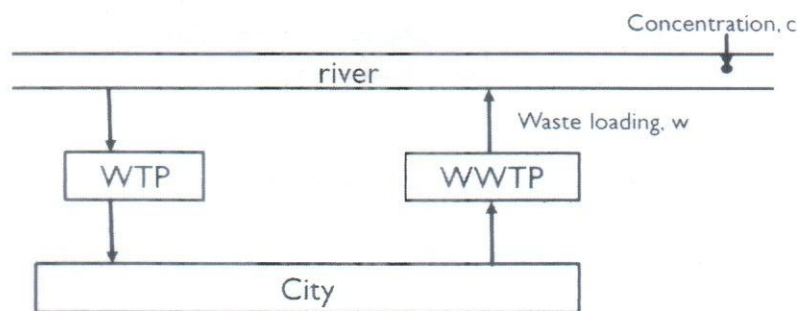
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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester: Mid Semester Examination
Course No.: CEE 4835
Course Title: Environmental Modeling

Summer Semester: 2018-2019
Full Marks: 75
Time: 1.5 hours

There are 4 (Four) Questions. Answer any 3 (Three) questions. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning. Assume reasonable data if needed.

- 1 (a) Mathematical models cannot help us in the all stage of environmental. Draw a diagram showing the level of contribution of different scientific tools in recognizing, understanding, solving, and controlling environmental problems. (04)
- (b) Establish a simple cause and effect relationship between loading and concentration on the basis of assimilation factor for the following condition. Also, implement your developed mathematical equation for different cases. (07)



- (c) A well-mixed lake has the following characteristics: (14)

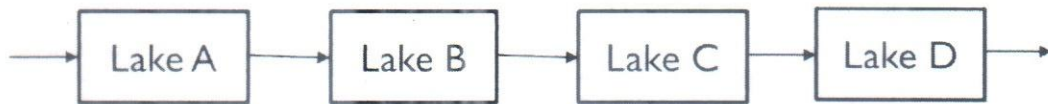
Volume = 50,000 m ³	Settling velocity = 0.001 m/d
Mean depth = 2 m	Pollutant decay rate = 0.25 d ⁻¹
Inflow = Outflow = 8000 m ³ /d	Temperature = 25°C

The lake receives pollutants from four sources: a factory discharge of 50 kg/d, a domestic sewage discharge of 20 kg/d, a flux from the atmosphere of 0.5 gm⁻²d⁻¹, and the inflow stream that has a concentration of 10 mg/L. Consider, $\theta = 1.05$. Display the mass balance results in a diagram and calculated the followings-

- i. Steady state concentration
 - ii. Transfer coefficient
 - iii. Response at t_{60}
- 2 (a) Write down the mass balanced equation for a CSTR lake. Also, list down different variables and parameters of the equation. (04)
- (b) You have calculated the first order rate constant of Turag river is 10 day⁻¹. Briefly explain the meaning of this rate constant. (07)

- (c) The Gulshan lake (volume = $4 \times 10^7 \text{ m}^3$, Surface area = $5 \times 10^6 \text{ m}^2$) has a steady state concentration of $10 \text{ } \mu\text{g/L}$ of total phosphorus. In 2010, it receives an additional loading of 500 Kg/year from a detergent processing plant located close to Tejgaon industrial area. The calculated settling rate is 8 m/year . Compute the concentration in the system from 2010 to 2018. Also draw the shape parameters to assess the ultimate effect of the plant. Consider, the lake has similar inflow and outflow of $5 \times 10^5 \text{ m}^3/\text{year}$. ($1 \text{ kg/m}^3 = 1 \mu\text{g/l}$) (14)
- 3 (a) Draw response of a CSTR lake at different loading conditions (04)
- (b) Name two most common methods of sensitivity analysis with necessary figures. (03)
- (c) Four lakes are connected in series have the following characteristics: (18)

Parameter	Lake			
	A	B	C	D
Volume (10^6 m^3)	5	4	3	3
Mean depth (m)	6	5	4	6
Surface area (10^6 m^2)	0.75	0.60	1.0	0.5
Loading (Kg/year)	500	400	100	75
Flow ($10^6 \text{ m}^3/\text{year}$)	1	1	1	1



If the pollutant settles at a rate of 10 m/year , calculate-

- i. The steady state chemical concentration in each lake.
 - ii. How much of the concentration in the fourth reactor due to the loading to the second reactor.
- 4 (a) Write down the Fick's law. Derive the $D' = \frac{A_c D}{l}$ and explain the significance of each parameter. (07)
- (b) Which transport mechanism is dominant for the followings- (08)
- i. Lake
 - ii. Bay
 - iii. Shoreline
 - iv. Estuaries

Provide justification behind your selection.

- (c) The Buriganga receives a total nitrogen loading of approximately $12 \times 10^6 \text{ kg/year}$ and in river concentration of $40 \text{ } \mu\text{g/L}$. The government wants to save the river from extensive eutrophication. For this reason, the authority was ordered to reduce the nitrogen loading to half of the previous loading. (10)
- i. Compute the assimilation factor.
 - ii. What in river concentration would result from the nitrogen reduction action?

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TERM : Mid Semester Examination
 COURSE NO. : CEE 4843
 COURSE TITLE: Soil Improvement Techniques

SUMMER SEMESTER: 2018-2019
 TIME: 1.5 Hours
 FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions including Question No. 1. Question No. 1 is compulsory. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

- 1 (a) Draw zero-air-void curve for a soil sample with specific gravity 2.66. (6)
 (b) The results of a Standard Compaction test are shown in the table below: (15)

w/c (%)	6.2	8.3	9.8	11.7	12.4	13.5
γ (kN/m ³)	16.8	18.7	19.5	20.4	20.8	21.1

- i) Plot conventional γ_d versus w/c diagram.
 ii) Determine the maximum dry unit weight and the OMC.
 iii) What is the dry unit weight and moisture content range at 85%, 95% and 98% RC (Relative Compaction)?
 iv) Determine the degree of saturation at the maximum dry density if $G_s = 2.65$.
- (c) Compare Standard Proctor test with Modified Proctor test. (4)
- 2 (a) How will you identify collapsible soil and expansive soil? (3+3)
 (b) Define: (8)
 Problematic soil Sheepfoot roller
 Smooth wheeled roller Pneumatic tyred roller
- (c) Write down the factors for selecting of soil improvement techniques. (5)
 (d) To what depth heavy tamping is effective for (6)
 i) A 15 ton mass dropping 10m?
 ii) A 160 ton mass dropping 22m?
 Where, modification factor is 0.5.
- 3 (a) A 12 story building is to be constructed in Basundhara Residential area. The size of the plot is 5 katha. The existing ground level of the plot is 2 m below the road level. The area needs to be filled with sandy soil trucked in from a borrow pit. The water content of the sandy soil in the borrow pit is 14% and its void ratio is 0.65. Specifications require the plot to be compacted before starting the construction. The required dry unit weight is 18 kN/m³. (1 katha= 720 sq.ft). Determine (20)
- i) The dry unit weight of sandy soil from the borrow pit required to fill the plot assuming specific gravity is 2.65.

- ii) The number of trucks required to transfer the soil from borrow pit to the site while each truck can carry 10 m^3 soil.
 - iii) The volume of fill required for the site.
 - iv) The volume required from the borrow pit.
- (d) How does compaction technique improve the engineering properties of soil? (5)
- 4 (a) For a vibroflotation work, the backfill to be used has the following characteristics: (5)
- $D_{50} = 1.75 \text{ mm}$
 - $D_{20} = 0.62 \text{ mm}$
 - $D_{10} = 0.05 \text{ mm}$
- Determine the suitability number of the backfill. How would you rate the material?
- (b) Write down the differences between vibro-flotation and vibro-replacement method. (5)
 - (c) With schematic diagram, write down the field procedure of dynamic compaction. When this technique is applicable? (8+2)
 - (d) Estimate the "safe" distance from an underground explosion of 10 kg of TNT, beyond which little or no soil liquefaction is likely to occur. (5)

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TERM : MID SEMESTER EXAMINATION SUMMER SEMESTER: 2018-2019
 COURSE NO. : CEE 4851 TIME : 1.5 Hours
 COURSE TITLE: **Professional Practice and Communication** FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (three) questions including question 4. Question 4 is compulsory. Do not write on this question paper. The figures in the right margin indicate full marks.

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- 1 (a) What are the most valuable attributes of an Engineer? Explain briefly. 6
 (b) According to IEEE code of ethics, describe at least four ethics of an engineer. 10.5
 (c) Write down the four conditions for a successful charge of negligence in view of law. 6
- 2(a) Upon what conditions personal morality governs over professional morality? 6
 (b) What are the ways to set verbal communication more effectively? 6
 (c) Write down the barriers of effective communication. Describe any three of those. 10.5
- 3 Write Short Notes on: 4.5x5
 (a) Conflict of Interest
 (b) Egocentric tendencies
 (c) Whistle Blowing
 (d) Body Language
 (e) Reasonable care mode of responsibility
- 4 Read the following paragraph and answer the questions from ethical point of view. 30

Dr Peter Gilmore works for BG Chemicals Ltd and is based at their plant in Leicestershire. He is sent to France for 6 months to liaise with Monsieur Loreau at the Douai site concerning a project to develop and produce marine lubricants. Peter rents a flat in a nearby village and is given a desk in Mr Loreau's office so that he can work comfortably. He is made to feel very welcome, with everyone being forgiving of his weak grasp of the beloved French language. It takes a couple of weeks to settle in properly but soon Peter is chatting in French that, whilst not fluent, is certainly understood by his colleagues. He is working closely with Mr Loreau and the project is progressing well, with completion due well within schedule.

Feeling more at home, Peter has started to explore around the office during his lunchtime, and on one of his walks finds a charming little bistro, tucked away

down a side street. He decides to try their *menu du jour* and is ushered to a table near the back. He glances over to the table next to his and sees faces that he recognises- he does not know their names to but he has seen the three men working on the factory floor. They look to be halfway through their lunch and there are already two empty bottles of wine on their table. As Peter enjoys his meal he observes that the Frenchmen polish off another bottle of wine before they leave the bistro and return to work.

Concerned, Peter approaches Mr Loreau when he returns to the office and tells him of the large amount of alcohol that he has seen some of the workers consuming before returning to deal with poisonous and corrosive chemicals as well as heavy machinery. Mr Loreau shrugs, and says that this is quite normal. The French tend to enjoy a leisurely lunch with free-flowing wine but this is always accompanied by a hearty meal. Plus, the men do this every day so alcohol does not affect them as it would someone less used to drinking regularly. Mr Loreau tells Peter that he is not to worry; wine is even served at the factory canteen for those that wish to stay in for their lunch.

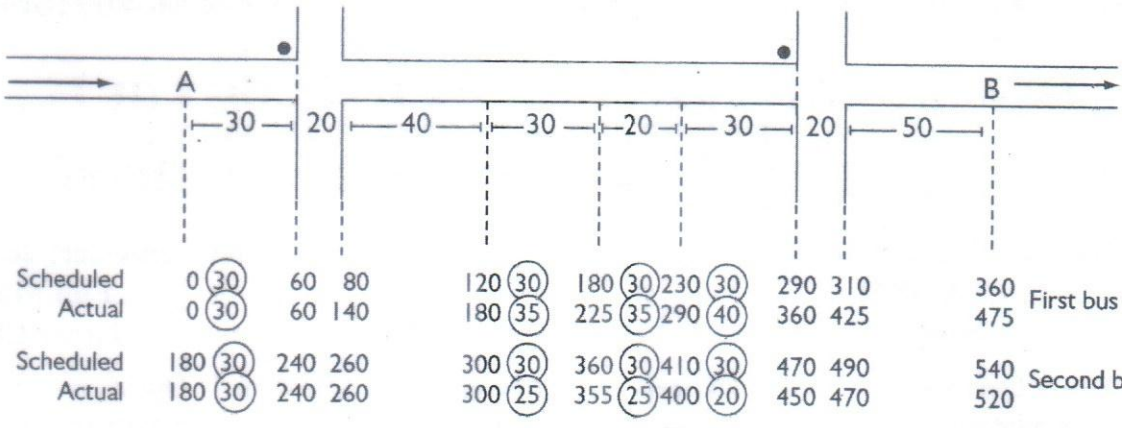
- (i) Why is Dr Gilmore concerned? Are his concerns justified? Why/ why not?
- (ii) Was Dr Gilmore right to take his concerns to Mr Loreau?
- (iii) What should Dr Gilmore do next? Why?

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Mid Semester Examination**Course No.: CEE 4853****Course Title: Public Transportation System****Summer Semester: 2018-2019****Full Marks: 75****Time: 1.5 hours**

There are 4 (Four) Questions. Answer 3 (Three) questions including Question 1. Question 1 is compulsory. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning. Assume values as necessary.

1. You are given the responsibility to evaluate the service quality of three public bus services (25)
 namely – A, B and C, plying on the same route. Your method of choice for multicriteria analysis (MCA) is Analytical Hierarchy Process (AHP). You will be evaluating these three bus services based on four criteria – travel time, comfort, reliability and security. Generate hypothetical data and find the best public bus service. Show the calculation step by step. Why did we not include cost as one of the criteria?
- 2(a) Write a short note on revised strategic plan for Dhaka city focusing on public transportation. To (12)
 what extent do you think the plan will be able to meet our future demand? Support your answer with arguments.
Hint: mention the major problems in transportation system, available modes, their modal share, future plan, to what extent they are resolving traffic demand in future, etc.
- (b) List the data that we need in the baseline phase of a transit data collection program. Present the (10)
 data collection program for baseline and monitoring phases with a diagram.
- (c) How do planners decide the distance between two routes while designing the public transit (3)
 network?
- 3(a) Why do we need to measure the performance of a public transport agency? Based on which (5)
 categories do we measure their performance?
- (b) List the indicators for measuring benefits of a public transportation system along with their pros (10)
 and cons. Write down the equation for measuring net benefit of customers along with the probable values of their coefficients.
- (c) What are the different planning horizons practiced in public transportation planning? Which (7)
 activities fell into each of these horizons? Propose different steps that can be taken at different planning horizon to improve the public bus service in Dhaka city.
- (d) How does car ownership impact public transportation? (3)
- 4(a) Explain the impact of short-term and long-term elasticity in context of public transportation (5)
 planning.
- (b) List the factors on which the energy consumption of metro systems depends. How can we (5)
 reduce energy consumption with smart design?
- (c) What are the areas of delay in a public bus system? How can we reduce them? Explain the (15)
 following diagram (see Page 2) illustrating the bus delays at an intersection.



Total boarding time (in seconds) at each stop is shown thus (30)
 Other timings are cumulative
 ● Traffic lights

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester: Mid Semester Examination
Course No.: CEE 6501
Course Title: Highway Engineering

Summer Semester: 2018-2019
Full Marks: 75
Time: 1.5 hours

There are 4 (Four) Questions. Answer any 3 (Three) questions. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this question paper. The symbols have their usual meaning. Assume reasonable values for any missing information. **Students can bring Highway Capacity Manual printouts.**

- 1(a). Describe LOS concept. Identify LOS defining criteria for following cases. Also, suggest one additional factor (not included in HCM) for each case that can be included for calculating LOS. (15)
 i) rural highway ii) urban intersection iii) pedestrian crosswalk iv) bus stop
- (b). Draw a cross section of a highway showing different elements. Define types of highways. (10)
2. A proposal is being offered to increase a 2 lane urban highway to 4 lane urban highway with the new additional lanes being managed access. Find the change of level of service for initial scenario and final (general and managed lane) scenarios. Relevant information is given below: (25)

	Case 1	Case 2
Number of Total Lane	2 (general)	2 (general) + 2 (managed)
Lane width	12'	10'
Right lateral clearance	4'	2'
Peak hour traffic (veh/hour)	2000	1100 (managed), 1500 (general)
Directional Split	50/50	50/50
FFS	60 mph	60 mph
Truck traffic	5%	6%
PHF	0.86	0.89
No passing zone	50%	100%
Access points	10	2
No interchange. Level terrain. Facility operates under ideal conditions.		

- 3(a) A highway connects to a ferry terminal for river crossing. Current problems are long wait time, chaotic queuing, absence of vehicle prioritization options (such as ambulance, perishable goods), inadequate facilities etc. As a designer, you are requested to re-design the whole terminal facility plus 2 km of adjacent highway leading to the terminal keeping existing number of ferries constant. Detail your plan aiming to keep improvement cost minimum and to maximize user experience (LOS). Provide schematic if possible. Explain with reasoning behind each decision. (15)
- (b) What are the human factors of design? Discuss how they influence highway design. (10)
- 4(a) Design a two phase signal system for an intersection with following info: E-W=1400, W-E=1200, N-S= 1200, S-N=1100. 2 lane in every direction. Lost and yellow time is 2.5 and 3 seconds, respectively. Saturation head way is 2.3 seconds. (15)
- (b) There will a BRT stop in front of IUT. What kind of access facilities should be provided for its efficient use? Consider various types of users commonly seen at Boardbazar and assign priority. (10)

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Semester Examination

Summer Semester: 2018-2019

Course No.: CEE 6505

Full Marks: 75

Course Title: Transportation Planning

Time: 1.5 hours

There are 4 (Four) Questions. Answer all four questions. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning. Assume any missing values.

- Write down the steps in a typical 4-step travel demand forecasting model. What are the inputs and outputs of these steps? Write down the names of the typical methods used for generating the outputs of these steps. List the factors affecting trip generation, distribution and mode choice. (20)
- Let the number of trips from Gazipur (i) to Uttara (j) be 15,000 per day. There are two modes available (bus and car) having characteristics presented with table below (symbols bear standard meanings): (15)

	t_{ij}^u	t_{ij}^b	t_{ij}^c	f_{ij}	ϕ_j
Car	18	-	20	5	-
Bus	32	6	2	8	-
a_i	0.04	0.05	0.07	0.15	0.12

Compute trips made by bus and the corresponding fare collected.

- There are three paths connecting an Origin-Destination pair having travel times as follows: (15)
 Path X_1 : $t_1 = 9 + 3X_1$; Path X_2 : $t_2 = 12 + 2X_2$; Path X_3 : $t_3 = 18 + X_3$
 The total flow from the origin to destination = 200 and 50% of the flow will pass through path X_2 ; and X_3 : Solve the assignment problem using system optimum assignment method. Assume any values/conditions as necessary
- The cost matrix and trip-end totals for a gravity model are estimated as table below. (25)
 The cost function is: $f(c_{ij}) = \frac{1}{c_{ij}^2}$

	1	2	3	4	Target O_i
1	3	11	18	22	400
2	12	3	13	19	460
3	15.5	13	5	7	400
4	24	18	8	5	702
Target D_j	260	400	500	802	1962

Fill up the Origin-Destination matrix using Gravity model. Performing two iterations will be sufficient.