B.Sc. Egg. (CEE)/ 2nd Sem. 23 October, 2018 (Gr B)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : FINAL SEMESTER EXAMINATION SEMESTER: 2017-2018
COURSE NO. : CEE 4201 TIME : 3 Hours
COURSE TITLE: **Analytical Mechanics** FULL MARKS: 200

There are 8 (Eight) questions. Answer any 6 (Six) 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) Write down the equilibrium conditions of a general coplanar force system. (8.33)

b) In Fig. 1, if $Q = 100$ lb., $\theta = 30^0$ and $F = 200$ lb., find the force in member BC. (25)

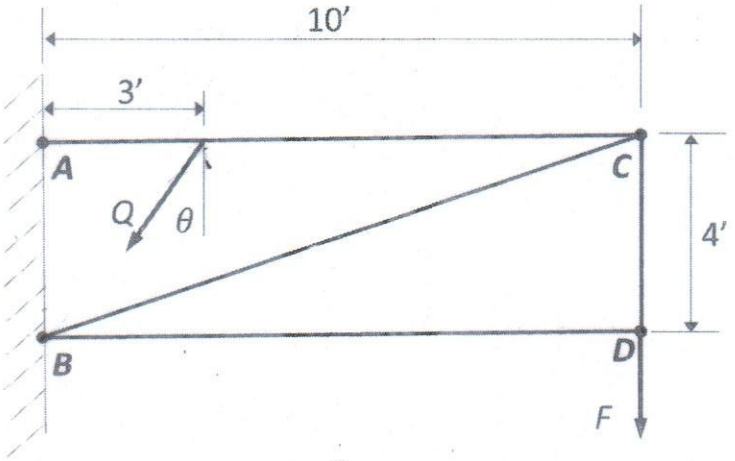

Fig. 1

2. a) When can we assume a cord to be parabolic? (8.33)

b) What is a catenary? Write down the general equation of a catenary? (8)

c) A cable is suspended with its ends at the same elevation and 200 ft. apart. The load is uniformly distributed horizontally. When the sag is 5% of the span, the maximum tension is 2040 lb. What is the load in pound per foot? (17)

3.a) What is the difference between coefficient of static friction and coefficient of kinetic friction? (8.33)

b) In Fig. 2, let $\theta = 30^0$, $f = 0.3$, $\alpha = 90^0$ and $W_A = 1000$ lb. What is the value of Q when sliding motion is impending down the plane? (25)

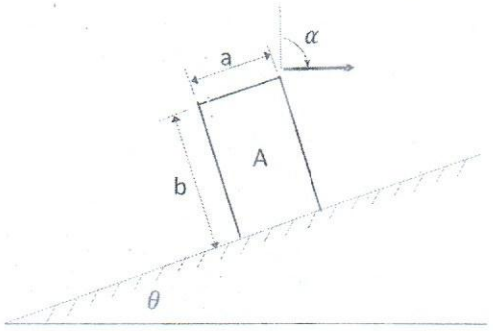

Fig. 2

4. a) What are the theories of Pappus and Guldinus? (10.33)

b) Find the coordinates of the centroid of the area bounded by the curves $y^2 = 16x$ and $y = x$. (23)

5. a) What are the principal axes? (9.33)

b) In the standard angle section of Fig. 3, let $a = ¼$ in., $b = 3$ in. and $c = 4$ in. Find the centroidal moments of inertia $\bar{I}_x$ and $\bar{I}_y$. (24)

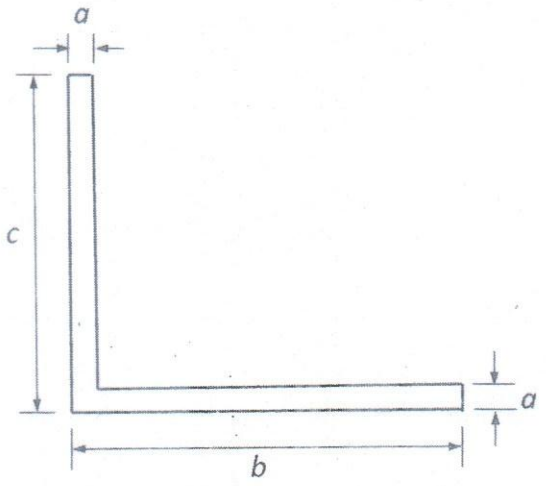

Fig. 3

6. a) By direct integration, determine the moment of inertia of a homogenous, right circular cylinder about a diameter of its base. The height is h and the radius is r. Let the differential element be a thin disk parallel to a base. (13.33)

b) A point P moves in the path of a curve defined by the equation $y = e^x$. Its tangential velocity is constant and is equal to 12 fps. At a position defined by $y = 10$ ft., what are the components v_x and v_y of the velocity? (20)

7. a) What is the principle of work and energy in dynamics? (8.33)

b) In Fig. 4, the grooved cylinder A weighs 200 lb. and has a moment of inertia $\bar{I}_A = 6$ slug-ft^2. Let $D_1 = 2$ ft., $D_2 = 3$ ft. $W_B = 32.2$ lb. and $f_C = 0$. Determine the speed of the cg of A and the acceleration of B after B has moved downward through 20 ft. (25)

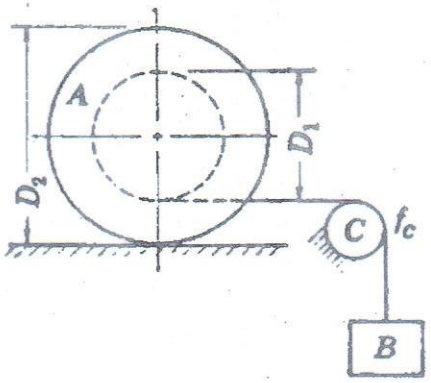

Fig. 4

8. a) Derive the principle of angular impulse and angular momentum. (9.33)

b) A homogenous sphere $D = 12$ in., rolls down a rough $\theta = 30^0$ inclined plane, Fig. 5. If the initial speed of its center of gravity is 10 fps. down the plane, find the speed 8 sec. later and find the minimum value of the coefficient of friction that will cause pure rolling. (24)

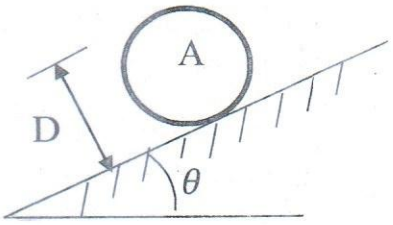

Fig. 5

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B.Sc. Eng. (CEE) 2st Semester **30 October 2018**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Semester Final Examination — Summer Semester, A.Y. 2017-2018
Course Code: Chem 4253 — Time : 3.0 hours
Course Title: Chemistry-II — Full Marks : 150

There are **8 (eight)** Questions. Answer any **6 (six)** of them.
Marks in the Margin indicate the full marks. The symbols have their usual meaning.

1 a) What is zeolite? Discuss the principle of softening hard water by using zeolite. **7**

b) Distinguish between scale and sludge. Write the reaction involved in the formation of sludge and scale in the boiler. What are the reasons for the formation of sludge and scale? How formation of scale and sludge can be prevented? **12**

c) Zeolite softener was completely exhausted by the treatment of water. It was then regenerated by passing 1000 litres of NaCl solution containing 50 g per litre NaCl. Calculate the amount (in litre) of sample water of hardness 300 ppm that can be softened by this softener. **6**

2 a) Discuss the effect of different factors on the rate of under-water corrosion. **10**

b) Discuss the principle of prevention of corrosion by impressed current. **5**

c) Write notes on the following terms: **10**
(i) Differential aeration corrosion (ii) Metal cladding
(iii) weld decay

3 a) Discuss the different steps with block diagram involved in the manufacturing of Portland cement. **12**

b) Discuss the theories of setting and hardening of cement with chemical reactions involved. **12**

4 a) What is glass? Describe the physical and chemical properties of glass. **5**

b) Write down the reactions involved during manufacturing of glass when the batch material contains (i) soda, limestone and silica (ii) red lead, K_2CO_3 and silica. **8**

c) Write notes on the following terms: **12**
(i) Borosilicate glass (ii) Tempered glass (iii) Soda lime glass

5 a) Define with examples each of the following polymer. 8
(i) Homopolymer (ii) Copolymer (iii) Organic polymer
(iv) inorganic polymer

b) What is HDPE? Describe the industrial manufacturing process of HDPE with flow diagram. Write down its industrial application 9

c) What is the difference between addition polymer and condensation polymer? Discuss the mechanistic path way of the free radical addition polymerization. 8

6 a) Describe the different steps of manufacturing ceramic white wares. 10

b) What do you mean by under-glaze and over-glaze decoration of ceramic wares? 7

c) Write notes on the following terms: 8
(i) Terra cotta (ii) Porcelain (iii) Enamel (iv) Stoneware

7 a) Show the polymerization reaction for the synthesis of the following polymers 8
(i) Neoprene rubber (ii) Silicon rubber (iii) Butadiene rubber (iv) Styrene butadiene rubber

b) What is latex? Discuss the processes of obtaining pale crepe rubber and smoke rubber from latex. 7

c) Describe the functions of the following substances which are used in compounding of natural rubber. 10
(i) Antioxidants (ii) Reinforcing agents (iii) Accelerator (iv) inert fillers.

8 a) What is grease? How it is prepared? What is the advantage and disadvantage of grease as a lubricant? 7

b) Write notes on the following terms: 9
(i) Spalling (ii) Thermal conductivity (iii) Porosity

c) Describe the different steps of the industrial manufacturing process of refractory material. 9

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

TERM : SEMESTER FINAL EXAMINATION — SUMMER SEMESTER: 2017-2018
COURSE NO. : **PHY 4253** — TIME : 3.0 Hours
COURSE TITLE: **Physics II** — FULL MARKS: 150

There are 8 (Eight) questions. Answer any 6 (Six) 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) State and explain the Biot-Savart law. **(04)**
   (b) A flat strip of copper of width 'a' and negligible thickness carrying a current i. Find the magnetic field at a distance R from the centre of the strip and at right angles to it. **(11)**
   (c) Applying the Biot-Savart law, calculate magnetic field B for points on the axis of a circular loop (at a distance x from its center) of radius R carrying a current i. **(10)**
2. (a) Define inertial and non-inertial frames of reference with examples. **(04)**
   (b) Discuss Michelson-Morley experiment and hence obtain the expression of expected fringe shift to find whether the ether medium exists or not. **(16)**
   (c) Prove that Newton's 2nd law of motion is invariant under Galilean transformation. **(05)**
3. (a) Derive the formulae of length contraction and time dilation? **(10)**
   (b) Obtain the expression of relativistic kinetic energy. **(10)**
   (c) A stationary body explodes into two fragments of rest mass 1kg each. If they move apart at speeds of 1.8×10^7m/s, find the rest mass of the original body. **(05)**
4. (a) What do you understand by photoelectric effect? **(05)**
   (b) Discuss the experimental observations of photoelectric effect and also discuss why the wave theory of light cannot explain the observed results of the photoelectric effect but the quantum theory can. **(15)**
   (c) The threshold wavelength for photoelectric emission in tungsten is 230 nm. What wavelength of light must be used in order for electrons with a maximum energy of 1.5 eV to be ejected? **(05)**
5. (a) Show that de Broglie wavelength of a moving particle is expressed by $\lambda = \frac{h}{mv}$. **(07)**
   (b) Discuss electron diffraction experiment of Davisson and Germer and prove that electron shows wave nature. **(13)**
   (c) What will be the de Broglie wavelength of a 20-keV electron? **(05)**

6. (a) Define crystalline, polycrystalline and amorphous solids with examples. **(06)**

   (b) In a tetragonal crystal system, find the relation of the distance between the successive atomic planes in terms of lattice parameters and Miller indices. **(11)**

   (c) Discuss how you will determine Miller indices. Find the Miller indices of a plane that makes intercepts of 2Å, 3 Å and 4 Å on the coordinate axes of an orthorhombic crystal with $a:b:c=4:3:2$. **(08)**

7. (a) Determine the number of atoms in simple-cubic (sc), body-centered-cubic (bcc) and face-centered-cubic (fcc) unit cells. **(06)**

   (b) What do you mean by atomic packing factor? Calculate the packing fractions for simple cubic and face centered cubic structures. **(12)**

   (c) Show that for an ideal hexagonal closed packed structure, where the atomic spheres touch each other, the ratio c/a is equal to 1.633. **(07)**

8. (a) Define cohesive energy of an ionic crystal. **(04)**

   (b) Obtain the expression of cohesive energy for ionic crystal. **(15)**

   (c) Distinguish between covalent bond and hydrogen bond. **(06)**

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B.Sc. Engg. (CEE)/ 2nd Sem. October 25, 2018 (Group B)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : SEMESTER FINAL EXAMINATION SUMMER SEMESTER: 2017-2018
COURSE NO. : GS 4253 TIME : 3.0 Hours
COURSE TITLE: Ecology and Environment FULL MARKS: 150

There are 8 (Eight) questions. Answer any 6 (Six) 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) The following data were gathered on 15 June 2018 from 260-meter line transect for Dhupchaya forest in southern Bangladesh. Strip width(w) was limited to 32m to the right side of the main transect line and 30m to the left side of the main transect line whereas the total area of the forest was .015km^2 . (25)

Sl. no	Plant type	Position of the sample from the transect line	Sighting distance (r) m	Sighting angle (degree)
1.	Plant type-2	Right	15	12
2.	Plant type-1	Left	19	8
3.	Plant type-2	Left	17	14
4.	Plant type-2	Right	33	32
5.	Plant type-2	Right	30	36
6.	Plant type-1	Left	35	48
7.	Plant type-1	Left	38	78
8.	Plant type-1	Left	23	84
9.	Plant type-2	Right	45	54
10	Plant type-2	Left	25	43
11	Plant type-1	Left	28	65
12	Plant type-1	Right	7	74
13	Plant type-2	Right	8	60
14	Plant type-1	Left	11	0
15	Plant type-2	Left	10	2
16	Plant type-1	Right	12	34
17	Plant type-2	Left	36	43
18	Plant type-1	Left	37	62
19	Plant type-2	Right	12	42
20	Plant type-1	Right	64	69

285-285

Based on the provided data calculate the followings:

I. Hayne estimate of population density for each types of the plants.

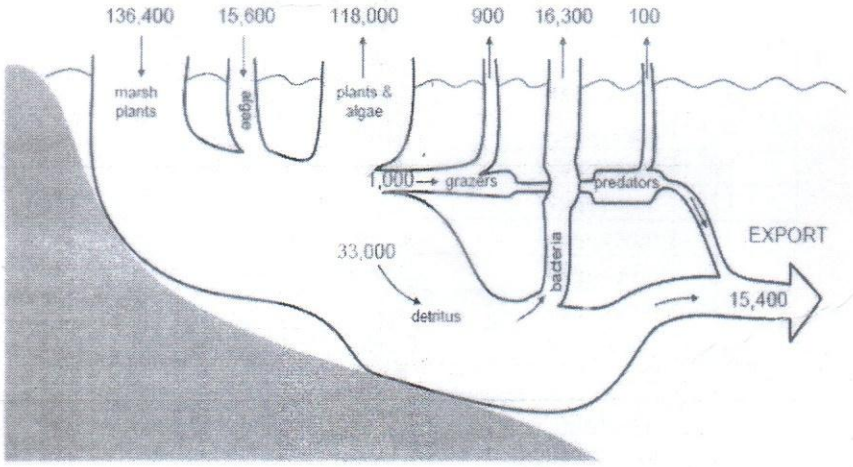
II. Biomass for each types of the plants considering the mass of each plant of Plant type 1 = 25kg & Plant type 2 = 9 kg.

III. Draw the biomass pyramid of this ecosystem by applying 10% rule for other trophic levels.

IV. A similar type of study was conducted on June 2015 for the same ecosystem where total biomass of the producer was found as 140×10^4 kg. What is the difference between the biomass pyramid between study conducted in 2018 & 2015?

2 (a) In an ecosystem, we currently have 300 rabbits and 65 foxes. These species are known to compete for some, but not all, of their resources. We are able to determine that the carrying capacity of rabbit (k_1) is 250 and the Lotka-Volterra model coefficient α is 4. The carrying capacity for foxes (k_2) is 100 and the Lotka-Volterra model coefficient β is 1. Over time, will both species be able to co-exist? If not, which one will be driven to extinction in this area? (15)

(b) The following diagram is the energy flow diagram for Bakkhali salt marsh in Bangladesh. All the units that has been used in the following diagram as g C m^{-2} yr^{-1}. (10)



Calculate the Gross Primary Production (GPP), Net Primary Production (NPP), and Net Community production (NCP) for the entire marsh ecosystem. Show all your work.

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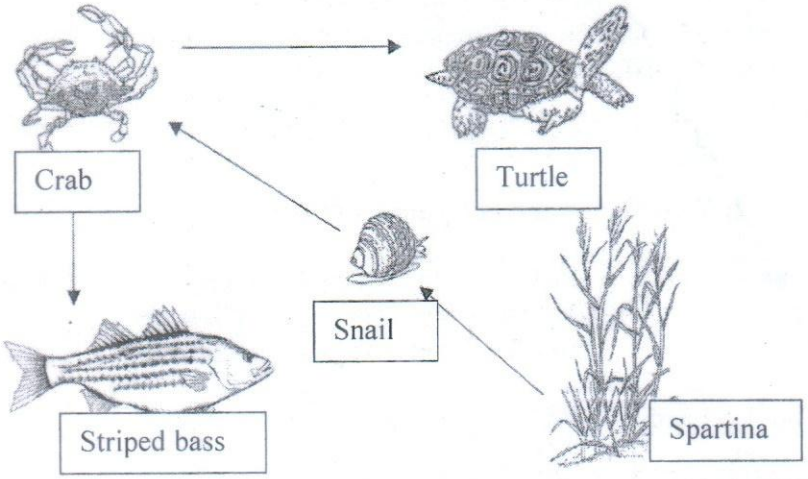
3 (a) Miss Kobita participates in a survey to determine the food web of the marshland. She draws the following food web that includes a turtle, a snail, Spartina, a blue crab, and a striped bass: (13)



I. Assume that the exploitation efficiency between all trophic levels is 10%. How much g C of Spartina is required to produce 1200 g C of striped bass?

II. She determines that for a patch of marshland the Gross Primary Productivity (GPP) is 400 g C m^{-2} day^{-1}, the NPP is 325 g C m^{-2} day^{-1}, and the NCP is 200 g C m^{-2} day^{-1}. What is the respiration rate of autotrophs and heterotrophs in this system?

(b) Average conventional diesel fuel production, including extraction of crude oil, transportation, and refining produces the following greenhouse gases for 100 gallon of fuel produced: (12)

1405 g of CH_4

15000 mg of CO_2

1200 µg of N_2O

1200 kg of CFC-12

190 g of SF6

1000 Kg of HCFC-123

Using only these emissions data, calculate the global warming potential of conventional diesel production expressed in kg CO_2-equivalent using a 100-year time frame. The overall Global warming potential standard for this industry is 5.6 kg CO_2-eq. Draw a conclusion whether you will allow this greenhouse gas emission or not.

4 (a) Calculate the current Ecological Footprint of Dhaka city, Chittagong city and Bangladesh as well as explain the result obtained from the following data: (20)

Table 1: Product harvested for different land

Built Up Land (GHa)	Carbon (GHa)	Cropland (GHa)	Fishing Ground (GHa)	Grazing Land (GHa)	Forest Products (GHa)
124634.3	434774.8	534612.26	34373.05	721.95	128910.28

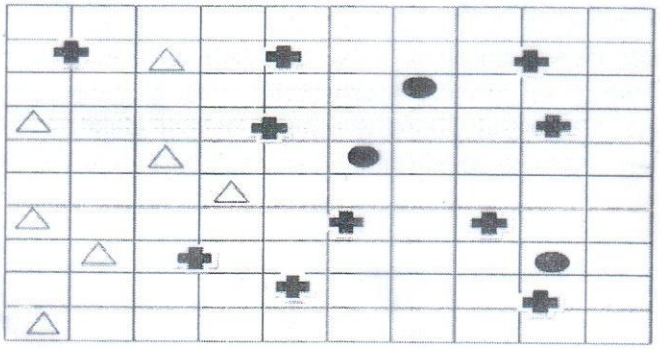
Table 2: Yield factor and equivalence factor

Type of Land	Dhaka (GHa per person)	Chittagong (GHa per person)	Bangladesh (GHa per person)	Equivalence Factor (GHa per person)
Built Up Land	0.07	0.09	0.06	2.51
Carbon	0.29	0.30	1.71	0.10
Cropland	0.34	0.30	0.55	2.51
Fishing Ground	0.02	0.04	0.09	0.37
Forest Products	0.08	0.06	0.28	1.26
Grazing land	0.50	0.45	0.14	0.46

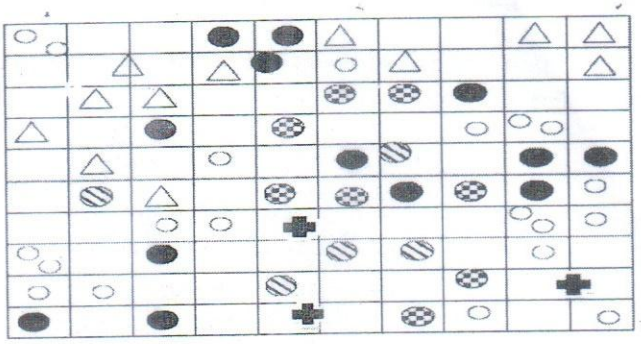
(b) Write down the process of the removal of CO_2 from the atmosphere by spraying external species above the sources of emissions. (5)

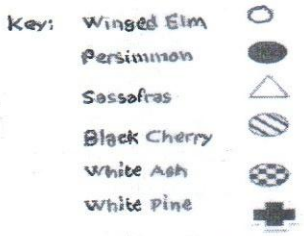
5 (a) The following model is an example of what you might find in a forest in the Southern part of Bangladesh. This example is a case study of the progression of a forest forming on farmland over a period of 20 years. The first quadrat (A) is a seedling count in a field after farming has been stopped for 5 years. The next quadrat (B) is that same field 20 years after farming has stopped (15)

Quadrat A: Tree species distribution in a $100m^2$ Quadrat abandoned for 5 years.



Quadrat B:Tree species distribution in a $100m^2$ Quadrat abandoned for 20 years





I. For each quadrat record the number of each type of tree or shrub and calculate the percentage of the total for each.

II. Examine quadrat B. What new or "emerging" species started to show up 20 years after the field was abandoned?

III. Ecologist noticed that the new "emerging" species after 20 years were mostly in the understory while the pioneer species that were still present were primarily tall trees making up the canopy. Can you explain why this might be?

IV. Is this model an example of primary or secondary succession? Explain your answer.

V. How would the information gathered help an ecologist determine the health of an ecosystem after a brush fire? Explain your answer.

(b) Calculate the deforestation rate of different city of Bangladesh based on the following data and find out which one is the green city according to the following data: (10)

Place	Forest area cover in the year 1980. (Km^2)	Forest area cover in the year 2010. (Km^2)
Dhaka	35000000	125000
Chattagram	125000000	2500000
Barisal	5210000	540000
Sylhet	4500000	50000000
Rajshahi	375000	35000
Khulna	4210000	42560000

6 (a) Write down the 17 Sustainable Development Goals with an example. (17)

(b) What is Restoration ecology? Write down the different techniques that are used to restore the soil organic matter into the ecosystem. (08)

7 (a) A recent collection of fossil skulls of *Unicornia imaginarus* showed the following age of death distribution: (20)

Age (yr)	No of Skulls
0-1	36
1-2	8
2-3	14
3-4	12
4-5	10
5-6	26
6-7	34
7-8	50
8-9	12
9-10	4

Tabulate the complete life table for this species and also plot the survivorship curve for this species.

(b) A population of 100 ferrets is introduced to a large island in the beginning of 1990. Ferrets have an intrinsic growth rate of 1.3 $^{yr-1}$ .Assuming unlimited resources—i.e., there are enough resources on this island to last the ferrets for hundreds of years—how many ferrets will there be on the island in the year 2000 and what is the doubling time of the population? (05)

8 (a) Model the removal of carbon dioxide from the atmosphere by spraying external species above the sources of emissions from the following data: (17)

$$Q = 2,\ \delta_0 = 1,\ \lambda_1 = 0.3, r_1 = 0.2,\ \lambda = 1, r = 1,\ \lambda_0 = 1.8,\ r_0 = 1.6, \theta_1 = 0.2, \theta_2 = 0.15,$$

$$\theta_{10} = 0.18,\ \theta_{20} = 0.12,\ \pi_{10} = 0.02,\ \pi_{20} = 0.02$$

(b) Define El Niño and La Niña. Use neat sketch to illustrate these two phenomena (08)

Supplementary data

		Global warming potential over integration time horizon		
Gas	**Lifetime(years)**	**20 years**	**100 years**	**500 years**
CO_2	~100	1	1	1
CH_4	10	62	25	8
N_2O	120	290	320	180
$CFC-12$	102	7900	8500	4200
$HCFC-123$	1.4	300	93	29
SF_6	3200	16500	24900	36500

$$\frac{dC}{dt} = Q - \delta_0 C - \lambda_1 C C_i - r_1 C C_p + \pi_{10}\theta_{10} C_a + \pi_{20}\theta_{20} C_{pa}$$

$$\frac{dC_i}{dt} = \lambda Q - \lambda_0 C_i - \lambda_1 C C_i$$

$$\frac{dC_p}{dt} = rQ - r_0 C_p - r_1 C C_p$$

$$\frac{dC_a}{dt} = \theta_1 C C_i - \theta_{10} C_a$$

$$\frac{dC_{pa}}{dt} = \theta_2 C C_p - \theta_{20} C_{pa}$$

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B. Sc. Engg. (CEE)/ 4th Sem. 26 October, 2018 (Group A)

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

TERM : FINAL EXAMINATION
COURSE NO. : CEE 4411
COURSE TITLE: Engineering Materials

SUMMER SEMESTER: 2017-2018
TIME : 3 Hours
FULL MARKS: 200

There are EIGHT questions. Answer SIX questions including Question No. 1 and Question No. 2. Question No. 1 and Question No. 2 are 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.

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1 Concrete mix design is required for a commercial building project based on the following data: (60)

Volume ratio of sand to total aggregate = 0.40
Air Content = 2 % (air-entraining admixture is not used)
Specific gravity of cement = 2.9 (Blended cement)
Specific gravity of sand (SSD) = 2.5
Specific gravity of coarse aggregate (SSD) = 2.6
Design compressive strength (28 days) = 4500 psi
Minimum required slump = 175 mm
Maximum aggregate size = ¾ inch, Aggregate type = Stone chips
Dosage of superplasticizer = 10 ml/kg of cement if W/C is less than 0.45.
The following graphs are provided :

- Variation of compressive strength (28 days) with W/C,
- Variation of cement content with compressive strength (28 days) for different aggregate size and slump value.

(i) Calculate the unit contents of the proposed mix of concrete.
(ii) Prepare a mixture proportion table. Typical form of mixture proportion table is attached.
(iii) Calculate the volume ratio of the mix. Assume unit weights of cement, sand (SSD), and coarse aggregate (SSD) with void are 1300 kg/m^3, 1350 kg/m^3 and 1450 kg/m^3, respectively.
(iv) Calculate the cost of concrete for one cubic meter. Assume the cost of 1 bag cement is Tk. 400, cost of 1 cft sand is Tk. 30, and cost of 1 cft stone chips is Tk. 180.
(v) Estimate the materials in weight and volume (cement, water, sand, and coarse aggregate) required to make 10 beams of 12 inch width 18 inch depth and 18 feet span. Assume 10% additional volume for losses during casting of concrete.
(vi) Assume 3% surplus water in sand over SSD condition and the amount of bulking of sand is 10%. What adjustments are

necessary in the mix design?

(vii) Calculate the compaction factor of the mix.

(viii) Explain the advantages and disadvantages of volumetric and weight based mix designs.

(ix) If instead of blended cement, CEM Type I cement is used, what will happen to the early strength and long-term strength of concrete?

(x) If sand to aggregate ratio is reduced from the designed value, what changes will occur in fresh and hardened properties of concrete?

2 For a bridge construction project, the recommended FM is 2.6 for sand and 6.6 for stone chips. From a nearby market, sand and stone chip samples were collected and sent to the Concrete Laboratory of Islamic University of Technology (IUT) for sieve analysis. The sieve analysis data are given below: (40)

ASTM Sieve	Amount Retained (g)	
	Sand	Stone Chips
3 inch	0	0
1.5 inch	0	0
¾ inch	0	2900
½ inch	0	500
3/8 inch	0	10
#4	0	1500
#8	40	0
#12	70	0
#16	5	0
#30	5	0
#40	5	0
#50	80	0
#100	50	0
#200	45	40
Pan	50	50

(i) Calculate the FM of the samples.

(ii) Calculate the amount of silt and clay of the samples.

(iii) Draw the grading curve of the samples.

(iv) Discuss the possible ways to improve the FM of the samples to the recommended values.

(v) Make comment on the samples based on the sieve analysis data and grading curves.

(vi) If all particles of a fine aggregate sample pass through the #100 sieve, what be the FM of the sample?

(vii) If all particles of a coarse aggregate sample retain on 3 inch sieve, what will be the FM of the sample?

(viii) What do you mean by uniform grading? Is it good for making concrete? Explain.

(ix) How do you calculate the combined FM of two aggregate samples?

(x) How do you separate a fine aggregate sample from a coarse aggregate sample?

Sieve openings for different sieves are provided (refer to the attached table).

3 (a)	Draw typical stress-strain curves of concrete and steel. Make a brief comparison on the curves.	(4)
(b)	Explain how yield strength is determined for high-strength steel.	(4)
(c)	Define the following mechanical properties of a material: (i) Ductility, (ii) Fatigue Strength, and (iii) Toughness.	(3)
(d)	Compare creep and relaxation.	(4)
(e)	Explain the strength development process of brick during burning.	(4)
(f)	Explain three harmful constituents of brick earth.	(3)
(g)	What is efflorescence? What will happen if the bricks having significant efflorescence are used for construction of brick walls?	(3)
4 (a)	Define hydration of cement. Write the reactions associated with the hydration of silicate and aluminate of cement.	(6)
(b)	Write the morphology of hydration products of cement.	(4)
(c)	Compare fly ash cement and OPC cement with respect to the following: (i) Heat of hydration, (ii) Early strength, (iii) Long-term strength, (iv) Workability of fresh concrete, and (v) Microstructure of hardened concrete.	(5)
(d)	Define normal consistency, initial setting time, and final setting time of cement.	(3)
(e)	"Cement industries are polluting the global environment"- Explain.	(3)
(f)	Discuss the possible ways for sustainable development of concrete construction works in Bangladesh.	(4)
5 (a)	Explain the seawater attack (chloride, sulfate and carbon-dioxide) of concrete with chemical reactions.	(8)
(b)	Assume that you are in-charge of a hotel construction project at Cox's Bazar. List and discuss the important factors that are to be seriously considered to ensure the durability of the project.	(6)
(c)	Define workability of concrete. How is it measured?	(3)
(d)	"W/C ratio is a key parameter related to strength and durability of concrete" – explain briefly.	(4)
(e)	Compare cold joint and construction joint of concrete.	(4)
6 (a)	Discuss the following factors associated with the compressive strength of concrete: (i) W/C, (ii) Temperature , (iii) Grading of aggregate, (iv) Compaction, and (v) Curing.	(5)
(b)	"Cube strength of concrete is higher than the cylinder strength of concrete" – why?	(5)
(c)	Write short notes on the followings:	(5)

8 (a)	How are steel bars protected against corrosion inside concrete? Discuss the ways for breakdown of this protection.	(5)
(b)	How is a corrosion cell formed over the steel bar inside concrete? Explain with anodic and cathodic reactions.	(5)
(c)	Write short notes on CEM Type II B - M and CEM Type II A – S cement.	(3)
(d)	Explain false setting and flash setting of cement.	(5)
(e)	"Fly ash shows pozzonanic activity but slag shows hydraulic activity" – discuss.	(3)
(f)	Explain segregation, bleeding, laitance, and honeycomb of concrete.	(4)

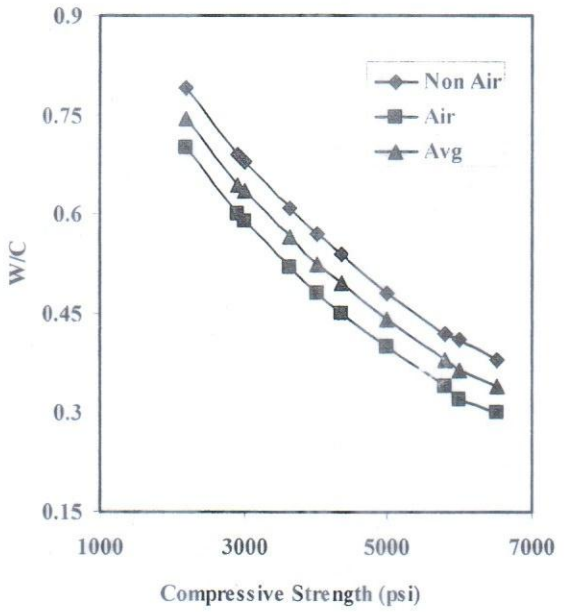

Fig. W/C versus Compressive Strength (aggregate type = stone chips)

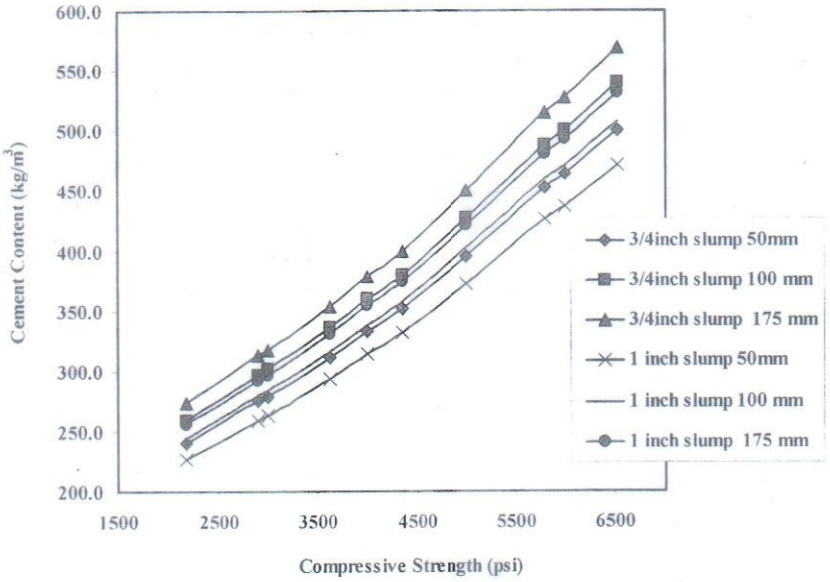

Fig. Cement Content versus Compressive Strength (aggregate type = stone chips)

Mixture Proportion Table

W/C	s/a	Maximum Aggregate Size	Slump	Air Content	Unit Contents (kg/m3)				Super plasticize
%	%	mm	cm	%	C	W	FA	CA	ml/kg of cement

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	$3\frac{1}{2}$ in.	$3\frac{1}{2}$ in.
75 mm	3	3 in.	3 in.
63 mm	2.5	$2\frac{1}{2}$ in.	$2\frac{1}{2}$ in.
53 mm	2.12	2 in.	2.12
45 mm	1.75	$1\frac{3}{4}$ in.	$1\frac{3}{4}$ in.
37.5 mm	1.50	$1\frac{1}{2}$ in.	$1\frac{1}{2}$ in.
31.5 mm	1.25	$1\frac{1}{4}$ in.	$1\frac{1}{4}$ in.
26.5 mm	1.06	1 in.	1.06
22.4 mm	0.875	$\frac{7}{8}$ in.	$\frac{7}{8}$ in.
19.0 mm	0.750	$\frac{3}{4}$ in.	$\frac{3}{4}$ in.
16.0 mm	0.625	$\frac{5}{8}$ in.	$\frac{5}{8}$ in.
13.2 mm	0.530	$\frac{1}{2}$ in.	0.530 in.
11.2 mm	0.438	—	$\frac{7}{16}$ in.
9.5 mm	0.375	$\frac{3}{8}$ in.	$\frac{3}{8}$ in.
8.0 mm	0.312	$\frac{5}{16}$ in.	$\frac{5}{16}$ in.
6.7 mm	0.265	$\frac{1}{4}$ in.	0.265 in.
5.6 mm	0.223	—	No. $3\frac{1}{2}$
4.75 mm	0.187	$\frac{3}{16}$ 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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B.Sc. Engg. (CEE)/ 4th Sem. 31 October, 2018 (Group A)

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

Semester: Semester Final Examination **Summer Semester: 2017-2018**
Course No.: CEE 4413 **Full Marks: 150**
Course Title: Mechanics of Solids II **Time: 3.0 hours**

There are **8 (Eight)** Questions. Answer any **6 (Six)** questions. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this question paper. The symbols have their usual meaning.

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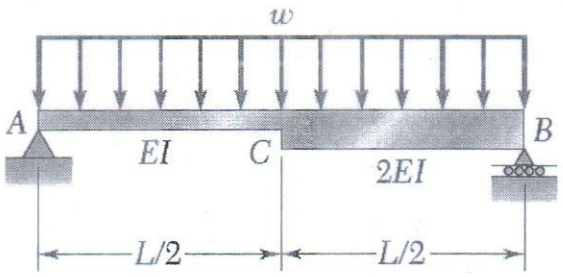
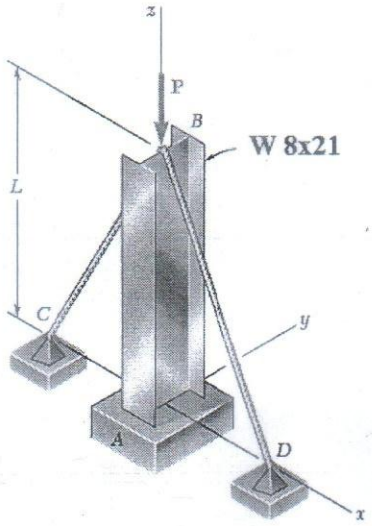
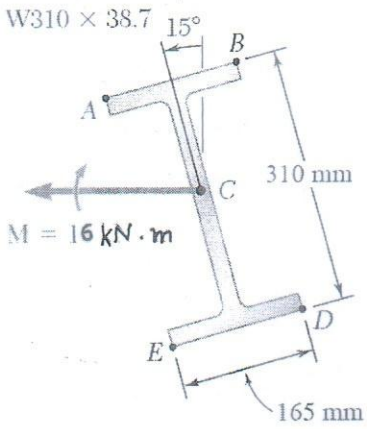
1 (a) For the beam and loading shown, determine (i) the slope at end A, (ii) the slope at end B, (iii) the deflection at the midpoint C. Use moment-area method. (18)



(b) A W8x21 rolled-steel shape is used with the support and cable arrangement shown in the figure. Knowing that L = 24 ft, determine the allowable centric load 'P' if a factor of safety of 2.2 is required. Use E = 29 x 10^6 psi. Given that for W 8x21, I_x= 75.3 in^4 and I_y = 9.77 in^4. (07)

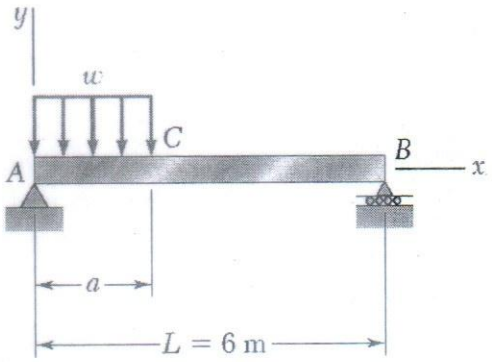


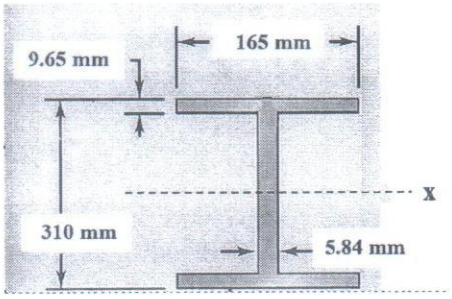
2 (a) The couple M acts in a vertical plane and is applied to a beam oriented as shown. Determine (i) the angle that the neutral axis forms with the horizontal, (ii) the maximum tensile stress in the beam. Given that the flange and web thickness of W310 x 38.7 beam is, respectively, 9.65 mm and 5.84 mm. (15)



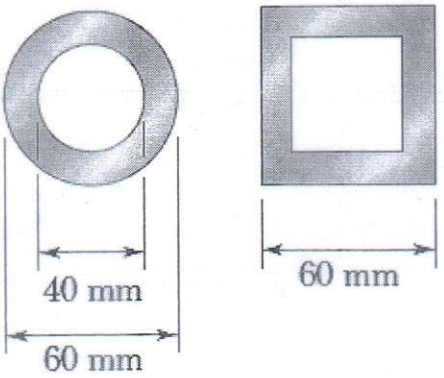
(b) Determine the largest internal pressure that can be applied to a cylindrical tank of 1.75 m diameter and 16 mm wall thickness if the ultimate normal stress of the steel used is 450 MPa and a factor of safety of 5.0 is required. (10)

3 (a) For the beam and loading shown, knowing that a = 2 m, w = 50 kN/m, and E = 200 GPa, determine (i) the slope at support A, (ii) the deflection at point C. Given that I = 85.1 x 10^6 mm^4. (16)





(b) Two brass rods used as compression members, each of 3-m effective length, have the cross sections shown. (i) Determine the wall thickness of the hollow *square* rod for which the rods have the same cross-sectional area. (ii) Using E = 105 GPa, determine the critical load of each rod. (09)



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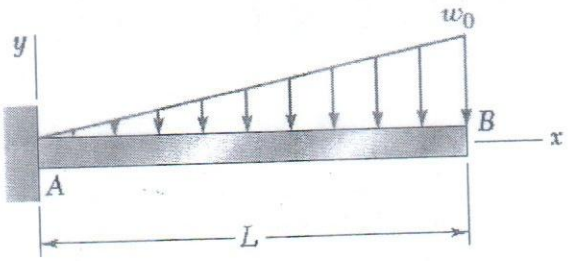
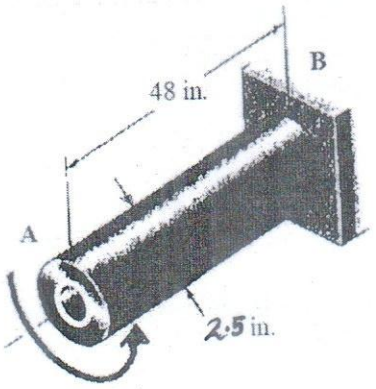
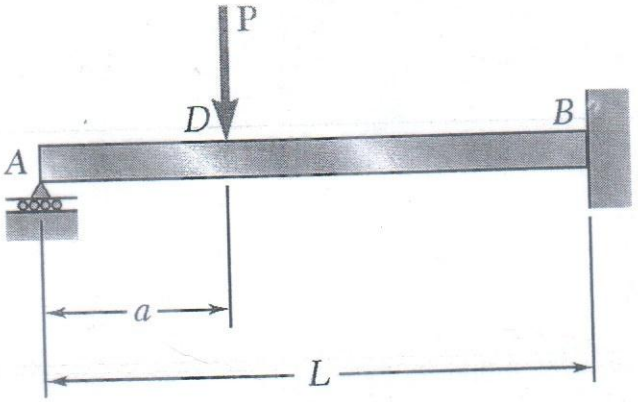
4 (a) For the loading shown, determine (i) the equation of the elastic curve for the cantilever beam AB, (ii) the deflection at the free end, and (iii) the slope at the free end. Assume that the flexural rigidity EI of each beam is constant throughout the length. (14)



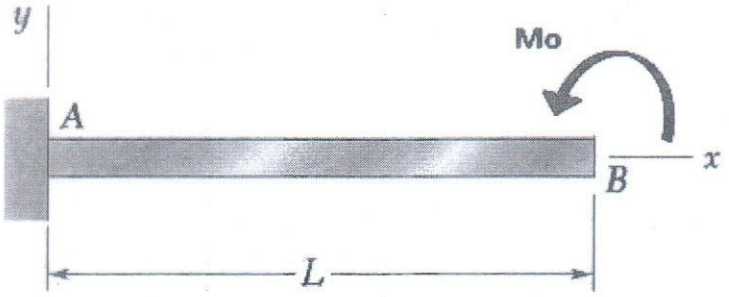
(b) The design specifications for the steel shaft AB require that the shaft acquire a strain energy of 400 in·lb as the 25 kip·in torque is applied. Using G = 11.2 x 10^6 psi, determine (i) the largest inner diameter of the shaft that can be used, (ii) the corresponding maximum shearing stress in the shaft. (11)



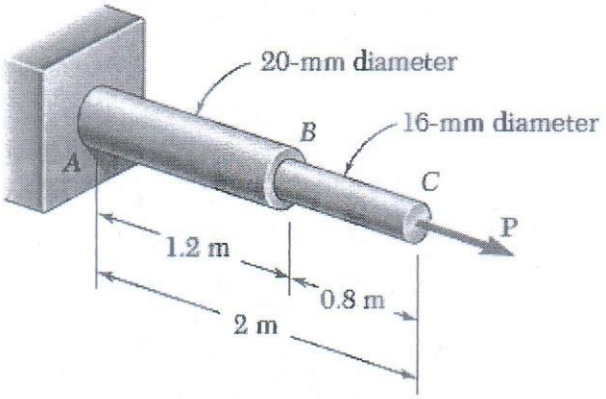
5 (a) Determine the reaction at the roller support B and the deflection at point D if "a" is equal to L/3. Assume that the flexural rigidity EI of each beam is constant throughout the length. (15)



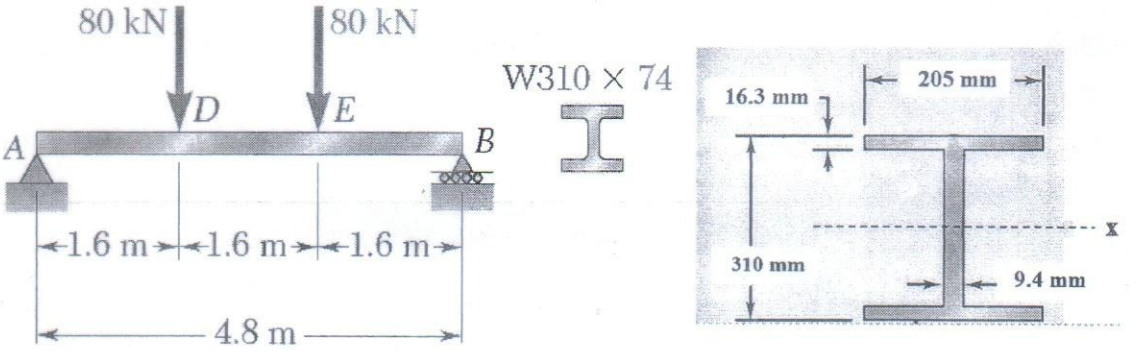
(b) For the loading shown, determine (i) the equation of the elastic curve for the cantilever beam AB, (ii) the deflection at the free end, (iii) the slope at the free end. Assume that the flexural rigidity EI of each beam is constant throughout the length. (10)



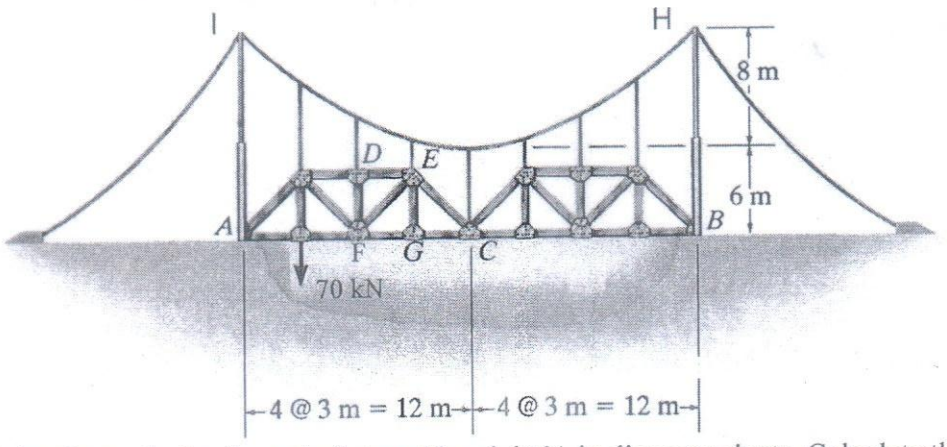
6 (a) Using E = 200 GPa, determine (i) the strain energy of the steel rod ABC when P = 25 kN, (ii) the corresponding strain-energy density in portions AB and BC of the rod. (10)



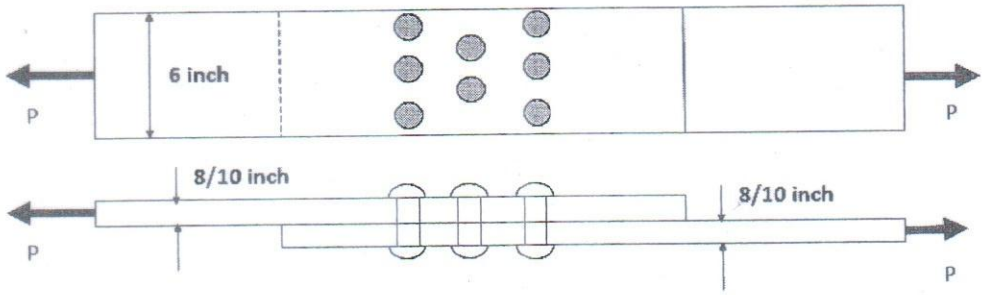
(b) Using E = 200 GPa, determine the strain energy due to bending for the steel beam and loading shown. Ignore the effect of shearing stresses. Given that for W310x74, I_x= 394 in^4 and I_y = 56.3 in^4. (15)



7 (a) The suspension bridge in the following figure is constructed using the two stiffening trusses that are pin connected at their ends 'C', and supported by a pin at 'A' and a rocker at 'B'. Determine the maximum tension in the cable 'IH'. The cable has a parabolic shape and the bridge is subjected to the single load of 70 kN. (15)



(b) The lap joint shown in the figure is fastened by eight ¾-in diameter rivets. Calculate the maximum safe load 'P' that can be applied if the maximum normal stress in the plate is limited to 30 ksi, shearing stress in the rivets is limited to 20 ksi, and the bearing stress in the plates is limited to 25 ksi. Assume the applied load is uniformly distributed among all the rivets. (10)



8 (a) A hot-rolled steel has a yield strength of $S_{yt} = S_{yc} = 120$ kpsi and a true strain at fracture of $\varepsilon_f = 0.60$. Estimate the factor safety for the following principal stress states: (12)

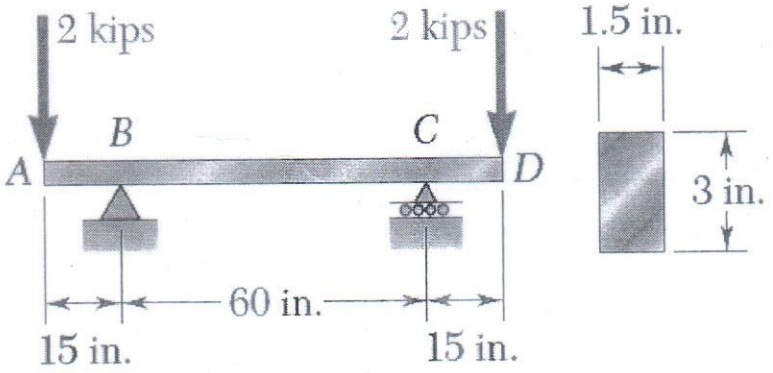
(i) $\sigma_x = 80$ kpsi, $\sigma_y = 50$ kpsi, $\tau_{xy} = 0$ kpsi

(ii) $\sigma_x = 0$ kpsi, $\sigma_y = 40$ kpsi, $\tau_{xy} = 45$ kpsi

(iii) $\sigma_x = -50$ kpsi, $\sigma_y = -80$ kpsi, $\tau_{xy} = 25$ kpsi

(iv) $\sigma_x = 40$ kpsi, $\sigma_y = 30$ kpsi, $\tau_{xy} = 30$ kpsi

(b) Using $E = 29 \times 10^6$ psi, determine the strain energy due to bending for the steel beam and loading shown. Ignore the effect of shearing stresses. (13)



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B.Sc. Engg. (CEE)/4th Sem. 13 August, 2018 (Morning)

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

Mid Semester Examination **Summer Semester: 2017-18**
Course No.: CEE 4431 **Full Marks: 75**
Course Title: WATER SUPPLY ENGINEERING **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.

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1 (a) In water supply, per capita water demand is very important. How can you calculate the per capita water demand? Explain the hourly variation of water demand with diagram. (06)

(b) Mention the requirements of an indicator organism in water. 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. Using the least square parabolic method; calculate the population in 2020 and 2030. (10)

Year	1950	1960	1970	1980	1990	2000
Population (Thousand)	25	28	32	37	43	52

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.

(d) What are the basic requirements of drinking water? Mention the quantities of water required for various purposes in rural areas of Bangladesh. (05)

2 (a) Distinguish among dissolved substances, suspended solids and colloidal substance based on their size. What are the factors to be considered in selecting a suitable source for water supply? (05)

(b) A ground water sample has the following chemical analysis at $20^{O}C$. (08)

Cations	Conc. (mg/L)	Anions	Conc. (mg/L)
Ca^{+2}	180	HCO_3^-	300
Mg^{+2}	65	CO_3^{-2}	40
Na^+	60	SO_4^{-2}	60
K^+	20	Cl^-	348
Fe^{+2}	0.5	NO_3^-	35

(i) Check the completeness of the chemical analysis data
(ii) Calculate the total hardness and non-carbonate hardness and alkalinity of the water in mg/L as $CaCO_3$.

(c) What types of impurities should be removed from raw water in order to make water safe for drinking and suitable for domestic uses? What are the treatment methods that could be used for removing those impurities from the water? (06)

(d) For a town having population of 60,000 estimate the average daily demand of water. Assume industrial use 10%, institutional and commercial use 15 %, public use 5% and livestock 10% of domestic demand. Assume per capita water demand is 50 L/day and leakage to be 5%. (06)

3 (a) What are the environmental significance of TDS? Mention the unit treatment processes for the removal of the following from water: (05)

(i) Color
(ii) Dissolved substances
(iv) Living impurities.

(b) What is effect of Surface Overflow Rate (SOR) on the performance of a Plain Sedimentation Process? Explain with diagram. (06)
Suppose that the depth of a sedimentation tank is reduced by 60%. Assume discrete particle settling, what is the effect on particle removal efficiency if the flow rate is unchanged (from the original case)? Explain your answer.

(c) What are the basic elements of a water supply system? (07)
For a water treatment plant with a design flow of 2.0 million gallon per day (MGD), determine the dimensions (in ft) for a rectangular sedimentation basin with a detention time of 4 hr, an overflow rate of 700 gpd/ft^2, and length to width ratio of 4 to 1. (Assume 1.0 ft^3 = 7.48 gal).

(d) 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.

4 (a) An ideal sedimentation tank with a surface are of 100 m^2 receives an inflow of 25 x 10^6 L/day of water. Referring to the data for particles types A, B and C, find the percentage of each particle size settle down. (06)

Particle Type	Settling velocity (cm/sec)
A	0.49
B	0.25
C	0.20

(b) What are the various conventional methods of water treatment? Draw a flow diagram to treat protected surface water and also list the chemicals generally required in the treatment process. (05)

(c) Distinguish between potable and palatable water. What are the allowable limit of turbidity, nitrate, fluoride, hardness and arsenic in drinking water according to WHO guideline and Bangladesh standard? (06)

(d) 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 m^3 per hector per day. The public water use and water unaccounted for are 10 and 6 percent of total municipal water demand, respectively. Calculate total municipal demand and each component as percent of total municipal demand. (08)

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B. Sc. Engg. (CEE)/ 4th Sem. 22 October , 2018

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester Final Examination **Summer Semester: 2017-2018**
Course No.: CEE 4441 **Full Marks: 200**
Course Title: Soil Mechanics **Time: 3 Hours**

There are 8 (Eight) questions. Answer any 6 (Six) 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) Define the followings: (10)
(i) Plastic limit, (ii) Liquidity index, (iii) Activity of soils, and (iv) Coefficient of compressibility.

(b) Write down the difference between Standard and Modified Proctor Compaction Tests of soils. ($6\frac{1}{3}$)

(c) Derive the basic differential equation of Terzaghi's one-dimensional consolidation theory. Write down the necessary assumptions for the derivation of the equation. (17)

2 (a) What is group index in AASHTO Classification System? Briefly describe the rules for determining the group index. ($6\frac{1}{3}$)

(b) Derive the coefficients of permeability in the vertical and horizontal directions in anisotropic soil. (7)

(b) In a clay layer shown in Fig.1, γ_{sat}=18.80kN/m^3, γ_w=9.80kN/m^3, C_c=0.50, C_s=0.10, e_0=1.0, c_v=0.10 m^2/day, σ'_c=80.0 kPa, surcharge q=40kPa. Compute- (20)
(i) Total settlement for primary consolidation.
(ii) Settlement for 90% consolidation.
(iii) Time required for the 90% consolidation, T_v=0.848.

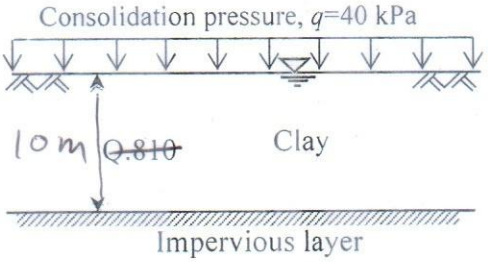

Fig.1 for Q.2(b)

3 (a) Draw flow-nets of the ground shown in Fig. 2. Estimate the seepage per day under the sheet pile. Here, coefficient of permeability of the soil, $k = 4.0\times10^{-4}$ m/s. (20)

(b) Compute total head, pressure head and elevation head at points A, B, C, and D shown in Fig.2. ($8\frac{1}{3}$)

(c) If saturated unit weight of soil, γ_{sat}=1.98 tf/m^3, check the condition of piping. (5)

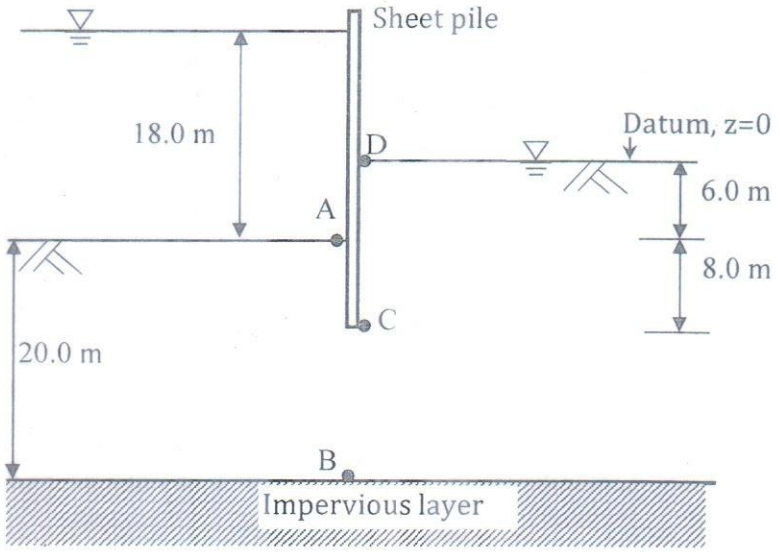

Fig.2 for Q.3

4 (a) For a given sand, the maximum and minimum void ratios are 0.95 and 0.50, respectively. Given, $G_s = 2.70$, determine the dry unit weight of the soil in kN/m^3 when the relative density is 80%. (18)

(b) Results of two triaxial CU tests are listed in Table 1 for a soil. A triaxial CD test for the same soil is carried out under confining stress of 100 kPa. At what axial stress (σ_1) the sample will fail? ($15\frac{1}{3}$)

Table 1: Results of CU tests

Test	Confining stress (σ_3) (kPa)	At failure	
		Deviatoric stress (q) (kPa)	Pore water pressure (kPa)
1	50	150	30
2	200	350	110

5 (a) Briefly describe sand drains and prefabricated vertical drains in accelerating consolidation of clayey soil. ($6\frac{1}{3}$)

(b) Define earth pressure at rest. What will be the value of coefficient of earth pressure at rest for a sandy ground having the angle of internal friction of 30°? (7)

(c) An embankment is shown in Fig.3. Determine the stress increase under the embankment at point A. Unit weight of the embankment soil, γ=15.0 kN/m^3. Use Fig.6 for getting I_2. (20)

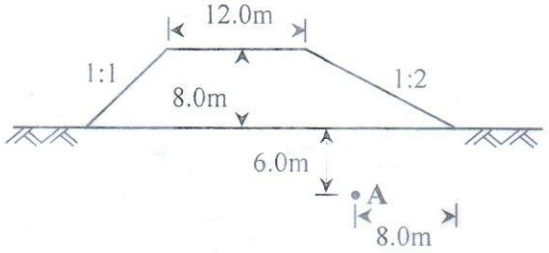

Fig. 3 - for Q.5(c)

6(a) Describe briefly soil fabric and structures of soils. ($6\frac{1}{3}$)

(b) The results of a standard Proctor test are given in Table 2. (27)
(i) Determine the maximum dry density (kg/m^3) of compaction and the optimum moisture content. Volume of the container is 9.44×10^{-4} m^3.
(ii) What is the void ratio at optimum moisture content, if $G_s = 2.70$.
(iii) If the moisture content in the field is 15% and moist density is 1700 kg/m^3. Compute the degree of compaction.

Table 2: Results of a standard Proctor test

Mass of Wet soil in the mold (kg)	Moisture content (%)
1.2	10.00
1.5	11.50
1.8	13.00
1.9	14.50
1.7	16.00
1.5	17.00

7(a) What is liquid limit? Describe briefly the procedure of Casagrande Method for determination of the liquid limit. ($12\frac{1}{3}$)

(b) Answer the following questions regarding earth pressure on the wall in sandy soil ($c'=0$, $\phi'=30^o$) when the wall moves towards the left due to the failure of the ground (Fig.4). (21)

(i) Compute Rankine active and passive earth pressure coefficients.
(ii) If active and passive earth pressures are equal, ($P_a=P_p$), find z_p, consider water table is far below from the tip of the wall. Use, $\gamma=17.0$ kN/m^3.
(iii) Compute active earth pressure and pore water pressure when the water table rises due to the rainfall to the position which is 5.0 m below the surface of the backfill ground. Use, $\gamma_{sat}=18.8$ kN/m^3, $\gamma_w=9.8$ kN/m^3.

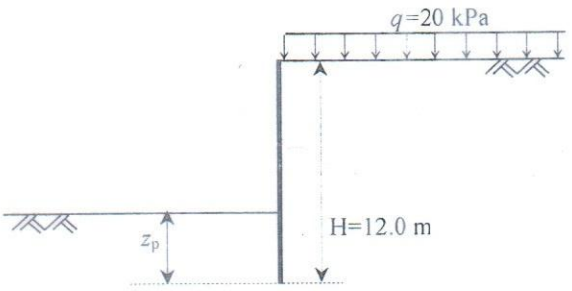

Fig. 4 - for Q.7(b)

8. A 10.0 m high retaining wall with a granular soil backfill is shown in Fig. 5. Given that unit weight of soil $\gamma = 1.64$ tf/m^3, angle of internal friction $\phi' = 30^\circ$, inclination of the wall face $\theta = 5^\circ$, and friction between the wall face and the ground $\delta = 10^\circ$. Determine the active thrust per meter length of the wall by Culmann graphical method. (Draw in a graph paper). ($33\frac{1}{3}$)

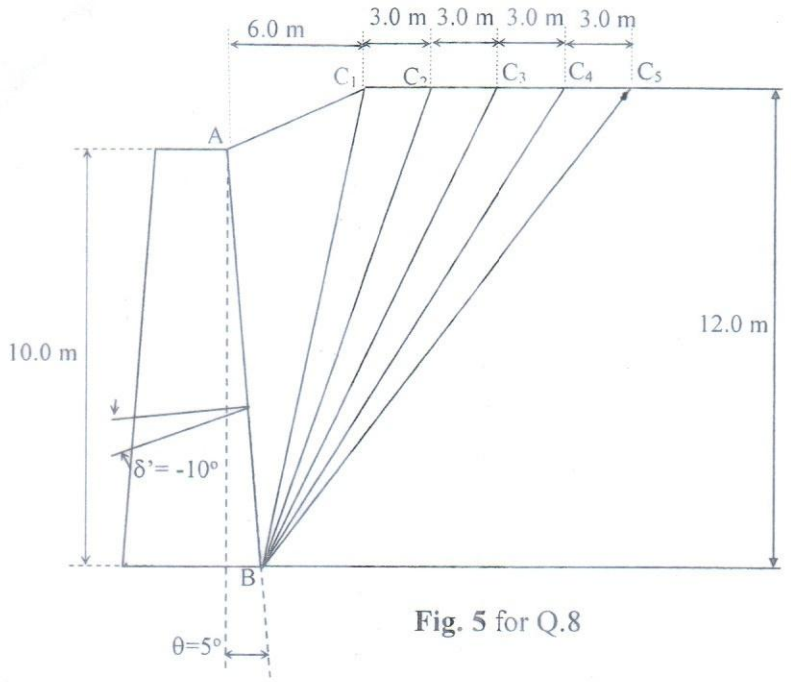
6.0 m
3.0 m
3.0 m
3.0 m
3.0 m
C1
C2
C3
C4
C5
A
B
10.0 m
12.0 m
δ'= -10°
θ=5°

Fig. 5 for Q.8

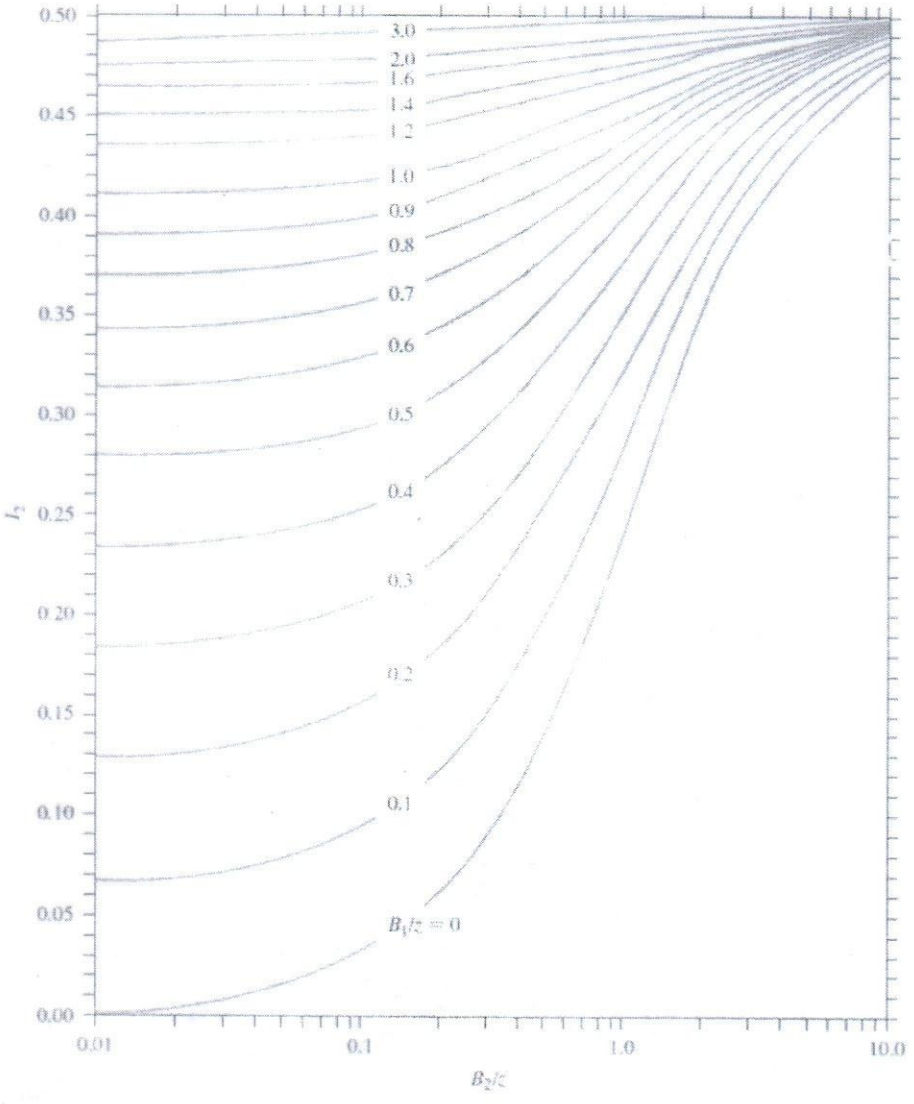
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3.0
2.0
1.6
1.4
1.2
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
$B_1/z = 0$
0.01
0.1
1.0
10.0
B_2/z

Fig. 6 Osterberg's chart for determination of vertical stress due to embankment loading (for Q.5(c))

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

SEMESTER FINAL EXAMINATION — SUMMER SEMESTER: 2017-2018
COURSE No: Math 4453 — TIME : 3 Hours
COURSE TITLE: Probability and Statistics — FULL MARKS: 150

There are 8 (Eight) questions. Answer any 6 (Six) of them.
Programmable calculators are not allowed. Do not write anything on this question paper.
All Questions carry equal Marks. The Symbols have their usual meaning.

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1. a) A company dealing in 60 products, in the course of establishing an inventory control system, classified products according to price as shown in the frequency table below: (10)

Unit cost (in hundreds of TK):	3-5	6-8	9-11	12-14	15-17	18-20	21-23
No. of items :	6	8	10	20	8	5	3

Prepare suitable diagram for the distribution on a graph paper. Use the graph to determine D_2 and P_{80}.

b) A collar manufacturer is considering the production of a new style of collar to attract young man. The following statistics of neck circumference are available based on measurements of a typical group of the college students: (15)

Mid value (in inches)	12.0	12.5	13.0	13.5	14.0	14.5	15.0	15.5	16.0
Number of students	3	16	36	60	76	37	18	4	3

Compute the standard deviation and use the criterion $\bar{X} \pm 3\sigma$ where σ is the standard deviation and $\bar{X}$ is the arithmetic mean to determine the largest and smallest size of the collar he should make in order to meet the needs of practically all the customers bearing in mind that collars are worn on average ½ inch longer than the neck size.

2. a) Define Skewness and Kurtosis with classifications. Using moments calculate the coefficients of Skewness and Kurtosis from the following distribution given below and comment on the result obtained (10)

Profits (in Taka):	10-20	20-30	30-40	40-50	50-60
No. of companies:	18	20	30	22	10

b) Define the followings: (15)

Conditional probability, **Mutually exclusive events** and **Mathematical expectation**.

The odds against student X solving a business statistics problem are 8:6 and odds in favor of student Y solving the same problem are 14:16. What is the probability that
(i) they both, working independently of each other, solve the problem?
(ii) neither solves the problem?

3. a) Define mathematical expectation of a random variable. Can this value be negative? Justify your answer with an example. (5)

b) The Delta Life Insurance Company offers to sell a Tk. 25000 one-year term life insurance policy to a 25-year-old man for a premium of Tk. 2500. According to Bangladesh life table, the probability of surviving one-year for a 25-year-old man is 0.97. What is the company's expected gain? (10)

c) A traffic control officer reports that 65% of the trucks passing through a check post are from within Dhaka city. What is the probability that at least three of the next five trucks are from out of the city? (10)

4. a) Define probability distribution. How does it differ from a frequency distribution? What conditions must a probability distribution satisfy? (10)

b) Verify that $f(x,\lambda)=\dfrac{e^{-\lambda}\lambda^{x}}{x!}$ is a probability function. (5)

c) The average number of calls received by a telephone operator during a time interval of 10 minutes during 5:00 pm to 5:10 pm daily is 3. What is the probability that the operator will receive (i) no call (ii) one call (iii) at least two calls tomorrow during the same time interval? (10)

5. In a study by Cross et al. (A-2), patients who were involved in problem gambling treatment were asked about co-occurring drug and alcohol addictions. Let the discrete random variable X represent the number of co-occurring addictive substances used by the subjects. Table below summarizes the frequency distribution for this random variable. (25)

No. of Substances Used	Frequency
0	144
1	342
2	142
3	72
4	39
5	20
6	6
7	9
8	3
9	2

a) Construct a graph of the probability distribution and a graph representing the cumulative probability distribution for these data.
b) What is the probability that an individual selected at random used more than six addictive substances?
c) What is the probability that an individual selected at random used between two and five addictive substances, inclusive?
d) Find the mean, variance, and standard deviation of this frequency distribution.

6. a) Show that central moments are independent of the origin but dependent on scale and hence verify this claim for the first four moments about the mean using the values 20, 25, 30, 40, 50 of the variable X. (15)

b) A bag contains 3 red, 4 white, 2 blue and 5 green balls. 20 balls are drawn at random from it one after another with replacement. What is the probability of obtaining 5 balls of each color? (10)

7. a) Find the mean and variance of the Binomial distribution. (10)
A commonly used practice of airline companies is to sell more tickets than actual seats to a particular flight because customers who buy tickets do not always show up for the flight. Suppose that the percentage of no-shows at flight time is 2%. For a particular flight with 197 seats, a total of 200 tickets was sold. What is the probability that the airline overbooked this flight?

b) The grade-point average score of 80 students of the Department of Civil and Environmental Engineering of IUT in their term final examination was found to follow approximately a normal distribution with a mean of 2.1 and a standard deviation 0.6. How many of these students are expected to have a score between 2.5 to 3.5? (15)

8. a) Define regression and correlation analyses. What is the difference between them? Write briefly about r = -1, 0 and 1. (15)
The following data related to advertising expenditure (in lakhs of taka) and their corresponding sales (in crores of taka). Find equations of both regression lines, regression coefficients and correlation coefficient between them

Advertising expenditure: 10 12 15 23 20
Sales : 14 17 23 25 21

Estimate (i) the sales corresponding to advertising expenditure of Tk. 30 lakhs
(ii) the advertising expenditure for a sales target of Tk. 35 crores

b) Fit a least squares parabola of the form $Y = a_0 + a_1X + a_2X^2$ to the set of data in Table below: (10)

X:	1.2	1.8	3.1	4.9	5.7	7.1	8.6	9.8
Y:	4.5	5.9	7.0	7.8	7.2	6.8	4.5	2.7

B.Sc. Engg. (CEE)/6th Sem. 312 25 October, 2018 (Group B)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

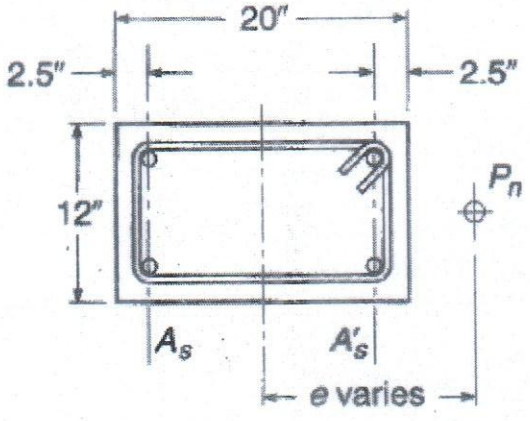
Term: Semester Final Examination **Summer Semester: 2017-2018**
Course No.: CEE 4611 **Full Marks: 150**
Course Title: Design of Concrete Structures II **Time: 3 Hours**

There are 8 (Eight) questions. Answer any 6 (Six) 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. In a three-story structure, an exterior column is to be designed for a service dead load of 222 kips, maximum live load of 297 kips, dead load moment of 136 ft-kips, and live load moment of 194 ft-kips. The minimum live load compatible with the full live load moment is 166 kips, obtained when no live load is placed on the roof but a full live load is placed on the second floor. Architectural considerations require that a rectangular column be used, with dimensions $b = 20$ in. and $h = 25$ in. Assume, reinforcement is evenly distributed around the column perimeter and $d' = 2.5$ in. (25)
   (i) Find the required column reinforcement for the condition that the full live load acts.
   (ii) Check to ensure that the column is adequate for the condition of no live load on the roof.

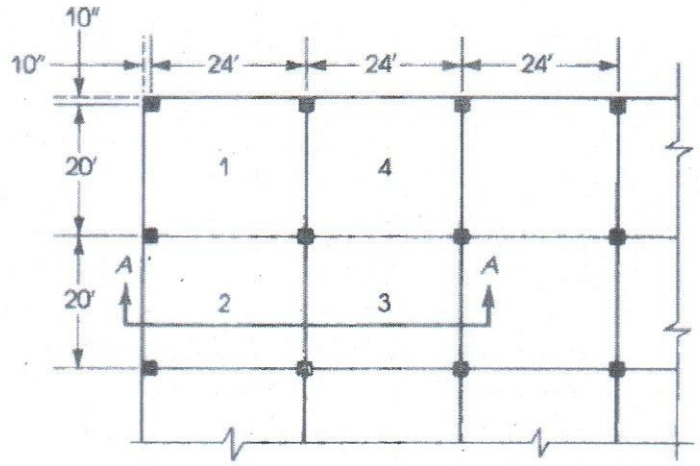
   Material strengths are $f'_c = 4{,}000$ psi and $f_y = 60{,}000$ psi. Use USD method.

2. A 12 × 20 in. column is reinforced with four No. 9 bars of area 1.0 in^2 each, one in each corner as shown in the following figure. The concrete cylinder strength is $f'_c = 4$ ksi and steel yield strength is $f_y = 60$ ksi. Draw the strength interaction diagram for the column for bending about its strong axis using USD method. (25)

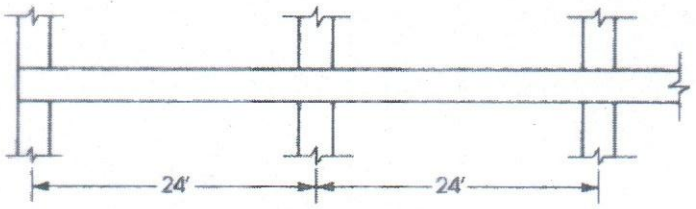


3. Using the direct design method, design a typical interior flat-plate panel (panel 3) as shown in the following figure. The floor system consists of four panels in each (25)

direction with a panel size of 24 × 20 ft. All panels are supported by 20 × 20-in. columns, 12 ft long. The slab carries a uniform service live load of 100 psf and a service dead load that consists of 24 psf of floor finish in addition to the slab self-weight. Use normal-weight concrete with f'_c = 4 ksi and f_y = 60 ksi. Use USD method.



All columns 20" × 20"



Section A-A

4 (a) Design a reinforced concrete footing to support a 20-in.-wide concrete wall carrying a dead load of 26 k/ft, including the weight of the wall, and a live load of 20 k/ft. The bottom of the footing is 6 ft below final grade. Use normal-weight concrete with f'_c = 4 ksi, f_y = 60 ksi, and an allowable soil pressure of 5 ksf. Assume, unit weight of soil = 100 pcf. Use USD method. (10)

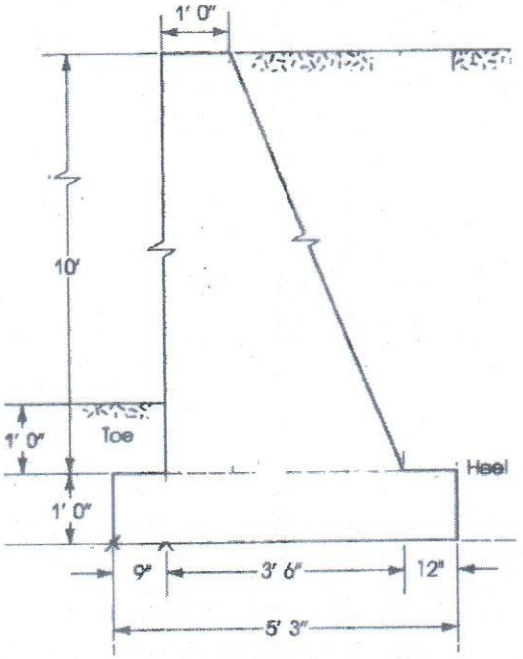
(b) Design a square footing to support an 18-in.-square tied interior column reinforced with eight no. 9 bars. The column carries an unfactored axial dead load of 245 kips and an axial live load of 200 kips. The base of the footing is 4 ft below final grade and the allowable soil pressure is 5 ksf. Use normal-weight concrete, with f'_c = 4 ksi and f_y = 60 ksi. Assume, unit weight of soil = 100 pcf. Use USD method. (15)

5. An exterior 24 × 18 in. column with D = 170 kips, L = 130 kips, and an interior 24 × 24 in. column with D = 250 kips, L = 200 kips are to be supported on a combined rectangular footing whose outer end cannot protrude beyond the outer face of the exterior column. The distance center to center of columns is 18 ft, and the allowable bearing pressure of the soil is 6000 psf. The bottom of the footing is (25)

6 ft below grade, and a surcharge of 100 psf is specified on the surface. Design the footing for f'_c = 3 ksi (normal-weight concrete) and f_y = 60 ksi. Use USD method.

6 (a) Describe the types and functions of retaining wall. What do you mean by active earth pressure and passive earth pressure? (10)

(b) The trial section of a gravity plain concrete retaining wall is shown in the following figure. It is required to check the safety of the wall against overturning, sliding, and bearing pressure under the footing. Given: weight of backfill material = 110 pcf, angle of internal friction (ϕ) = 35°, coefficient of friction between concrete and soil (f) = 0.5, allowable soil pressure (q_a) = 2.5 ksf, and f'_c = 3 ksi. Use USD method. (15)



7 (a) Write the guidelines for establishing the axes of rotation and yield lines for slab analysis. (8)

(b) What are the limitations of yield line theory of slab analysis? (7)

(c) A square slab 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 q psf. (10)

8. A two-way reinforced concrete building floor system is composed of slab panels measuring 14 × 20 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, random wall = 50 psf and live load = 60 psf. Moment coefficients are: $C_{a(D)+}$ = 0.031, $C_{a(L)+}$ = 0.050, C_{a-} = 0.076, $C_{b(D)+}$ = 0.007, $C_{b(L)+}$ = 0.011, C_{b-} = 0.016. Given: f_c' = 3 ksi, f_y = 50 ksi, and size of all beams = 12 × 20 in. Design a typical interior panel using USD method. (25)

315

Given Formula and Equations

$$\emptyset P_{n(max)} = 0.85\emptyset\left[0.85f_c^{'}\left(A_g - A_{st}\right) + f_y A_{st}\right]$$

$$\emptyset P_{n(max)} = 0.80\emptyset\left[0.85f_c^{'}\left(A_g - A_{st}\right) + f_y A_{st}\right]$$

$$A_{sp} = \frac{\rho_s d_c s}{4}\ ;\ \rho_s = 0.45\left(\frac{A_g}{A_{ch}} - 1\right)\frac{f_c^{'}}{f_{yt}}$$

$$P_n = 0.85f_c^{'}ab + A_s^{'}f_s^{'} - A_s f_s\ ;$$

$$M_n = P_n e = 0.85f_c^{'}ab\left(\frac{h}{2} - \frac{a}{2}\right) + A_s^{'}f_s^{'}\left(\frac{h}{2} - d^{'}\right) + A_s f_s\left(d - \frac{h}{2}\right)$$

$$\epsilon_s = \epsilon_u\frac{d-c}{c}\ ;\ f_s = \epsilon_u E_s\frac{d-c}{c} \le f_y$$

$$\epsilon_s^{'} = \epsilon_u\frac{c-d^{'}}{c}\ ;\ f_s^{'} = \epsilon_u E_s\frac{c-d^{'}}{c} \le f_y$$

$$a = \beta_1 c \le h\ ;\ C = 0.85f_c^{'}ab\ ;\ c_b = d\frac{\epsilon_u}{\epsilon_u + \epsilon_y}$$

$$M_o = \frac{q_u l_2 l_n^2}{8}\ ;\ \alpha_f = \frac{E_{cb}I_b}{E_{cs}I_s}\ ;\ \beta_t = \frac{E_{cb}C}{2E_{cs}I_s}\ ;\ C = \sum\left(1 - 0.63\frac{x}{y}\right)\frac{x^3 y}{3}$$

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

$$M_u = \emptyset\rho f_y bd^2\left(1 - 0.59\rho\frac{f_y}{f_c^{'}}\right)$$

$$A_s = \frac{M_u}{\emptyset f_y\left(d - \frac{a}{2}\right)};\ a = \frac{A_s f_y}{0.85f_c^{'}b}$$

$$A_s = \left(\frac{f_c}{f_y}\right)\left[1 - \sqrt{\left\{1 - \frac{2M_u}{\emptyset f_c bd^2}\right\}}\right]bd$$

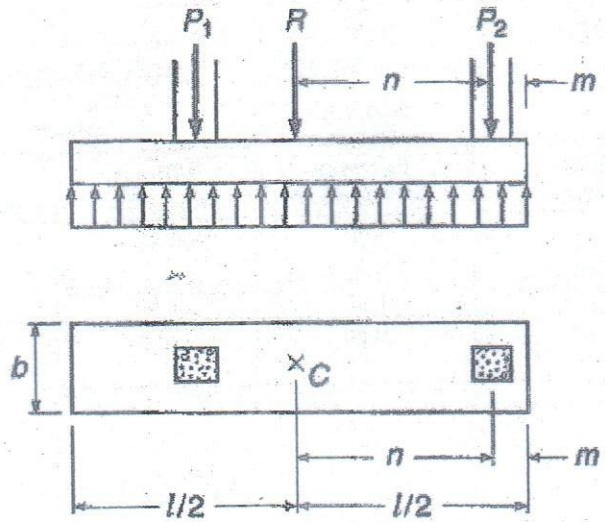
For beam or one-way shear: $\emptyset V_c = \emptyset\left(2\lambda\sqrt{f_c^{'}}bd\right)$

For two-way or punching shear: $\emptyset V_c = \emptyset\left(4\lambda\sqrt{f_c^{'}}b_o d\right)$.

$$K_{ah} = \frac{1-\sin\emptyset}{1+\sin\emptyset}\ ;\ K_{ph} = \frac{1+\sin\emptyset}{1-\sin\emptyset}$$

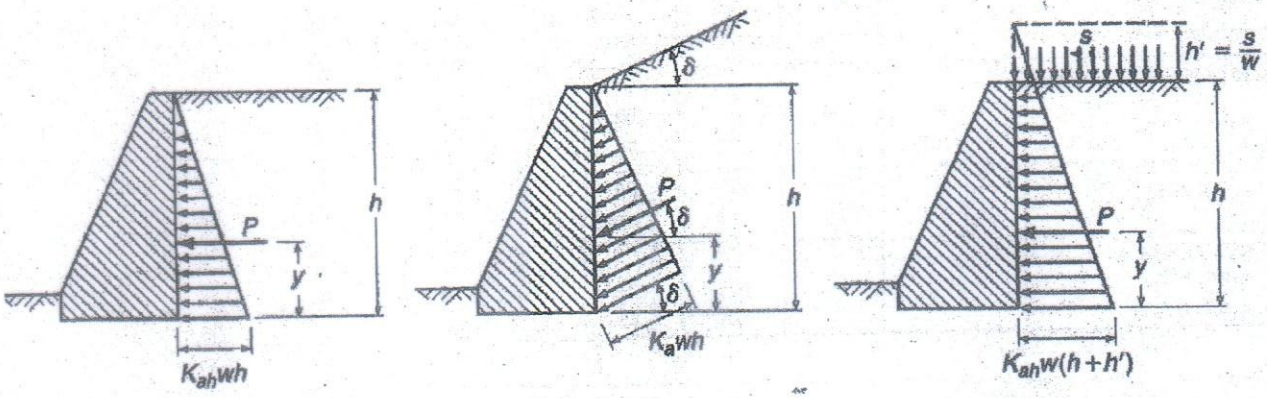
$$A_{s,min} = \frac{3\sqrt{f_c^{'}}}{f_y}b_w d \ge \frac{200b_w d}{f_y}$$

FIGURE
Two-column footing.



$$l = 2(m+n)$$

$$b = \frac{R}{q_e l}$$



$y = \frac{h}{3}$

$P = \frac{1}{2}K_{ah}wh^2$

(a)

$y = \frac{h}{3}$ $P = \frac{1}{2}K_a wh^2$

For $\delta = \phi$, $K_a = \cos\phi$

(b)

$y = \frac{h^2 + 3hh'}{3(h+2h')}$

$P = \frac{1}{2}K_{ah}wh(h+2h')$

(c)

FIGURE
Earth pressures for (*a*) horizontal surface; (*b*) sloping surface; (*c*) horizontal surface with surcharge *s*.

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				
$\alpha_{f1}l_2/l_1 = 0$		75	75	75
$\alpha_{f1}l_2/l_1 \geq 1.0$		90	75	45
Exterior negative moment				
$\alpha_{f1}l_2/l_1 = 0$	$\beta_t = 0$	100	100	100
	$\beta_t \geq 2.5$	75	75	75
$\alpha_{f1}l_2/l_1 \geq 1.0$	$\beta_t = 0$	100	100	100
	$\beta_t \geq 2.5$	90	75	45
Positive moment				
$\alpha_{f1}l_2/l_1 = 0$		60	60	60
$\alpha_{f1}l_2/l_1 \geq 1.0$		90	75	45

TABLE
Minimum thickness of slabs without interior beams

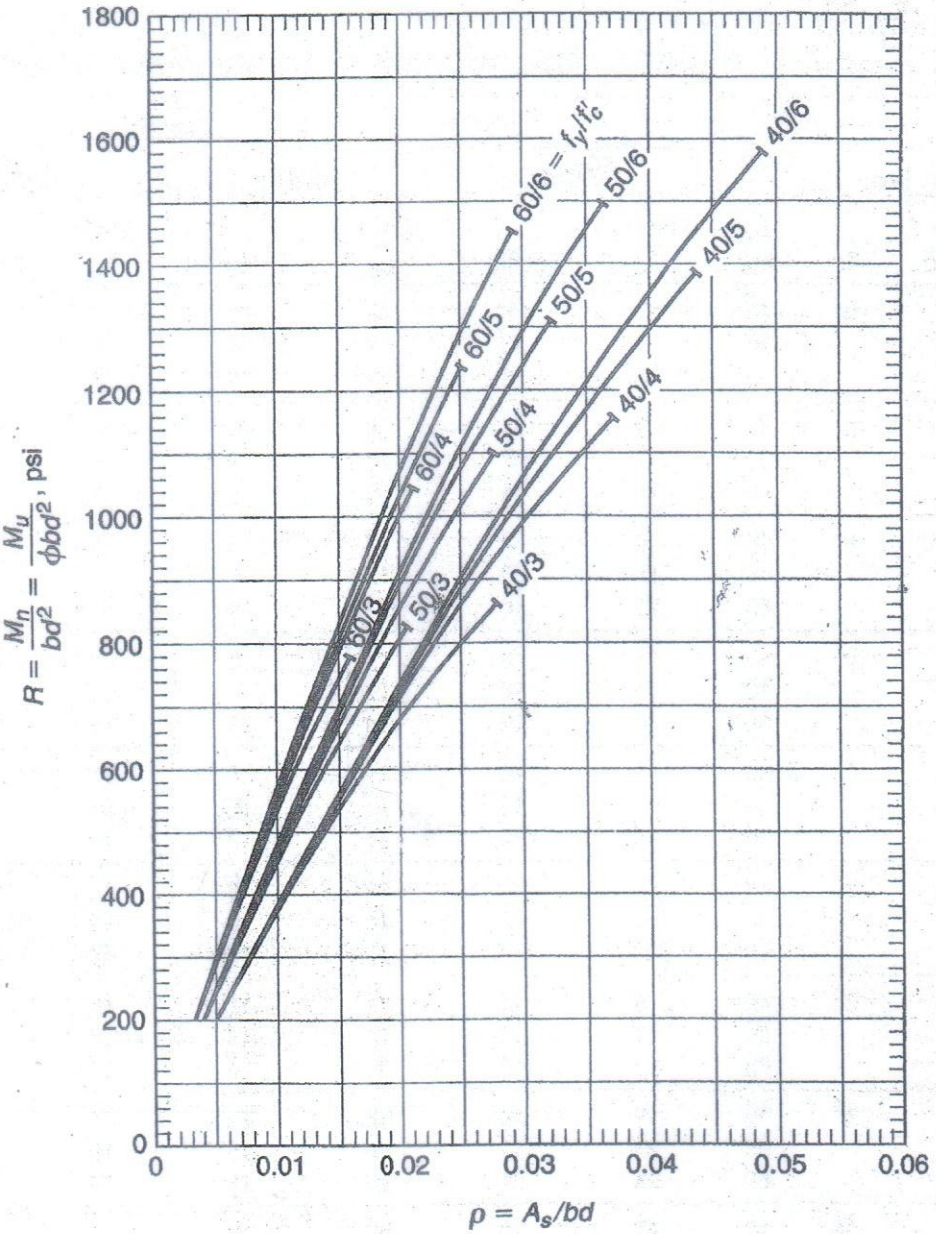
Yield Stress f_y, psi	Without Drop Panels			With Drop Panels		
	Exterior Panels		Interior Panels	Exterior Panels		Interior Panels
	Without Edge Beams	With Edge Beams[a]		Without Edge Beams	With Edge Beams[a]	
40,000	$l_n/33$	$l_n/36$	$l_n/36$	$l_n/36$	$l_n/40$	$l_n/40$
60,000	$l_n/30$	$l_n/33$	$l_n/33$	$l_n/33$	$l_n/36$	$l_n/36$
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.

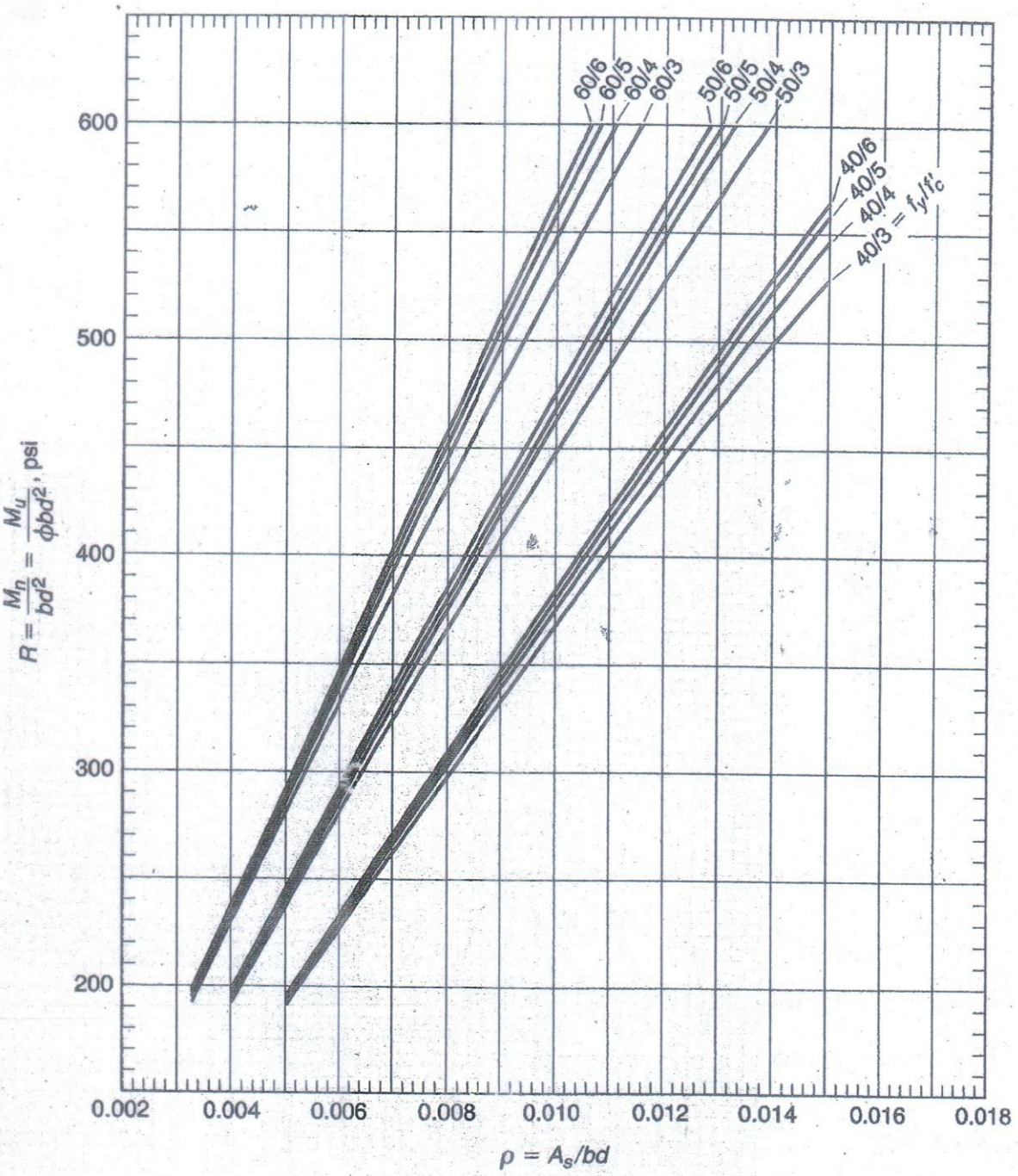
Development length in compression, in., for normalweight concrete
l_{dc} = greater of $(0.02f_y/\sqrt{f'_c})d_b$ or $0.0003f_y d_b$ (Minimum length 8 in. in all cases.)

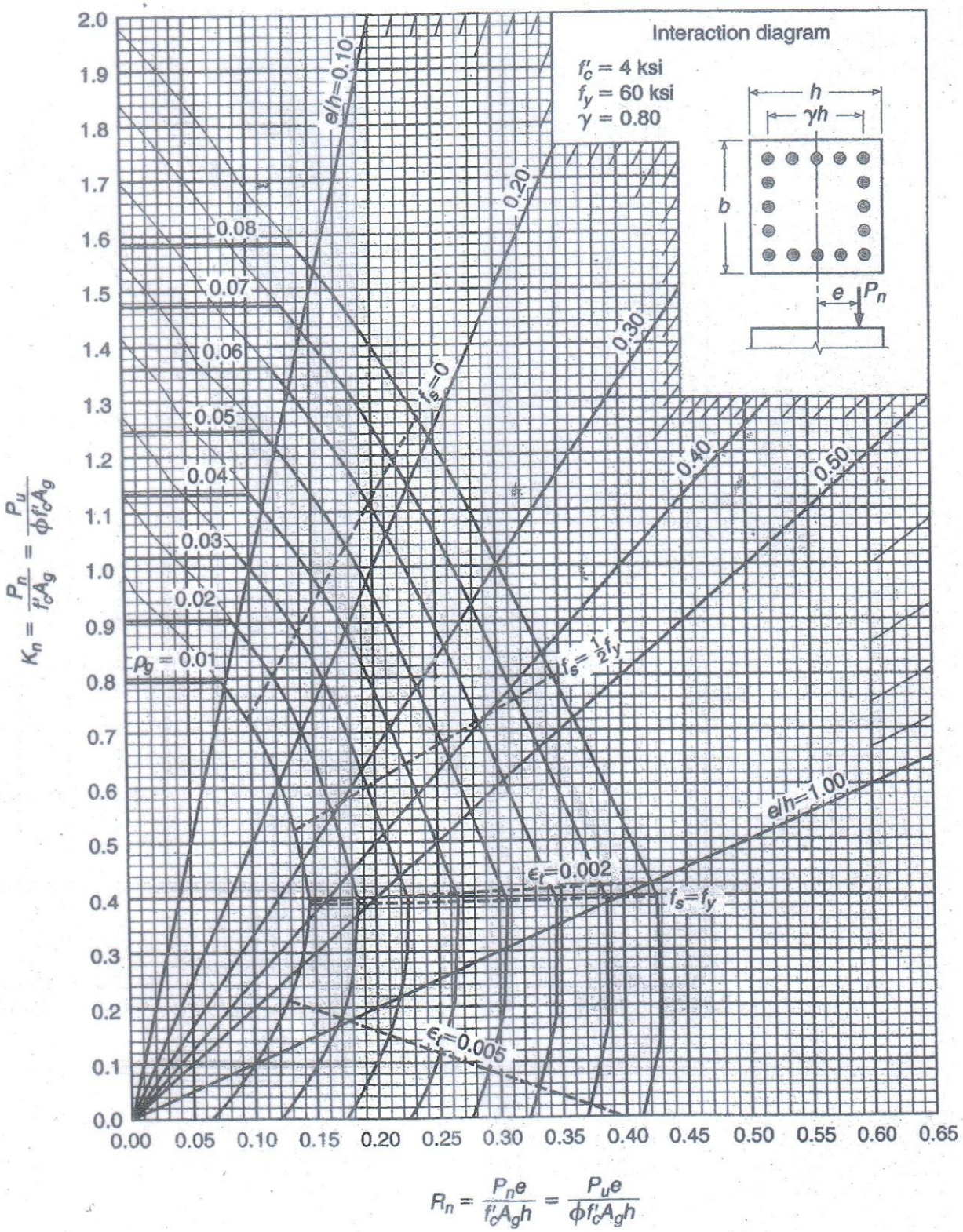
Bar No.			f'_c, psi							
			3000		4000		5000		6000	
Inch-Pound	SI	f_y, ksi	Basic l_{db}	Confined	Basic l_{db}	Confined	Basic l_{db}	Confined	Basic l_{db}	Confined
3	10	40	8	8	8	8	8	8	8	8
		50	8	8	8	8	8	8	8	8
		60	8	8	8	8	8	8	8	8
4	13	40	8	8	8	8	8	8	8	8
		50	9	8	8	8	8	8	8	8
		60	11	8	9	8	9	8	9	8
5	16	40	9	8	8	8	8	8	8	8
		50	11	9	10	8	9	8	9	8
		60	14	10	12	9	11	8	11	8
6	19	40	11	8	9	8	9	8	9	8
		50	14	10	12	9	11	8	11	8
		60	16	12	14	11	14	10	14	10
7	22	40	13	10	11	8	11	8	11	8
		50	16	12	14	10	13	10	13	10
		60	19	14	17	12	16	12	16	12
8	25	40	15	11	13	9	12	9	12	9
		50	18	14	16	12	15	11	15	11
		60	22	16	19	14	18	14	18	14
9	29	40	16	12	14	11	14	10	14	10
		50	21	15	18	13	17	13	17	13
		60	25	19	21	16	20	15	20	15
10	32	40	19	14	16	12	15	11	15	11
		50	23	17	20	15	19	14	19	14
		60	28	21	24	18	23	17	23	17
11	36	40	21	15	18	13	17	13	17	13
		50	26	19	22	17	21	16	21	16
		60	31	23	27	20	25	19	25	19
14	43	40	25	19	21	16	20	15	20	15
		50	31	23	27	20	25	19	25	19
		60	37	28	32	24	30	23	30	23
18	57	40	33	25	29	21	27	20	27	20
		50	41	31	36	27	34	25	34	25
		60	49	37	43	32	41	30	41	30

GRAPH
Moment capacity of rectangular sections.



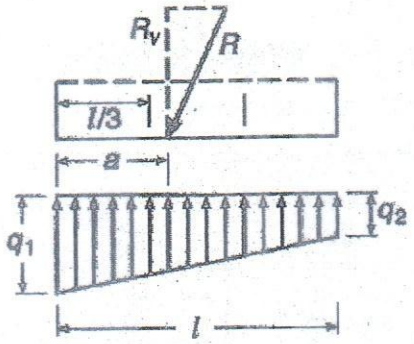
GRAPH
Moment capacity of rectangular sections.





Column strength interaction diagram for rectangular section with bars on four faces and $\gamma = 0.80$.

FIGURE
Bearing pressures for different locations of resultant.

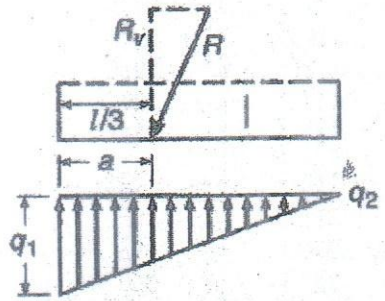


$$q_1 = (4l - 6a)\frac{R_v}{l^2}$$

$$q_2 = (6a - 2l)\frac{R_v}{l^2}$$

when $a = \frac{l}{2}$, $q_1 = q_2 = \frac{R_v}{l}$

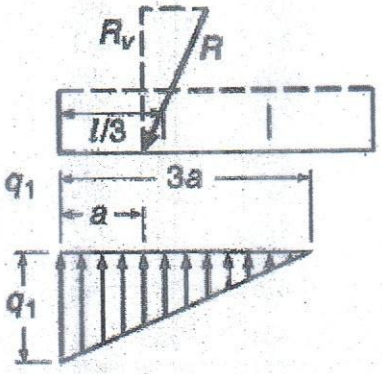
(*a*) Resultant in middle third



$$q_1 = \frac{2R_v}{l}$$

$$q_2 = 0$$

(*b*) Resultant at edge of middle third



$$q_1 = \frac{2R_v}{3a}$$

(*c*) Resultant outside middle third

TABLE
Flexural resistance factor: $R = \rho f_y\left(1 - 0.588\,\frac{\rho f_y}{f'_c}\right)$ psi

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

TABLE .
Simplified tension development length in bar diameters l_d/d_b for uncoated bars and normalweight concrete

		No. 6 (No. 19) and Smaller[a]			No. 7 (No. 22) and Larger		
		f'_c, psi			f'_c, psi		
	f_y, ksi	4000	5000	6000	4000	5000	6000
(1) Bottom bars							
Spacing, cover	40	25	23	21	32	28	26
and ties as per	50	32	28	26	40	35	32
Case *a* or *b*	60	38	34	31	47	42	39
Other cases	40	38	34	31	47	42	39
	50	47	42	39	59	53	48
	60	57	51	46	71	64	58
(2) Top bars							
Spacing, cover	40	33	29	27	41	37	34
and ties as per	50	41	37	34	51	46	42
Case *a* or *b*	60	49	44	40	62	55	50
Other cases	40	49	44	40	62	55	50
	50	62	55	50	77	69	63
	60	74	66	60	92	83	76

Case *a*: Clear spacing of bars being developed or spliced $\geq d_b$, clear cover $\geq d_b$, and stirrups or ties throughout l_d not less than the Code minimum.

Case *b*: Clear spacing of bars being developed or spliced $\geq 2d_b$, and clear cover not less than d_b.

[a]ACI Committee 408 recommends that the values indicated for bar sizes No. 7 (No. 22) and larger be used for all bar sizes.

TABLE
Flexural resistance factor: $R = \rho f_y\left(1 - 0.588\,\frac{\rho f_y}{f'_c}\right)$ psi

	f_y = 40,000 psi				f_y = 60,000 psi			
	f'_c, psi				f'_c, psi			
ρ	3000	4000	5000	6000	3000	4000	5000	6000
0.003	117	118	118	119	174	175	176	177
0.004	155	156	157	157	229	232	233	234
0.005	192	194	195	196	282	287	289	291
0.006	229	232	233	234	335	341	345	347
0.007	265	268	271	272	385	394	399	403
0.008	300	305	308	310	435	446	453	457
0.009	335	341	345	347	483	497	506	511
0.010	369	376	381	384	529	547	558	565
0.011	402	412	417	421	575	596	609	617
0.012	435	446	453	457	618	644	659	669
0.013	467	480	488	494	661	691	708	720
0.014	499	514	523	529	702	736	757	771
0.015	529	547	558	565	741	781	805	821
0.016	560	580	592	600	779	825	852	870
0.017	589	612	626	635		867	898	918
0.018	618	644	659	669		909	943	966
0.019	647	675	692	703		949	987	1013
0.020	675	706	725	737		988	1031	1059
0.021	702	736	757	771			1073	1104
0.022	728	766	789	804			1115	1149
0.023	754	796	820	837			1156	1193
0.024		825	852	870			1196	1237
0.025		853	882	902				1280
0.026		881	913	934				1322
0.027		909	943	966				1363
0.028		936	972	997				
0.029		962	1002	1028				
0.030		988	1031	1059				
0.031		1014	1059	1089				
0.032			1087	1119				
0.033			1115	1149				
0.034			1142	1179				
0.035			1170	1208				
0.036			1196	1237				
0.037				1265				
0.038				1294				
0.039				1322				
0.040				1349				
0.041				1376				

B. Sc. Engg. (CEE)/ 6th Sem. 23 October, 2018 (Group B)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : FINAL EXAMINATION SUMMER SEMESTER: 2017-2018
COURSE NO. : CEE 4613 TIME : 3.0 Hours
COURSE TITLE: Design of Pre-Stressed Concrete Structures FULL MARKS: 150

There are 8 (Eight) questions. Answer any 6 (Six) 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) Write short notes on the following: (5)

(i) Posttensioned and pretensioned PC beams,
(ii) Crack spacing and crack width of RC and PC beams,
(iii) Transfer length and flexural bond length,
(iv) Bursting tension and spalling tension of posttensioned PC beam, and
(v) Importance of grouting of posttensioned PC beams.

(b) A rectangular concrete beam (span = 18 m), 300 mm wide and 600 mm deep, is prestressed by means of 6-14 mm diameter high-tensile bars located 150 mm from the soffit of the beam. The initial prestress is 1200 N/mm^2. The total loss of prestress is 20%. What is the maximum concentrated load (in addition to the self-weight of the beam) that can be applied over the mid-span without causing tension at the soffit of the beam? What changes in result will occur if total loss of prestress is increased to 25%? Given: Υ_{con}=24 kN/m^3. (20)

2 (a) List the losses that are to be considered in calculation of effective prestress of a post-tensioned and a pre-tensioned PC beam. Derive the following equation for calculation of loss of prestress due to friction and wobble effect: (10)

$$Loss\ (friction\ and\ wobble\ effect) = f_{jack}(1 - e^{-\mu L - kL})$$

(b) A straight post-tensioned concrete member 40 ft long with a cross section of 15 inch by 24 inch is concentrically prestressed with 6 tendons with 0.5 sq. in. per tendon. The tendons are tensioned one after another to the stress of 150,000 psi. Given: Eci= 4,900,000 psi, Es = 29,000,000 psi. (15)

(i) Calculate the loss due to elastic shortening for each tendon.
(ii) Calculate the average loss of prestress for all tendons.
(iii) Calculate the average loss of the 1st and the 6th tendons,
(iv) Calculate the average loss using ACI-ASCE recommendation.
(v) Explain the procedure that can be applied during application of prestress to avoid the calculation for loss due to elastic shortening.
(vi) If 6 tendons are pulled simultaneously, calculate the loss due to elastic shortening?

(vii) Make a brief discussion on the results.

3 (a) Compare PC and RC beams. (6)

(b) Make a list of the devices that are used during making pre-tensioned PC beams. (4)

(c) A prestressed concrete beam of section 250 mm wide by 700 mm deep is prestressed by an effective prestressing force of 600 kN at a constant eccentricity of 60 mm. The beam supports a concentrated load of 75 kN at the center of a span of 12 m. Determine the location of the pressure line at the center, quarter span, and support sections of the beam. Neglect the self-weight of the beam. Also do the following: (15)

(i) Draw the locus the pressure line along the beam.

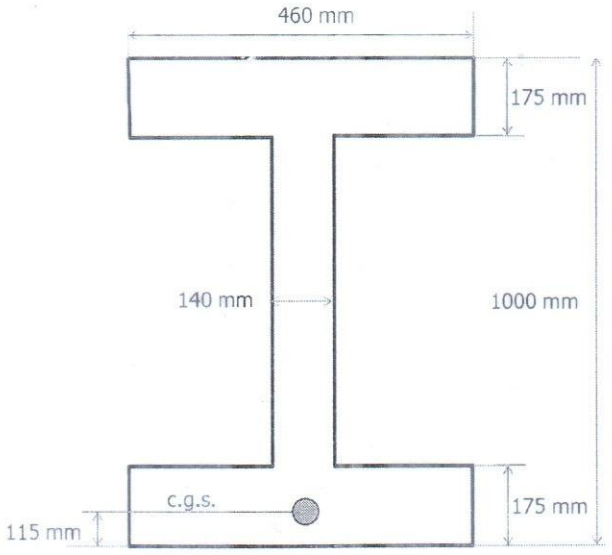
(ii) What will happen to the slope of the pressure line, if effective prestress is increased?

(iii) If two concentrated loads are applied at 4 m and 8 m from the end of a support, draw the locus (schematically) of the pressure line.

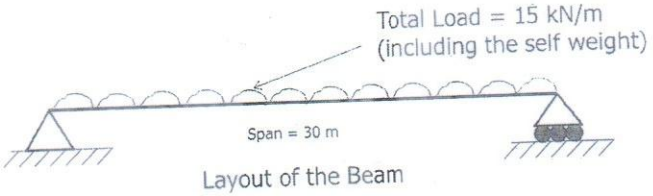
(iv) If instead of concentrated load, uniformly distributed load is applied, draw the locus (schematically) of the pressure line, and

(v) Make a brief discussion on the results.

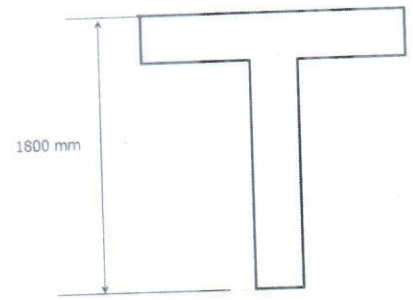
4 Refer to the following mid-span section of a pretensioned PC beam. The cgs of the strands is 115 mm above the bottom of the beam. The area of the strands is 2200 mm^2. The effective steel stress is 1100 MPa. Material properties are f_{pu}=1860 MPa, f'_c=50 MPa. Find the ultimate resisting moment of the section as per ACI code. If the area of the strands is reduced to 1400 mm^2, what will be the moment capacity of the section? Discuss the results. Make comments on the selected cross-section of the beam with respect to cost and materials utilization. (25)



5 (a) Refer to the following simply supported PC beam. The total uniformly distributed load on the beam is 15 kN/m including self-weight of the beam. The overall depth of the beam is 1800 mm. Make a preliminary design of the mid-span section of the beam. Given: f'_c = 30 MPa, f_{pu} = 1600 Mpa, f_{si}= 0.7 f_{pu}, f_t=15 Mpa, f_b= 22 Mpa. Consider Type 1 member. Total loss = 20%. (10)



Layout of the Beam

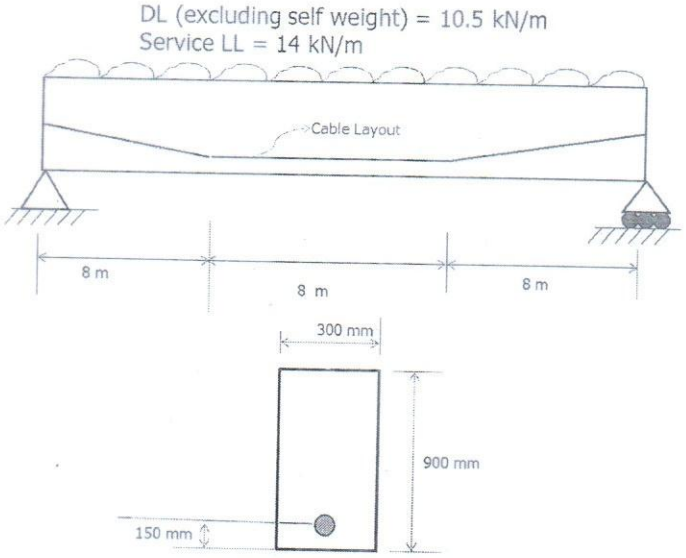


(b) Make the final design of the mid-span section (as designed in Q5(a)) without allowing any tension in the section either at transfer or under working load. Make one trial only and give comments on the next trial, if necessary. (15)

6 (a) Derive the following equation for the cracking moment of a PC beam: (5)

$$M_{cr} = \frac{I}{y_t}(0.5\sqrt{f'_c} + f_{pe} - f_d)$$

(b) Refer to the following beam and mid-span section of the beam of span 24 m. Calculate the flexural shear resistance and web shear resistance of concrete at a section 4 m from the left support. Also, determine vertical U-stirrup required of the said section. Given: f_{pu}=1720 MPa, f_{se}=1050 MPa, A_{ps}=1760 mm^2, f'_c=49 MPa, f_{vy}=275 MPa, Υ_{con} = 24.0 kN/m^3. (20)

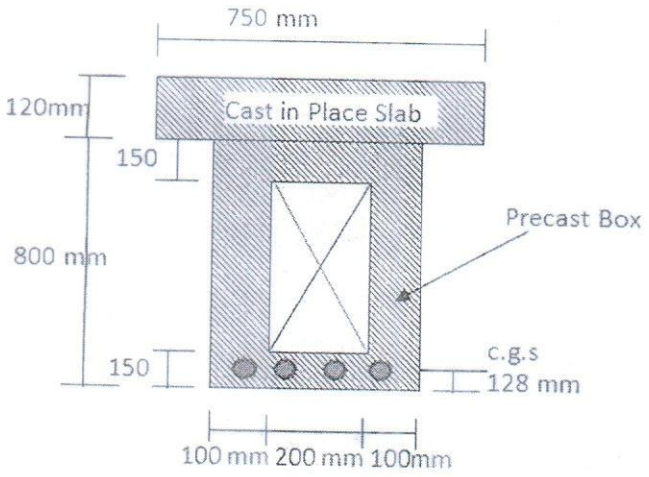


7 The mid-span section of a composite beam of span 20 m is shown in the following figure. The precast stem is a box section 800 mm deep and is pretensioned with an initial force of 2500 kN. Total loss of prestress is 12%. Υ_{con} = 24 kN/m^3, LL = 14 kN/m. Do the following: (25)

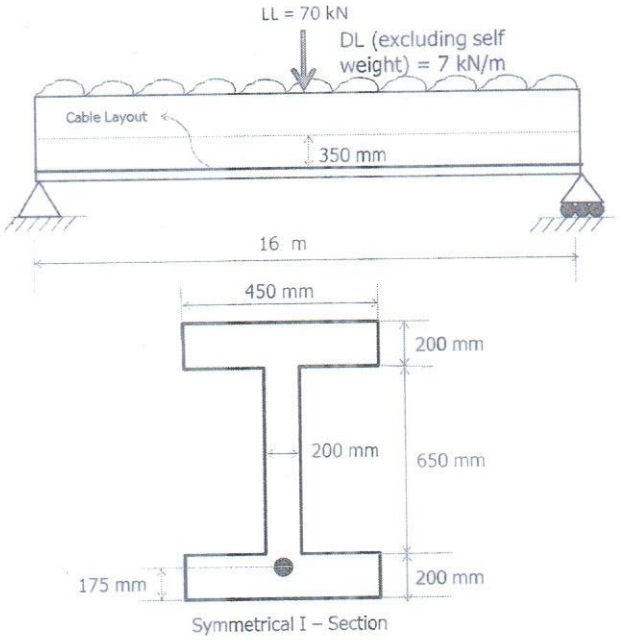
(i) Compute the stresses in the section at transfer, after all losses, after pouring the top slab, and after application of LL.

(ii) Draw the stress profile along the section and make comments on the results.

(iii) Determine the ultimate moment capacity of the section. Given : f_{pu} = 1655 MPa, f'_c = 50 MPa, A_{ps} = 2400 mm^2. Make comments on the capacity of the section.



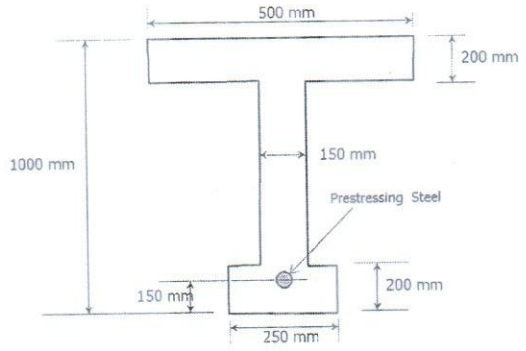
8 (a) Refer to the following layout and the mid-span section of a simply supported pretensioned PC beam of span 16 m. Calculate the deflection (i) immediately after transfer, and (ii) after 10 years. Given: A_{ps} = 2000 mm^2, f_{pi} = 1300 MPa, f_{pe} = 1120 MPa, C_u = 2.3, Υ_{con} = 24 kN/m^3, E_{ci} = 25100 MPa, and E_c= 27400 MPa. (15)



Symmetrical I – Section

Make comments on deflection of the beam if (i) eccentricity is reduced, (ii) steel area is reduced, and (iii) excessive losses of prestress is occurred.

(b) Refer to the following mid-span section of a pretensioned simply supported PC beam of span 18 m. Given : M_{LL}=648 kN-m (at the mid span section), F_0=1600 kN, Loss = 15%. Allowable stress at transfer and service are f_c=18 N/mm^2. Estimate the limiting zone (e_{max} and e_{min}) of c.g.s. at the mid-span section, if no tension in concrete is allowed. (10)



Detail of Mid-Span Section

ACI Guideline for Inclined Shear Cracking of Concrete for PC Beams

$$V_{ci} = 0.05 b_w d \sqrt{f_c'} + V_d + \frac{V_i M_{cr}}{M_{max}}$$

$$M_{cr} = \frac{I}{y_t}(0.5\sqrt{f_c'} + f_{pe} - f_d)$$

$$f_{pe} = \frac{F_e}{A} + \frac{F_e e C_b}{I}$$

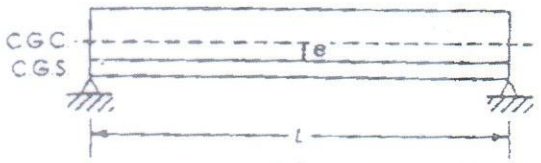
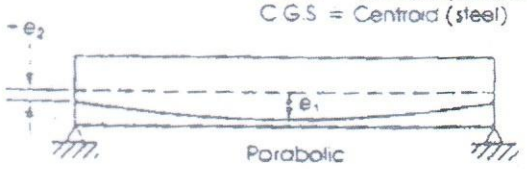
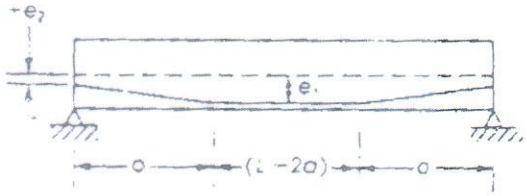
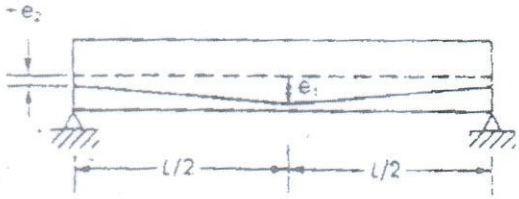
ACI Guideline for Web Shear Cracking of Concrete for PC Beams

$$V_{cw} = 0.29\sqrt{f_c'} b_w d + 0.3 f_{pc} b_w d + V_p$$

ACI Guideline for Maximum Spacing of Shear Reinforcement for PC Beam

$$S_{max} = Smaller\ of\ \left[\frac{A_v f_{vy}}{0.34 b_w}, \frac{3}{4}h, 610\ mm\right]$$

MIDSPAN DEFLECTIONS OF SIMPLY SUPPORTED BEAMS

Schematic	*Deflection equations*
Camber due to prestressing force	
	$\Delta = \frac{(Fe)L^2}{8EI}$ (1)
CGC = Centroid (concrete) CGS = Centroid (steel)	(Horizontal tendons)
	$\Delta = \frac{FL^2}{8EI}\left[\frac{5}{6}e_1 + \frac{1}{6}e_2\right]$ (2) When $e_2 = 0$: $\Delta = \frac{5(Fe_1)L^2}{48EI}$ (3)
	$\Delta = \frac{FL^2}{8EI}\left[e_1 + \frac{4}{3}\left(\frac{a}{L}\right)^2 (e_2 - e_1)\right]$ (4) When $a = \frac{L}{3}$: $\Delta = \frac{FL^2}{8EI}\left[e_1 + \frac{4}{27}(e_2 - e_1)\right]$ (5) When $a = \frac{L}{3}$ and $e_2 = 0$: $\Delta = \frac{23(Fe_1)L^2}{216EI}$ (6)
	$\Delta = \frac{FL^2}{24EI}[2e_1 + e_2]$ (7) When $e_2 = 0$: $\Delta = \frac{(Fe_1)L^2}{12EI}$ (8)

Variation of Creep Coefficient with Time

$$C_t = \frac{t^{0.6}}{10 + t^{0.6}} C_u$$

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B.Sc. Engg. (CE)/ 6th Sem. 27 October, 2018 (Group B)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

SEMESTER FINAL EXAMINATION SUMMER SEMESTER: 2017-2018

COURSE NO. : CEE 4633 TIME: 3:00 Hours

COURSE TITLE: Wastewater Engineering and Environmental Sanitation FULL MARKS: 150

There are 8 (Eight) questions. Answer any 6 (Six). 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. Assume any reasonable values for missing data.

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1. (a) Define WSP. Write down the advantages and disadvantages of WSP. [4]
   (b) Briefly discuss facultative ponds and provide a schematic representation of facultative pond. [8]
   (c) Define sanitation and mention its different types. [3]
   (d) Distinguish between the followings [10]
   (i) On site and off site sanitation system
   (ii) Dry and wet sanitation system

2. (a) What is CBOD and NBOD? Draw a typical graph showing CBOD and NBOD. Why do the COD analysis and BOD analysis usually give different results for the same wastewater? [5]
   (b) What is the detention time in a stabilization pond if the influent flow rate is 0.785 MGD, the pond depth is 4.5 feet and the pond covers 17 acres? [1 acre = 43560 sft] [5]
   (c) A waste stabilization pond (WSP) is designed for a residential estate consisting of 7000 people contributing sewage at 180 L/capita/day. The plant consists of a facultative pond and maturation pond(s), arranged in series. The depths of both ponds are 1.5 m and the Hydraulic Retention Time (HRT) of the maturation pond is 5 days. The first-order BOD removal rate constant (at 20°C) and first order FC removal rate constant (at 20°C) are 0.3 per day and 2.6 per day, respectively. The BOD of raw sewage is 200 mg/L, the influent FC is 1×10^8 FC/100 mL and the operating temperature is 30°C. [15]
   Determine:
   (i) The area and HRT of the facultative pond
   (ii) The number of maturation pond(s) required to achieve the effluent FC of 1000/100 mL
   (iii) The effluent BOD of maturation pond

3. (a) Why are dilution and seeding needed in performing BOD test? What is the significant of BOD_5/COD ratio? [4]
   (b) What is VIP latrine? Briefly discuss its scope of use and different types with sketch. [12]
   (c) What is the principle of operation of pour flush toilet technology? Where it is applicable? [4]
   (d) What are the advantages of pour flush technology over simple pit latrine? [5]

4. (a) What is a septic tank? Design a double chamber septic tank for six families consisting of 4 persons in each family with a desludging interval of 7 years. The average wastewater flow is 88 liters per capita per day. Also design the soak pit for the disposal of septic tank effluent. The soil is silty loam with a long term infiltration rate of 20 l/m^2- day. Draw neat sketches for septic tank and soak pit. Assume reasonable values for missing data (if any). [20]
   (b) Why fly screen is used in different ventilated latrine? [2]

(c) What is sludge clear depth? What is the function of manhole cover in septic tank? [3]

5. (a) What are the hydraulic design considerations of sanitary sewer system? [5]

(b) Consider the design of a wastewater treatment plant (WWTP) for a community with average daily flow of 2.0 MGD. The raw sewage has an average of 230 mg/L BOD_5. [20]

Determine the diameter and depth of tank for design criteria of an overflow rate of 700 GPD/ft^2 and detention time of 3 hours at average flow. Also determine the BOD concentrations in the primary sedimentation effluent flow.

Suppose that the primary effluent will be treated by two parallel high-rate single stage tricking filters with the following characteristics:

(i) 6 feet deep rock trickling filter media
(ii) Design BOD loading of 50 lb/day/1000 ft^3
(iii) Design hydraulic loading of 0.30 gpm/ft^2; gpm = gallon per minute
(iv) Recirculation ratio of 1.5

Determine the volume (ft^3), diameter (ft) and efficiency of each trickling filter.

6. (a) In determining the BOD_5 of a sample, an analyst added 2, 5 and 10 mL of sample to three 300 mL BOD bottles and filled them with seeded dilution water. The analyst also prepared three blank bottles with same dilution water and incubated the set at 200C for 5 days. DO measurements were made on the samples and the following results were obtained: [6]

Sample size in bottle, mL	**Initial DO (mg/L)**	**Final DO (mg/L)**
2	8.1	5.6
5	8.0	1.7
10	8.1	0.0
Blank average	8.2	8.0

(i) What is the BOD5 for the sample?
(ii) If the reaction rate constant is 0.22/days, calculate also the ultimate CBOD of the wastewater and the remaining oxygen demand after 5-days.

(b) Calculate the BOD rate constant and ultimate BOD from the following data using least squares and Fujimoto method. [10]

Time (days)	2	4	6	8	10
BOD (mg/L)	11	18	22	24	26

(c) A farmer excavated 1.5 m x 2.0 m x 2.5 m (depth) pit for construction of a room which he now wants to convert into a pit latrine. [9]

Requirements/constraints are: Water availability is limited. Excreta cannot be seen through squatting hole. Design a suitable latrine and calculate design life for 6 persons. Consider low GWT.

7. (a) What are the technical advantages of small bore sewerage system over conventional sewerage system? [5]

(b) What is At-Site Time and Off-Route factor in HCS? Draw the schematic operational sequence of HCS? Differentiate between HCS and SCS. [8]

(c) Write short notes on the followings (any three): [12]

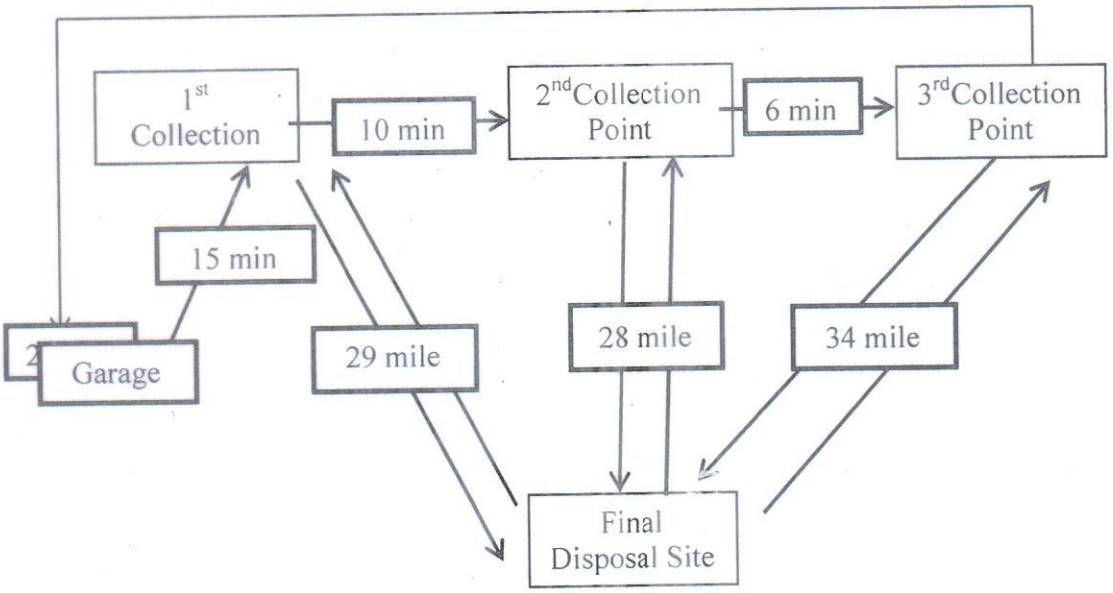
i) On-Site Storage
ii) Maturation Pond
iii) Primary treatment vs Secondary Treatment
iv) Reed Odorless Earth Closet (ROEC) sanitation technology

8. (a) What are the necessities of sewage treatment? What are the major components of [5]

wastewater management? Explain the role of Civil Engineers in wastewater management system in urban areas.

(b) Show the flow diagram of functional elements of Solid Waste Management System. [5]

(c) Solid waste from a new industrial park is to be collected in large containers. Based on traffic studies at similar parks; the estimated time to drive between different locations is given in the following diagram. The distance given from different collection point to disposal site is round-way distance. Name the type of this collection system shown in the following figure. Determine the number of containers that can be emptied per day, based on an 8-h workday. Also determine the actual length of workday. Comment on your answers. [15]
Assume speed limit of collection vehicle is 55 mile/hour and at-site time is 0.133 h/trip. Haul-time constants, a = 0.016 h/trip and b = 0.018 h/mi and the average pick-up and unloading time per trip is 0.4 hour. Assume reasonable values for any missing data.



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B.Sc. Engg. (CEE)/ 6th Sem. November 01, 2018 (Group-B)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : SEMESTER FINAL EXAMINATION SUMMER SEMESTER: 2017-2018
COURSE NO. : CEE 4653 TIME : 3.0 Hours
COURSE TITLE: Pavement Design and Railway Engineering FULL MARKS: 150

There are 8 (Eight) questions. Answer any 6 (Six) questions. Programmable calculators are not allowed. Do not write on this question paper. Figures in the right margin indicate full marks. The Symbols have their usual meaning.

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1. (a) Mention different types of road with corresponding authority name of Bangladesh. (06)

   (b) Suppose you are given in charge of Superintending Engineer of Dhaka Circle in RHD. Recently, a project has been announced to be initiated by the Road Transport and Bridge Ministry for constructing additional 2 lanes on N5 (Dhaka-Aricha) highway. Mention some desirable qualities of the pavement you would prefer for the construction of additional lanes towards which you will direct the Executive Engineer. Note that, there are trauma centers, educational institutions, garments and residential infrastructures adjacent to the highway all through. Additionally, the original ground lies below flood plain and contains low quality of subgrade materials. (13)

   (c) Define the functions of bogies. What do you know about tilting trains? (06)

2. (a) Write down the full forms of the following abbreviations in terms of pavement engineering: (10)
   JPCP, JRCP, CRCP, HMA, CSB, SMA, CBR, PMB, WBM, SBM

   (b) What do you understand by high speed rail? List its technical features (description is not required). How can high speed rail compete with travel by air? (05)

   (c) Using necessary figures show the current trends of revise thinking over the traditional approach to reduce costs and improve the scope of the roads for handling more traffic demands. Write down some alternative road surface improvement techniques. (10)

3. Suppose you need to construct a 2 (two) lane road comprising of rigid pavement adjacent to a residential area. Square concrete blocks of 15 ft × 15 ft dimension are available.

   (a) Draw the top view and side view of the pavement showing the direction of travel and other necessary components. (12)

   (b) Show the arrangement of tie bars and dowel bars in details in an enlarged sketch. (08)

   (c) Also sketch the joint reservoir in details, if the width of the joint reservoir is 2 inch and hot pour sealant has been used for sealing the joint. (05)

4. (a) List the names of various rail profiles (e.g., metric gauge) available in practice throughout the world along with their market share. What caused these differences? (05)

(b) While conducting Marshall Mix design, for 3.5% asphalt content, specimen weight in air is found to be 1239.60 gm and in water 699.60 gm, in air (SSD) 1242.80 gm. If effective specific gravity of all aggregates and bulk dry specific gravity of total aggregate are 2.721 and 2.691 respectively, then find out the percent air void, voids in mineral aggregate and voids filled with asphalt. (Specific gravity of asphalt is 1.016) (12)

(c) As an engineer in charge under RHD of a national highway, you've noticed the following defect shown in **Figure 1** throughout the roadway. Mention the name of this defect, problems due to this defect, probable reasons and repairing techniques. (08)

Figure 1

5. (a) What do you understand by asphalt, bitumen and tar? Write down the steps for determining optimum asphalt content using Marshall Mix Design method. Also state the Asphalt Institute Criteria to be satisfied during this test. (20)

   (b) Write down the classifications of subgrade along with their suitability for construction of a railway track. (05)

6. (a) State the desirable properties of asphalt. In a neat sketch show standard carriageway section of 5.5m provided by RHD. (15)

   (b) What are the steps for patchwork? Show prime coat, tack coat and seal coat by sketching a flexible pavement layer system. (10)

7. (a) With neat sketches show the load transfer mechanism without any transfer device and load transfer mechanism with transfer device on rigid pavement joints. (06)

   (b) Draw the cross section of a track system and identify its various components. Briefly describe the function of each component. (15)

   (c) Why do you think we need to promote rail as a mode of transport from the perspective of sustainability? Explain. (04)

8. (a) Draw the typical graphs containing different features of an asphaltic mix vs. asphalt content commonly used during Marshall Mix Design. (06)

   (b) A road will be constructed in a village for the convenience of the village people for transportation. You're given the charge by the authority of LGED there and asked to use conventional Herring Bone Brick (HBB) pattern for roadway. Sketch the pattern showing plan and side view along with the necessary components. (09)

   (c) List the equipment and parts of a lighting system along with their various components. (10)

B. Sc. Engg. (CEE)/ 6th Sem. 23rd October, 2018

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

Semester Final Examination — **Summer Semester: 2017-2018**
Course No.: CEE 4655 — **Full Marks: 150**
Course Title: Civil Engineering Data Analysis — **Time: 3.0 Hours**

There are 8 (Eight) questions. Answer any 6 (Six) 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 BOOK and OPEN NOTES exam.

1(a) 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 gallons. From his records, he selects a random sample of 60 sales and finds the mean number of gallons sold is 8.60. (12)

(i) What is the point estimate of the population mean?
(ii) Develop a 99 percent confidence interval for the population mean.
(iii) Interpret the meaning of part (ii)

(b) A number of minor automobile accidents occur at various high-risk intersections in Teton County despite traffic lights. The Traffic Department claims that a modification in the type of light will reduce these accidents. The county commissioner agreed to a proposed experiment. Eight intersections were chosen at random, and the lights at those intersections were modified. The numbers of minor accidents during a six-month period before and after the modifications were: (13)

	Number of Accidents							
	A	B	C	D	E	F	G	H
Before Modification	5	7	6	4	8	9	8	10
After Modification	3	7	7	0	4	6	8	2

At the 0.01 significance level is it reasonable to conclude that the modification reduced the number of traffic accidents?

2(a) Lammers Limos offers limousine service from the city hall in Toledo, Ohio, to Metro Airport in Detroit. Sean Lammers, president of the company, is considering two routes. One is via U.S. Route 25 and the other via Interstate-75. He wants to study the time it takes to drive to the airport using each route and then compare the results. He collected the following sample data, which is reported in minutes. Using the 0.10 significance level, is there a difference in the variation in the driving times for the two routes? (15)

U.S. Route 25 (min)	Interstate 75 (min)
52	59
67	60
56	61
45	51
70	56
54	63
64	57
-	65

(b) Influential Republicans and Democrats (from a nationwide sample) was asked whether they favored lowering environmental standards so that high-sulfur coal could be burned in coal-fired power plants. The results were: (10)

	Republicans	Democrats
Number sampled	1000	800
Number in favor	200	168

At the 0.02 level of significance, can we conclude that there is a larger proportion of Democrats in favor of lowering the standards? Determine the p-value.

3(a) Recent crime reports indicate that 3.1 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 one theft in a minute?

(b) 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 10 of the selected policyholders submitted a claim last year?

(iii) What is the probability that 10 or more of the selected policyholders submitted a claim last year?

4. We are studying mutual bond funds for the purpose of investing in several funds. For this particular study, we want to focus on the assets of a fund and its five-year performance. The question is: Can the five-year rate of return be estimated based on the assets of the fund? Nine mutual funds were selected at random, and their assets and rates of return are shown below: (25)

Fund	Assets($ millions)	Return(%)
AARP High Quality Bond	622.2	10.8
Babson Bond L	160.4	11.3
Compass Capital Fixed Income	275.7	11.4
Galaxy Bond Retail	433.2	9.1
Keystone Custodian B-1	437.9	9.2
MFS Bond A	494.5	11.6
Nichols Income	158.3	9.5
T. Rowe Price Short-term	681.0	8.2
Thompson Income B	241.3	6.8

(i) Draw a scatter diagram.
(ii) Compute the coefficient of correlation.
(iii) Compute the coefficient of determination.
(iv) Write a brief report of your findings for parts (ii) and (iii).
(v) Determine the regression equation. Use assets as the independent variable.
(vi) For a fund with $ 400 million in sales, determine the five-year rate of return(in percent).

5. Given the following sample information, test the hypothesis that the treatment means are equal or not at the 0.05 significance level by ANOVA (Analysis of variance) test. (25)

Treatment 1	Treatment 2	Treatment 3
8	3	3
11	2	4
10	1	5
-	3	4
-	2	-

6. The director of advertising for the Carolina Sun Times, the largest newspaper in the Carolinas, is studying the relationship between the type of community in which a subscriber resides and the section of the newspaper he or she reads first. For a sample of readers, she collected the following sample information. (25)

	National News	Sports	Comics
City	170	124	90
Suburb	120	112	100
Rural	130	90	88

At the 0.05 significance level, can we conclude there is a relationship between the type of community where the person resides and the section of the paper read first?

7. The district manager of Toyota, a large car selling chain, is investigating why certain stores in her region are performing better than others. She believes that three factors are related to total sales: the number of competitors in the region, the population in the surrounding area, and the amount spent on advertising. From her district, consisting of several hundred stores, she selects a random sample of 30 stores. For each store she gathered the following information. (25)

$$Y = total\ sales\ last\ year\ (in\ \$\ thousands).$$
$$X_1 = number\ of\ competitors\ in\ the\ region.$$
$$X_2 = population\ of\ the\ region (in\ millions)$$
$$X_3 = advertising\ expense (in\ \$\ thousands)$$

The sample data were run on STATA and following results are obtained.

Analysis of Variance			
Source	DF	SS	MS
Regression	3	3050.00	1016.67
Error	26	2200.00	84.62
Total	29	5250.00	
Predictor	Coefficient	Standard Dev	t- ratio
Constant	14.00	7.00	2.00
X_1	-1.00	0.70	-1.43
X_2	30.00	5.20	5.77
X_3	0.20	0.08	2.50

(i) What are the estimated sales for a store, which has four competitors, a regional population of 400,000 and advertising expense of $30,000?
(ii) Compute the R^2 value.
(iii) Compute the multiple standard error of estimate.
(iv) Conduct a global test of hypothesis to determine whether any of the regression coefficients are not equal to zero. Use the 0.05 level of significance.

(v) Conduct tests of hypothesis to determine which of the independent variables have significant regression coefficients. Which variables would you consider eliminating? Use the 0.05 significance level.

8(a) Three machines A, B and C produce respectively 50%, 30% and 20% of the total number of items of a factory. The percentages of defective output of these machines are 3%, 4% and 5%. If an item is selected at random. Find the probability that the item is defective. (09)

(b) The compressive strength of concrete is being tested by a civil engineer for building transportation engineering laboratory at the Islamic University of Technology (IUT). He tests 12 specimens and obtains the following data. (16)

Compressive strength(psi)			
2216	2237	2249	2204
2225	2301	2281	2263
2318	2255	2275	2295

(i) Use the sign test to investigate the claim that the median strength is at least 2250 psi. Use $\alpha = 0.05$.

(ii) Use the normal approximation to test the same hypothesis that you formulated in part (i). What is the p-value for this test?

B.Sc. Engg. (CEE)/ 8th Sem. 26th October, 2018 (Group A)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : SEMESTER FINAL EXAMINATION SUMMER SEMESTER: 2017-2018
COURSE NO. : CEE 4803 TIME : 3.0 Hours
COURSE TITLE : Socio Economic Aspects of Development FULL MARKS: 100

There are 8 (Eight) questions. Answer any 6 (Six) 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.

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1 (a) "Transforming our world: the 2030 Agenda for Sustainable Development" is a plan of action for people, planet and prosperity. What is meant by sustainable development? How many goals and associated targets are there is this agenda. List the names (titles only) of all the goals in this agenda. (10)

(b) Are the SDG's legally binding for nations? How will be the SDG's implemented and monitored in the global and national level? How many indicators are there in the Official Revised List of Global SDG Indicators? (10)

2 (a) When do you think it is appropriate to use Key Informant Interviews? Discuss in brief about the advantages and disadvantages of this data collection method. (7)

(b) Discuss about the steps involved in Key Informant Interviews. (9)

3 (a) Discuss about Malthusian Growth Model with an arbitrary example. (4)

(b) What is the significance of response rate in surveys? What are arrangements to be recommended to increase the response rate of a survey? (5)

(c) Discuss about the impacts and effects of population growth over attaining economic prosperity. (7)

4 (a) State SDG 9, targets 9.1, 9.2, 9.3, and associated indicators for those targets. (10)

(b) Discuss about the weakness of GNI as a development indicator. (6)

5 (a) What is meant by NPV? What is the Decision Rule for NPV? (2)

(b) A machinery which requires an initial investment of $12450 is expected to generate cash inflows of $3500, $4700 and $3200 at the end of three consecutive years. At the end of third year the machinery will be sold for $1500. Calculate the present value of the investment if the discount rate is 18%. (7)

(c) Calculate the IRR of an investment having initial cash outflow of $215000. The cash inflows during the first, second, third and fourth years are expected to be $65000, $94000, $71000 and $52000 respectively. (Assume necessary values) (7)

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6 (a) State SDG 6, targets 6.1, 6.2, 6.3, 6.4, 6.5 and 6.6 and associated indicators for those. (10)

(b) How do arsenic mitigation programs on the southern coast of Bangladesh contribute to achieving SDG 6? (6)

7 (a) Discuss about the socio-economic aspects of the decentralized water projects in Africa. (8)

(b) Write down about the strengths and limitations of questionnaire survey, open survey and closed survey. (6)

(c) What is meant by IRR? What is the Decision Rule for IRR? (2)

8 (a) Write about the valued socio-economic components and issues related to those components. (7)

(b) Write down about the considerations for conduction SEIA. Discuss about the steps involved in SEIA process. (7)

(c) What is the significance of poverty line. (2)

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

Semester Final Examination **Summer Semester: 2018**
Course No. CEE 4821 **Full Marks: 150**
Course Title: Integrated Water resources Management **Time: 3 hours**

There are 8 (Eight) Questions. Answer any 6 (Six) 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) Explain the aims of Water Resources Planning. (5)

(b) Explain the different degrees of details and purposes for Water Resources Management (WRM) at (i) National and regional level master planning (ii) River basin level planning (iii) project level planning (15)

(c) What are the differences of goals and objectives of water resources planning in a particular project? Explain with specific examples. (5)

2 (a) What do you know by strategies of a project? Explain physical measures, Institutional measures and ecological measures of a strategy with two examples each. (10)

(b) You are asked to achieve flood management, fisheries development and navigational improvement through water resources planning using IWRM. What would be best strategy to achieve the above targets? Explain with examples. (15)

3 (a) Define criteria of a development project. Prepare criteria of the following projects where objectives are: i) to improve employment (ii) to increase employment production iii) to increase fish production iv) to improve public health v) to increase income of people. (15)

(b) Define indicators of a development project. River bank erosion and flooding are the major constraints against development of major parts of the Rangpur, Bogura and Sirajganj Districts. How do you generate the indicators that likely to be utilized in that project for the management of river bank erosion and flooding? (10)

4 (a) How do you define scenarios for a project designed with the concept of IWRM? (5)

(b) How many planning steps are used in the conceptual framework for analysis of WRM? Sketch the frame work and explain the interrelationships among each of the steps. (10)

(c) A project is conceptualized to protect a region of Bhola district from cyclonic storm surges disasters. Explain how do you handle planning step 1 (analysis of problems and identification of possible measures) in this process. (10)

5 (a) What is Multi criteria analysis (MCA) used in evaluation of selected strategies? What are the methods of standardization used in MCA? Explain. (10)

(b) A project is designed in which – exploitation of surface water (SW) in combination with ground water (GW) is required. Alternative strategies A, B and C have been generated. Which one do you evaluate best? (15)

Criteria	Alternative strategies		
	A	B	C
Investment costs (M$)	80	75	60
Irrigated area (ha)	25,000	30,000	20,000
GWL draw-down (m)	3.0	10.0	14.0
People displaced	8000	3000	5000
Environmental deterioration	yes	no	Unclear
Flood security (T yrs)	100	50	30

6 (a) How do you specify objectives and criteria in planning of step 2 in a project to improve water quality and ecosystem in the coastal districts of Bangladesh? (10)

(b) How do you delineate the condition of the analysis usually known as step 3 in the problem in 6 (a)? (15)

7 (a) Explain the frame work of enabling environment for the application of IWRM. What are the roles of Government to create enabling environment for the application of IWRM? What do you expect the institutional roles in such process? (15)

(b) Explain the participatory processes towards preparation of IWRM frame work. What kind of cautions do you need to keep in mind during application of IWRM from administrative point of view? (10)

8 (a) Explain the main pillars for institutional reforms in IWRM? Explain the problems usually encountered towards this process. (10)

(b) Explain the IWRM processes (schematic) towards the development objectives of a country. (5)

(c) Explain the roles and responsibilities of different actors in the formulation process of IWRM. Why capacity building is essential in such activities? (10)

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B.Sc. Engg. (CEE)/ 8th Sem. 22 October, 2018 (Group A)

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

EXAM : SEMESTER FINAL SUMMER SEMESTER: 2017-18
COURSE NO. : CEE 4831 TIME : 3.0 Hours
COURSE TITLE: Environmental Impact Assessment FULL MARKS: 100

There are 8 (Eight) questions. Answer any 6 (Six) 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) What are the purpose and objectives of review of EIA report? List the key aspects that should be addressed during the review of EIA report. (03)

(b) In EIA report, a review of the environmental rules, legislation and policy is undertaken. What are the necessity and purposes of such review in an EIA study? (04)

(c) What are the objectives of Bangladesh Environmental Policy (1992)? Mention the basic features of the Bangladesh Environmental Conservation Act (1995). (4.67)

(d) Categorize the following projects based on ECR (1997) and mention also the types of environmental assessment necessary. (05)

i. Multi-storied commercial and apartment building
ii. Bridge (<100 m)
iii. Waste treatment plant
iv. Sludge treatment plant
v. Construction of warehouse

2 (a) Undertaking any project in Bangladesh, it is pre-requisite to take the environmental clearance. What is the governmental organization responsible for the environmental clearance of any project in Bangladesh? List the documents that need to be submitted for getting environmental clearance certificate for Orange B category project. (04)

(b) What are the possible decision making outcomes after the completion of an EIA and who are the decision makers for a bridge project in Bangladesh? (2.67)

(c) To find out the possible environmental impacts an EIA was performed for a power plant, which will be established near the bank of the river Meghna. A total no. of 300 people were participated in the survey. Find out the **Total EIV** (in tabular form) from the following information. **Discuss** about each environmental parameter with respect to EIV and finally **comment** about the results whether it should be established or not. In parentheses relative importance factor are given. (10)

Ecological Impact:-

Fisheries **[10]**: 180 people answered severe negative impact, 100 people answered moderate negative impact, and 20 people answered very low negative impact.

Tree plantation **[5]**: 100 people answered higher negative impact, 175 people answered very low negative impact, and others answered no change of environment.

Wetland **[1]**: 120 people answered no change, 50 people answered moderate negative impact, 50 people answered very low positive impact and remaining answered no impact.

Physio-chemical:-

Drainage Congestion **[5]**: 80 people answered low negative impact, 120 people answered very low negative impact, and the remaining people answered no change.

Obstruction to waste water flow **[4]**: 130 people answered moderate negative impact, 50 people answered very low negative impact and remaining answered no change.

Human Interest:-

Employment opportunities **[8]**: 170 people answered severe positive impact, 50 people answered higher positive impact and 30 people answered low positive impact, and remaining answered no change.

Industrial activities **[3]**: All the people answered very low positive impact.

3 (a) Environmental monitoring is considered as an integral part of an EIA-explain the statement. What are the objectives of environmental monitoring? (3.67)

(b) What are the purposes of compliance monitoring? (10)
Suppose a Leather Producing Company is planning to set up a Tannery Industry at the bank of river Sitalakhya located near Ghorashal. Sitalakhya river water is used for drinking water supply at Dhaka city through a SWTP at Saidabad.
Develop a Compliance Environmental Monitoring Plan for the proposed industry during the construction and operation period with details of monitoring parameters, methods of monitoring and monitoring frequency during construction and operation phases.

(c) Discuss the advantages and disadvantages of the following EIA methodologies: (03)
i. Matrix method
ii. Network method
iii. Overlays method

4 (a) Why is institutional arrangement necessary for the successful implementation of an environmental monitoring (EM) program? Suggest for an institutional arrangement to conduct an EM program for a water supply project of Dhaka WASA. (04)

(b) Environmental monitoring programs collect data on *environmental indicators* in order to assess the *valued environmental components* by the implementation of a project. State the criteria for selecting *environmental indicators* in environmental monitoring. (3.67)

(c) Although there are many environmental laws prevailing in Bangladesh, the instances of enforcement of the laws are scarce here - state the main reasons of non-enforcement of environmental laws in Bangladesh. (03)

(d) A chemistry fabric has been working in an industrial area for 15 years already. In the last 5 years the production of this fabric has doubled. An urban area near the fabric has been complaining about the bad smell coming from this fabric. For this reason the community asked the Municipality to perform an environmental evaluation to this fabric since never before has any evaluation been executed? The fabric hired an Environmental Consultancy in order to perform this evaluation. You are the leader of this consultancy. (06)

i. What type of environmental evaluation you will need to perform according in this case? Explain your answer.
ii. What types of experts will you consider to work in your EIA team and why?
iii. Do you need to undertake any survey or discussion to verify the complain of the local community and why?
iv. What should be the objectives of this EIA study?

5 (a) Define EMP? What are the role and importance of EMP in EIA study? Outline the content of an EMP report. (04)

(b) What are the consideration for undertaking an EM? What are the important steps that should be considered in incorporating mitigation measures to reduce the scale of impacts to acceptable levels? (04)

(c) Prepare a general checklist of environmental components considering physic-chemical, biological and human interest related parameters that are commonly subject to impacts from various development projects. (04)

(d) Develop a mitigation plan as part of EMP at the construction phase of a highway project mentioning the institutional responsibility and the possible budget for mitigation measures. (4.67)

6 (a) Briefly describe the legal requirements of undertaking EIA in Bangladesh. (03)

(b) Suppose, Gazipur City Corporation (GCC) has planned to improve the solid waste management systems in the city by undertaking an environmental management system (EMS). One of the key elements in implementing an EMS is to make effective communication with stakeholders and other. List the key stakeholders in implementing EMS in solid waste management sector of GCC and how can you make communication with them? Also mention the importance of effective communication in implementing an EMS. (06)

(c) What are the difference between standards and guidelines? Which environmental standards have been mentioned in ECR 1997? Mention the limitations of environmental standards in ECR, 1997. (4.67)

(d) List the typical impacts of road development projects on (i) air environment, (ii) water environment and (iii) socio-economic condition. (03)

7 (a) What are the differences between EIA and SEA? Why SEA approach is considered as comprehensive? (05)

(b) What is policy, plan and programme? What roles both EIA and SEA do play in improving the decision-making around policies, plans, programmes and projects? (4.67)

(c) Briefly explain the content of a SEA report. What are the steps to be followed in conducting SEA? (03)

(d) What is a 'baseline description', and why is it an important component of an ESIA? (04)

8 (a) List the activities that are prohibited to undertake in an ecologically critical area. (03)

(b) State the framework for predicting and assessment of SIA. Briefly explain the social assessment project cycle. (04)

(c) What are the major components of SIA? What types of data need to be collected in SIA? (03)

(d) A new township of 5 km^2 in a rough terrain area will be developed and is expected to complete by 2018. This new township will comprise of residential neighborhood, primary and secondary schools, commercial area including 4 blocks of double storied shopping mall and also recreational area which include playground and lake for water activity. This new township area is surrounded by traditional villages and the town center is located 5 km southwest. (6.67)

i. Describe, the environmental monitoring program need to be carried out to manage the environmental impact of this project.

ii. What parameters need to be monitored?

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B.Sc. Engg. (CEE)/ 8th Sem. 31 October, 2018 (Group A)

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

Semester: Semester Final Examination **Summer Semester: 2017-2018**
Course No.: CEE 4835 **Full Marks: 150**
Course Title: Environmental Modeling **Time: 3.0 hours**

There are **8 (Eight)** Questions. Answer any **6 (Six)** questions. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this question paper. The symbols have their usual meaning.

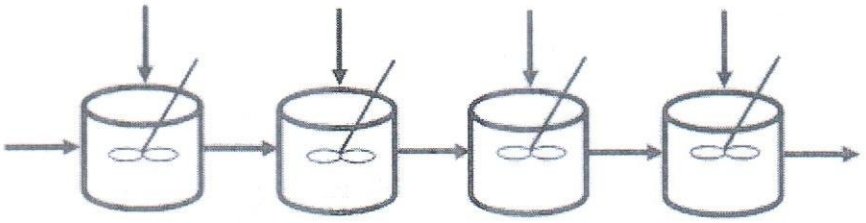
1(a) A well-mixed lake has a steady-state concentration of 3 μgL^{-1} of total phosphorus. From the beginning of 1994, it starts receiving addition loading of 500 kg yr^{-1} from a fertilizer processing plant. The lake has the following characteristics: (07)

Inflow = Outflow = $5 \times 10^5 m^3 yr^{-1}$
Volume = $4 \times 10^7 m^3$
Surface area = $5 \times 10^6 m^2$

It total phosphorus settles at a rate of 8 m yr^{-1}, show the concentration diagram of the lake from 1994 through 2004.

(b) Four lakes are connected in series have the following characteristics: (18)

Parameter	*Lake*			
	1	2	3	4
Volume ($10^6 m^3$)	2	3	4	3
Mean depth (m)	3	4	3	5
Surface area ($10^6 m^2$)	0.667	0.571	1.000	0.500
Loading (Kg yr^{-1})	1200	1300	2000	4000
Flow ($10^6 m^3 yr^{-1}$)	0.5	0.4	0.75	0.60



The pollutant settles at a rate of 10 m yr^{-1} and decays at a rate of 0.25 d^{-1}.
(i) Calculate the steady-state concentration in each of the reactors.
(ii) Determine how much of the concentration in the 4th reactor is due to the loading to the second reactor.

2(a) A lake has the following characteristics: (16)

Mean depth = 3 m

Surface area =2 x 10^5 m^2

The lake gets an inflow of 12000 m^3 d^{-1} from a stream having BOD concentration of 5 mg L^{-1}. In addition to the stream, the lake gets an inflow of raw sewage from a watershed area accommodating 1000 people. Each individual contributes about 150 gal $capita^{-1}$ d^{-1} of wastewater and 0.25 lb $capita^{-1}$ d^{-1} of biochemical oxygen demand (BOD). The temperature of the lake, stream, and raw sewage is 25°C. The total inflow of the lake is equal to the total outflow. If BOD decays at a rate of 0.25 d^{-1} at 20°C (θ = 1.05),

(i) Compute the assimilation factor.
(ii) Determine the steady-state concentration.
(iii) Compute the transfer coefficient.
(iv) Compute BOD residence time

(b) Explain the following types of loadings with examples and diagrams (i.e., loading functions versus time): (09)

(i) Impulse, (ii) Step, (iii) Linear, (iv) Exponential, (v) Sinusoidal, (vi) Real

3(a) Explain advection and diffusion. (02)

(b) Explain the following terms in the light of water quality modeling: (04)
(i) Model calibration and model validation
(ii) Model sensitivity and its application.

(c) Explain model complexity versus model reliability considering the accuracy, cost and uncertainty of the model. (05)

(d) A lake has following characteristics: (14)
V = volume of the lake = 50,000 m^3
Q = inflow =outflow = 60,000 $m^3 d^{-1}$
H = mean depth = 3 m.
k_1 = first-order conversion rate = 1 to 4 d^{-1}
v_s = settling velocity = 0 to 3 m d^{-1}

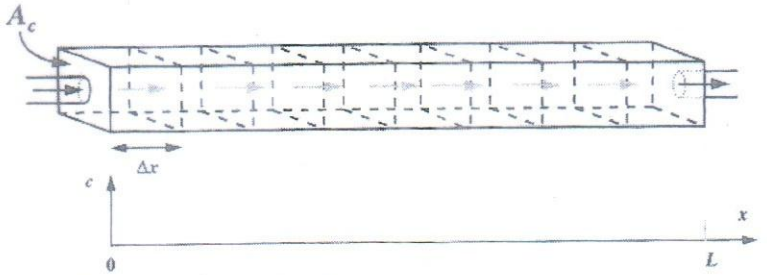
The following model has been developed for steady-state solution of a pollutant in the lake:
$c = c_{in} \cdot (k_q + k_q k_1 + k_q k_2^2)$
where, c = steady state concentration
$k_q = Q/V$
$k_2 = v_s/H$
c_{in} = concentration in the inflow stream = 10 mg L^{-1}

Use these information to estimate the sensitivity and uncertainty of the model to the parameter k_1 and k_2. Employ the first-order sensitivity analysis.

4(a) Determine the saturated concentration of dissolved oxygen (DO) in a lake with temperature of water = 10°C and salinity of 10 ppt at an elevation of 1000 m from mean sea level. You may use the following equations as appropriate: (06)

$\ln O_{sf} = -139.3411 + (1.575701 \times 10^5/T_a) - (6.642308 \times 10^7/T_a^2) + (1.243800 \times 10^{10}/T_a^3) - (8.621949 \times 10^{11}/T_a^4)$
$\ln O_{ss} = \ln O_{sf} - S\,[1.7674 \times 10^{-2} - (1.0754 \times 10^1/T_a) + (2.1407 \times 10^3/T_a^2)]$

(b) Use the cascade model to simulate the steady-state distribution of concentration in an elongated tank shown as follows: (10)



The tank has cross-sectional area $A_c = 10\ m^2$, total length L = 100 m, velocity U =100 m hr^{-1}, first order reaction rate k = 2 hr^{-1}, settling velocity 5 m hr^{-1}, total surface area =316 m^2. The inflow concentration is 2 mgL^{-1}. Use n = 2 and 4.

(c) A power plant emits SO_2 at a rate of 23.11 gm/s. The plant has an effective stack height of 45 m. The ambient wind speed is 3.2 m s^{-1} (at 10 meter height). There is no temperature inversion and the atmosphere is under 'slightly unstable' condition. Assume urban (rough) terrain and no plume rise. Compute maximum ground level concentration of SO_2 at a point of 2 km downward of the plant. Repeat calculation for 'extremely unstable' atmosphere. If required, necessary tables and figures are provided as below: (09)

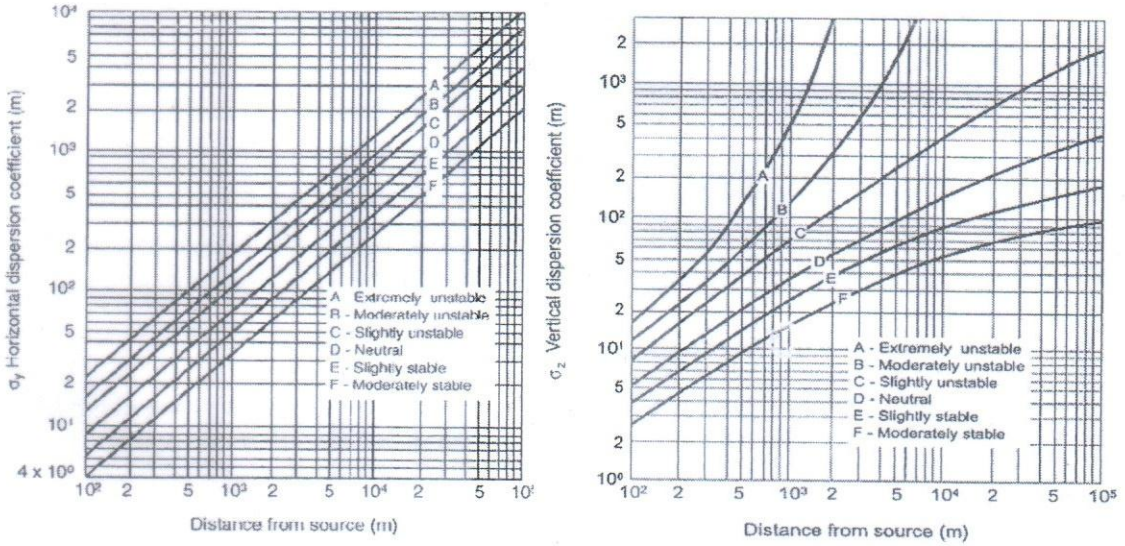


Fig.: Gaussian dispersion coefficients as a function of distance downwind (a) horizontal coefficient (b) vertical coefficient (Turner, 1970)

Wind Profile Exponent *p*, for Rough Terrain[a]

Stability Class	Description	Exponent *p*
A	Very unstable	0.15
B	Moderately unstable	0.15
C	Slightly unstable	0.20
D	Neutral	0.25
E	Slightly stable	0.40
F	Stable	0.60

[a]For smooth terrain, multiply *p* by 0.6; see Table 7.7 for further descriptions of the stability classifications used here.
Source: Peterson, 1978.

5(a) Write down the uses of groundwater wells. (05)

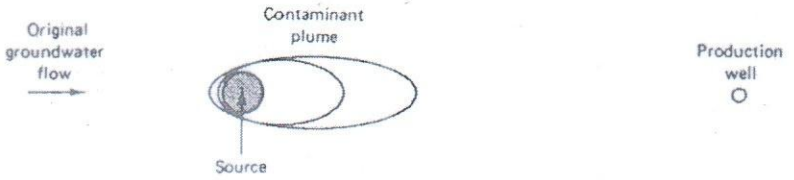
(b) The hydraulic conductivity in a confined aquifer 4 m thick is estimated to be 10^{-2} cm/sec. The hydraulic gradient is approximately 0.0015, and the porosity is 0.30. A well 30 cm in diameter is installed in the aquifer and is pumped at an average rate of 10 liter/min. (10)

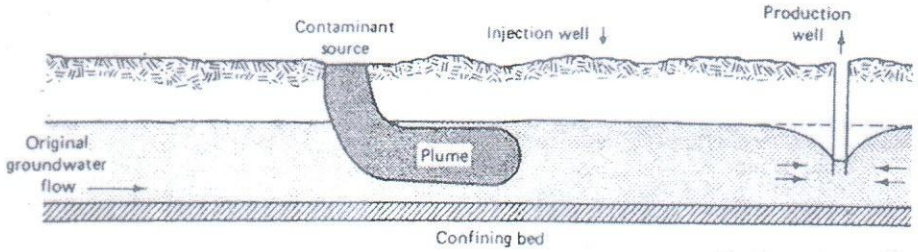
i. What is the drawdown in this well if the radius of influence is 80 ft?

ii. Estimate the hydraulic gradient in the aquifer at distances of 5 and 20 m, both directly upstream and downstream of the well.

(c) A well penetrates an unconfined aquifer. Before pumping the water table is in $h_o = 25$ m. After a long period of pumping at a constant rate of 0.5 m^3/s, the drawdowns at distances of 50 m from the well were observed 3 m. If $K = 7.26 \times 10^{-2}$ m/s, find the drawdowns at distances 150 m from the well. (04)

(d) Demonstrate how you can control the contaminated plume shown in the following figure against natural gradient using injection well or extraction well or both of them so that the production well remains contamination free. (06)

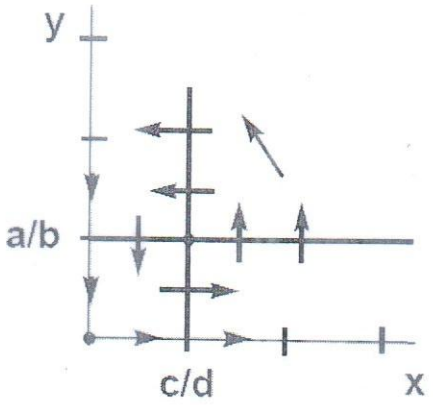




6(a) Write down the assumptions and shortcomings of Lotka-Volterra model. (09)

(b) Write down the Lotka-Volterra equations for a three species ecosystem where 1st species is a prey to 2nd species, 2nd species is a prey to 3rd species and there is no interaction between 1st and 3rd species. (10)
Also write the meanings of different notations used in the equations.

(c) The vector field representation of a predator-prey model is given. Draw its phase plane (state-phase representation) and explain the orientation of the curves at four different points. (06)



7(a) What are the modeling challenges? Write the differences between analytic and simulation models. (06)

(b) Define Nutrient Cycle. Give an example of the application of Nutrient cycle modeling. (08)

(c) Write the names of different model types used in Bioscreen. (06)

(d) Draw a figure showing the load configuration in Bioscreen. Write the names of the processes simulated in this model. (05)

8(a) A confined aquifer has been contaminated and a rectangular (for simplicity) plume has been created in the aquifer. The characteristics of the aquifer are as follows: (15)

Thickness of the aquifer = 25 m
Hydraulic conductivity = 0.0015 m/s
Regional hydraulic gradient = 0.001
Maximum pumping rate = 0.003 m^3/s
Width of the plume = 60 m

To clean up this aquifer, it is decided to pump out the groundwater and treat it at the aboveground facilities.

i. Determine the location of a single well that can totally extract the plume.
ii. If two optimally located wells are aligned along the leading edge of the plume, what minimum pumping rate Q would assure complete plume capture? What is the optimum space between the wells?
iii. Imagine the length of the plume is 750 m. How long would it take to pump out all of the contaminated groundwater? The aquifer porosity is 0.45

(b) A column experiment is set up in the laboratory. Sand with a mean grain size of approx 0.5 mm is packed (porosity 0.3) into a cylindrical column, 1.5 m in length and 10 cm in dia. Water flows through the column with a seepage velocity of 1 m/hr. 5 mg of salt are injected into the column (pulse injection) (10)

(i) What will be the concentration of salt after an hour at a distance 1.1 m down the column?
(ii) When the tracer mass is centered 3.5 m down the column, what is the concentration of tracer at this location?
(iii) If the inflow of pure water is replaced by inflow of a solution with a salt concentration of 5 mg/L beginning at t = 0 (continuous injection), what will be the concentration of salt at a distance 1.1 m down the column after 1 hour?

Note: The complementary error function table is provided as follows:

The Complementary Error Function[a]

x	erfc(x)	x	erfc(x)
0	1.0		
0.05	0.943628	1.1	0.119795
0.1	0.887537	1.2	0.089686
0.15	0.832004	1.3	0.065992
0.2	0.777297	1.4	0.047715
0.25	0.723674	1.5	0.033895
0.3	0.671373	1.6	0.023652
0.35	0.620618	1.7	0.016210
0.4	0.571608	1.8	0.010909
0.45	0.524518	1.9	0.007210
0.5	0.479500	2.0	0.004678
0.55	0.436677	2.1	0.002979
0.6	0.396144	2.2	0.001863
0.65	0.357971	2.3	0.001143
0.7	0.322199	2.4	0.000689
0.75	0.288844	2.5	0.000407
0.8	0.257899	2.6	0.000236
0.85	0.229332	2.7	0.000134
0.9	0.203092	2.8	0.000075
0.95	0.179109	2.9	0.000041
1.0	0.157299	3.0	0.000022

$$\text{erfc}(x) = 1 - (2/\sqrt{\pi})\int_0^x e^{-\epsilon^2} d\epsilon$$

$$\text{erfc}(-x) = 2 - \text{erfc}(x)$$

[a] Adapted from Freeze and Cherry (1979).

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B. Sc. Engg. (CEE)/ 8th Sem. 31 October, 2018 (Group A)

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

Semester Final Examination **Summer Semester: 2017-2018**
Course No.: CEE 4837 **Full Marks: 150**
Course Title: GIS Application in Environmental Engineering **Time: 3 Hours**

There **are 8 (Eight)** questions. Answer any **6 (Six)** 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. Assume values as needed. The examination is **OPEN BOOK**.

1 (a) The values of the known 15 points and their interpolated values are represented as z_i and z_j, where z_i = {8, 10, 12, …., 36} and z_j = {8.7, 12.2, 14.7, 16.2, 19.5, 22.9, 24.2, 26.3, 27.4, 30.5, 32.6, 33.65, 36.7, 37.75, 42.8}. The points are unit distance away, i.e, the distance vector for the points is d={1, 2, 3, …., 15}. Draw a semi-variogram and identify the nugget, range and sill. Briefly explain the results as well. (20)

(b) What is redundancy, and why should you avoid it in a geographical database? Explain with an example. (5)

2 (a) The raster below presents a cost surface. Calculate the cheapest path from cell (2,1) to cell (4,4) [values having asterisk as superscript represent these two cells respectively]. (20)

6	1	1	7
33*	9	3	5
2	4	1	12
8	25	5	4
2	1	17	51*

(b) The values of an attribute are given as: 33, 51, 47, 85, 16 and 778. Normalize them into a scale between -5 and +5. (5)

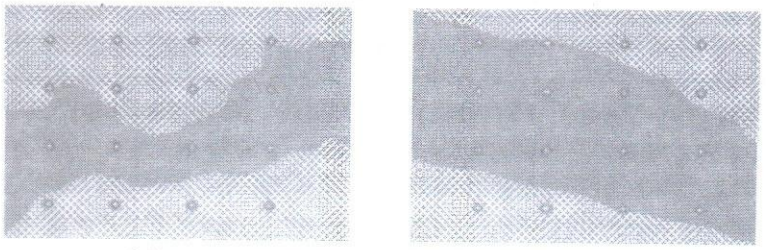
3 (a) From the raster map below, calculate slope, aspect, and flow direction for the shaded area. If each cell has a dimension = 100 m and the rainfall intensity is 50 cm/sq. meter/day then how much water will be accumulated in the three cells in the middle of the last row (2, 1, 2) if it rains for two hours? Assume that the rainwater falls only in the shaded area. (20)

4	7	9	6	9
9	2	8	1	6
7	7	7	6	7
8	5	6	5	8
3	2	1	2	7

(b) Draw the polyline having sequentially connected nodes as [(2,9); (4,8); (5,9); (7,8); (8,5); (7,4); (5,5); (2,3); (3,2); (2,1)] in a graph paper and demonstrate step by step how the vector shape can be simplified using Douglas-Peucker algorithm. The tolerance level is one unit. (5)

4 (a) A map along the path of a river was prepared in 2000. However, since then the river has changed its course and a new survey was conducted to classify different ground points. The result is presented with the figure below. Calculate overall, user/object, procedure/classification, mean and aerial accuracy of the existing map. Also, calculate the coefficient of agreement for the map as well as for the two classes (river and land separately). (20)

River Land



Map Ground Truth

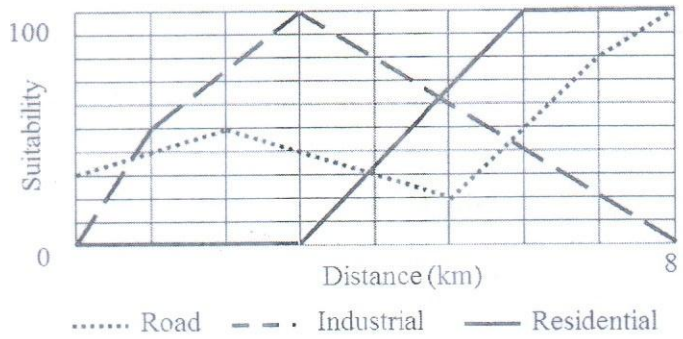
(b) What steps would you do in a GIS to know the area (in hectares) of urban land found only in high risk landslide zones. Explain. (5)

5 (a) Present the method of interpolation using Thiessen polygon with an example. In your example, you will take rainfall data of at least 6 stations, interpolate the rainfall on the catchment and calculate the amount of water that will be accumulated in the event of a week-long rainfall. Use appropriate graph paper. (20)

(b) Describe various ways of projecting a sphere into a flat surface. (5)

6 (a) You have been hired to evaluate the feasibility of establishing a waste disposal site in Gazipur. The dumping site will receive both industrial and residential waste. The suitability graph for sites has been prepared based on the distance to industrial area, residential area and main road. Two sites have been shortlisted. Their distances from road, industrial and residential areas are as follows: (20)

Site 1: 3 km, 6 km, 7 km
Site 2: 2 km, 4 km, 6 km
Which site shall you pick for waste disposal? (Assume values as necessary)
[The suitability graph is attached below.]



(b) Which are the four most important functions a GIS must be able to handle? What is the most important entity in a GIS? (5)

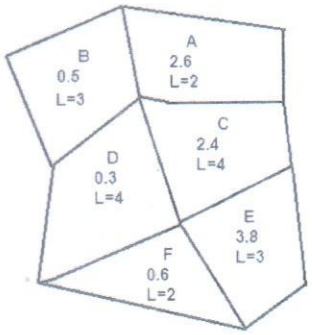
7 (a) Table below represents the coordinates of a vector map kept in the simple polygons with co-ordinate list method. There are four polygons in the map (There may be other features present, too). Draw the vector map on a graph paper and present the data in topological polygon structure using Spaghetti model and Topological model. (20)

ID	X	Y	ID	X	Y
N1	2	6	N6	4	6
N2	1	3	N7	6	7
N3	3	2	N8	7	6
N4	5	3	N9	6	5
N5	5	5	N10	6	4

(b) Smooth the entire raster data of Figure 8 by applying Filtering method (use average value). (5)

18	12	13	12	21
8	14	12	16	10
7	9	17	11	9
28	19	9	31	28
9	13	17	10	8

8 (a) Calculate the spatial correlation coefficient for the area below. The area is divided into 6 polygons (A to F). The attribute data and the distance (L) for each of the polygons are given. Also, show with calculations whether the polygon attributes are randomly distributed or spatially correlated. (20)



(b) Rasterization of vector data is sometimes required in data preparation. What reasons may exist for this? If it is needed, the raster resolution must be carefully selected. Argue why. (5)

B.Sc. Engg. (CEE)/ 8th Sem. 29 October, 2018 (Group A)

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

Semester Final Examination **Summer Semester: 2017-2018**
Course No.: CEE 4851 **Full Marks: 150**
Course Title: Highway Design and Railway Engineering **Time: 3.0 hours**

There are **8 (Eight)** Questions. Answer any **6 (Six)** questions. Programmable calculators are not allowed. Do not write on this questions paper. The figures in the right margin indicate full marks. The symbols have their usual meaning.

1.(a) What are the usage of switches and crossings? List various types of switches and crossings and illustrate them with diagrams. (15)

(b) Explain the major differences between flexible and rigid pavement using appropriate figures. (10)

2.(a) Explain the advantages and disadvantages of making a track on ballast or on concrete slab. (10)

(b) Write short notes on: i) Well graded aggregate; ii) Job- mix formula in the design of high type bituminous paving mixture. (10)

(c) Explain the material requirements and construction steps for soil-cement stabilization. (5)

3.(a) List the different kinds of sleepers used historically and discuss their advantages and disadvantages. (12)

(b) How do you propose to control weed growth around railway tracks? (8)

(c) What is "Cutback Asphalt"? How does "Emulsified Asphalt" work? (5)

4.(a) Why was it necessary to increase the axle load from 20t to 22.5 t? What changes were brought in the track system to carry this extra design load? (5)

(b) How is traffic load calculated for a modern railway system? (10)

(c) How does pumping through joints occur? How can this problem be handled? (10)

5.(a) Why do we need a signaling system for trains? List the equipment and parts of a lighting system along with their various components. (15)

(b) Describe the factors that affect pavement design. (10)

6.(a) What are cant, cant deficiency and excess cant? Why do we need cant? Discuss how theoretical and actual values of cants are determined. (10)

(b) Briefly explain the desirable properties of subgrade soil as a highway material. (10)

(c) Describe the properties of an ideal pavement. (5)

7.(a) Explain with diagram the distribution of train load through a track system. (5)

(b) Is high speed rail (HSR) more sustainable as a mode of transport than air transport? How can HSR compete/complement air travel? (10)

(c) Briefly explain the major flexible and rigid pavement failures. (10)

8.(a) Draw the cross section of a track system and identify its various components. Briefly describe the function of each component. (15)

(b) What is resilient modulus? Why it is important in flexible pavement design? (5)

(c) Differentiate between asphalt and tar. (5)

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M. Sc. Engg. (CEE) 26 October, 2018 (Group-B)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester Final Examination **Winter Semester: 2017-2018**
Course No.: CEE 6703 **Full Marks: 150**
Course Title: Constitutive Modeling of Soils **Time: 3.0 Hours**

There are 7 (Seven) questions. Answer any 6 (Six) questions. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

1(a). Derive the elastic D-matrix in tensorial form for a constitutive model of elastic material which is given by, (7)

$$\sigma_{ij} = \lambda \varepsilon_{kk} \delta_{ij} + 2\mu \varepsilon_{ij}$$

(b). For Modified Cam clay model, yield function $f = \ln p + \ln\left(\frac{M^2 + \eta^2}{M^2}\right) - \ln p_1 = 0$, (18)

derive $\frac{\partial f}{\partial \sigma_{ij}}$.

2(a). Write down the stress-strain relations in incremental form including the loading criteria for – (i) rigid plastic, (ii) elastic-perfectly plastic, and (iii) strain-hardening elasto-plastic conditions. Also, draw qualitative diagrams of stress-strain relations for all cases. (10)

(b). Illustrates (i) Mohr-Coulomb, (ii) Tresca, (iii) von Mises, (iv) Matsuoka-Nakai, and (v) Lade-Duncan failure criteria. (15)

3. Answer the following questions for Normally Consolidated Clay: (25)

(i) Derive the relation of $e \sim p' \sim q$ at critical state condition.

(ii) Using the equation derived in Q.3(i), determine the undrained shear strength c_u for the effective stress of p'_0=200 kN/m^2. Use, $\lambda = 0.5$, $D = 0.25$, $M = 0.6$, $e_0 = 1.2$ at p'_0=100 kN/m^2.

4(a). Derive a one-dimensional elastoplastic constitutive model for over-consolidated clay. Also, describe an evolution rule for the state variable representing the density parameter. (18)

(b). Extend the constitutive model of Q.4(a) for explaining the behavior of structured soil. (7)

5. Draw the graph of e - $\ln\sigma$ relation (range of stresses from 50 kPa to 350 kPa) in a graph paper for an over-consolidated soil in one-dimensional condition having initial void ratio 0.75 corresponding to the initial stress σ_0 = 50 kPa. Here, the parameters of the soil are – N=0.85, λ=0.30, κ=0.030, a=100. Use equation of state variable $G(\rho)=a\rho^2$. (25)

6(a). Derive the yield function of original Cam clay model. (18)

(b). Illustrates the limitations of the Cam clay model. (7)

7(a). Derive D^{ep} for a relation of $d\sigma = D^{ep} d\varepsilon$ in a one-dimensional elastoplastic constitutive model $d(e) = \left\{ \frac{\lambda - \kappa}{1 + G + Q} + \kappa \right\} \frac{d\sigma}{\sigma}$, where, G and Q are the state parameters of the soil. (7)

(b). Derive the general three-dimensional formulation of D-Matrix in associated flow rule for elasto-plastic material. Consider, yield function $f = f(\sigma_{ij}, H)$, hardening parameter $H = H(\varepsilon_{ij}^{p})$. (18)