B.Sc. Engg. (CEE)/ 1st Sem.   08th March, 2019 (Morning)
ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM   : MID SEMESTER EXAMINATION   SUMMER SEMESTER: 2018-2019
COURSE NO.   : CEE 4101   TIME   : 1.5 Hours
COURSE TITLE: Introduction to Civil Engineering   FULL MARKS: 50

There are 4 (Four) questions. **Answer any 3 (Three) questions including Question No. 1. Question No. 1 is compulsory.** 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) "A structure must possess four properties to perform it's function of supporting the building in response to whatever the load may be applied to it"- explicate this statement.   (6)

   (b) What do you mean by Standard, Code and Specification in terms of Civil Engineering? Why are they required for Civil Engineers?   (6)

   (c) What are the significance of Research on Civil Engineering Materials?   (2)

   (d) Define the following terms: (i) Stress (ii) Strain (iii) Strength (iv) Stiffness   (4)

2. (a) Discuss about the contributions of civil engineers to the society.   (7)
   (b) Mention and Discuss about the different fields of Civil engineering.   (5)
   (c) What is meant by Photogrammetry? Discuss about aerial photography.   (4)

3. (a) What is structural Engineering? What is the use of 'Newton's Law of Motion' and 'Hooks Law' in structural engineering?   (4)

   (b) Write down the properties of first class bricks.   (6)

   (c) (i) Explain load transfer system in a typical framed structure. (ii) Explain the types of load that an ideal structure resists? (iii) Draw the schematic diagram of five loading types in a structure.   (1+2.5 +2.5)

4. (a) Discuss about the skills a Civil Engineer should possess. In your opinion, which skill is the most important one to have for Civil Engineers? Explain your reasoning. (7)

   (b) What are the duties an Engineering Manager must perform?   (5)

   (c) Categorize the different types of construction machineries based on purpose and use. Give two examples of each category.   (4)

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Semester Examination   **Summer Semester: 2018-2019**
Course No.: CEE 4103   **Full Marks: 100**
Course Title: Surveying   **Time: 1.5 Hours**

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

1(a)   A straight embankment having level section has a formation level width of 15 m. Side slope is 2.5 horizontal to 1 vertical. Using the prismoidal rule, determine the volume of earthwork for the following data: (20)

Chainage(m)	0	25	50
Ground level(m)	9.0	4.0	5.0
Formation level(m)	8.0	8.0	8.0

(b)   List five methods of direct distance measurements and describe them in brief. What are the instrument used in plane table surveying? $(10 + 3\frac{1}{3})$

2(a)   The following lengths and bearings were recorded in running a traverse ABCDE, the length and bearing of EA having been omitted: (20)

Line	Length, m	Bearing
AB	217.5	120°15'
BC	318.0	62°30'
CD	375.0	322°24'
DE	283.5	335°18'
EA	?	?

Sketch the traverse and calculate the length and bearing of the line EA.

(b)   The following offsets were taken from a chain line to a hedge: $(13\frac{1}{3})$

Distance (m)	0	8	16	24	32	48	64	88	112
Offset (m)	8.76	4.32	5.44	4.88	3.84	3.36	3.00	2.52	1.84

Compute the area in square metres included between the chain line, the hedge, and the end offsets, by Simpson's rule.

3(a) List the points on which 'Traverse Surveying' differs from 'Chain Surveying'. .   (3+7)
Describe the 'Graphical Method' for balancing a closed traverse.

(b) A tape was exactly 30 m long at 20^0 C when placed on the flat under a pull of 75 N. $(13\frac{1}{3})$
A survey line was measured with this tape under a pull of 120 N and found to be 810
m. The average temperature during the measurement was 30^0 C. If the tape was
supported in spans of one tape length each time, determine the corrected length of
the survey line. The cross-sectional area of the tape in 4 mm². The unit weight of
the material of the tape is 7.8 x 10^{-5} N/mm³. The modulus of elasticity of the material
of the tape is 2.1 x 10^5 N/mm². The coefficient of linear expansion of the material of
the tape is 11.7x $10^{-6}/^0$C.

(c) Descrbe the method of Radiation and Intersection of plane tabling with proper figure. -   (10)

4(a) A 400 m² square plot ABCD forms the plane of a pit excavated for road work.   (10)
Calculate the volume of the excavation in cubic metres from the following data:

Point	A	B	C	D
Original level (m)	25	26	27	24
Final level (m)	21	20	22	19

(b) The following bearings were observed in a closed traverse ABCDEFA. Calculate the · $(18\frac{1}{3})$
whole circle bearings (W.B), Reduced Bearings(R.B.) and the included angles.

Line	F. B	B.B.
AB	203^0 S.W.	23^0 N. E.
BC	$133^0 37'$ S. E.	$313^0 37'$ N.W.
CD	$89^0 41'$ N.E.	$289^0 4'$ S. W.
DE	$24^0 25'$ N. E.	$204^0 25'$ S.W.
EF	$314^0 20'$ N. W.	$134^0 20'$ S. E.
FA	$256^0 56'$ S. W.	$76^0 56'$ N.E.

(c) Discuss the uses of following instruments in chain survey.   (05)
(i)Peg   (ii) Ranging Rod and (iii) Optical square

Equations' Table

1. $l = l'.\left(\frac{L/}{L}\right)$	18. $\Delta = \left(\frac{O_0 + O_n}{2} + O_1 + O_2 + O_3 + \cdots + O_{n-1}\right)d$
2. $A = A'.\left(\frac{L/}{L}\right)^2$	19. $\Delta = \frac{d}{3}[(O_0 + O_n) + 4(O_1 + O_3 + \cdots + O_{n-1}) + 2(O_2 + O4 + \cdots + On-2)$
3. $V = V'.\left(\frac{L/}{L}\right)^3$	20. $V = d\left[\frac{(A_0 + A_n)}{2} + A_1 + A_2 + \cdots + A_{n-1}\right]$
4. $C_t = \alpha(T_m - T_o)L$	21. $V = \frac{d}{3}[(A_0 + A_n) + 4(A_1 + A_3 + \cdots + A_{n-1}) + 2(A_2 + A4 + \cdots + An-2)$
5. $C_p = \frac{(P - P_0)L}{AE}$	22. $A = h(nh + b)$
6. $C_s = nC_{s1} = \frac{nl_1(wl_1)^2}{24P^2}$	23. $C_p = V_T - V_P$
7. $P_n = \frac{0.204w_1\sqrt{AE}}{\sqrt{P_n - P_0}}$	24. $C_c = \frac{d^2}{2R}$ (Subs)
8. Back Bearing = Force Bearing $\pm 180^o$	25. $C_R = \frac{1}{7} \cdot \frac{d^2}{2R}$ (add)
9. B.B of AB = F.B of BA	26. $C_c = \frac{6}{7} \cdot \frac{d^2}{2R}$
10. include angle = $(2N-4) \times 90^o$	27. $H = \frac{1}{2}[(h_a - h_b) + (h_a - h_b)]$
11. exclude angle = $(2N+4) \times 90^o$	28. $D = (b + s\cot\alpha_2)\frac{\tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2}$
12. $\sum L = l_1\cos\theta_1 + l_2\cos\theta_2 + l_3\cos\theta_3 + \cdots = 0$	29. $h_1 = D\tan\alpha_1$
13. $\sum D = l_1\sin\theta_1 + l_2\sin\theta_2 + l_3\sin\theta_3 + \cdots = 0$	30. $D = (KS + C)\cos\theta + h\sin\theta$
14. $A = \sqrt{s(s-a)(s-b)(s-c)}$	31. $H = L\sin\theta = KS\sin\theta + C\sin\theta$
15. $A = |\sum M_i L_i|$	32. $D = L\cos\theta = KS(\cos\theta)^2 + C\cos\theta$
16. $M_i = M_{i-1} + \frac{D_{i-1} + D_i}{2}$	33. $H = L\sin\theta = KS\frac{\sin 2\theta}{2} + C\sin\theta$
17. $\Delta = \frac{O_1 + O_2 + O_3 + \cdots + O_n}{n+1} \times L = \frac{L}{n+1}\sum O$	34. $\frac{Map\ Distance}{Photo\ Distance} = \frac{Map\ Scale}{Photo\ Scale}$

B.Sc. Engg. (CEE) 1st Sem.   12 March, 2019

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

Mid Term Examination   Winter Semester: 2018-2019
Course No.: Chem 4153   **Full Marks: 75**
Course Title: Chemistry   **Time: 1.5 Hours**

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

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1 (a) Give a complete definition of solution. Classify it into different classes giving   (8)
        at least one example of each class. Describe the preparation of super-saturated
        solution.

  (b)   Define solubility and solubility curve. Explain why for endothermic solute the   (8)
        solubility increases with increase of temperature but for exothermic solute
        solubility decreases with the increase of temperature.

  (c)   A 100 mL saturated solution contains 0.5g CaCO3. Calculate the solubility (s),   (9)
        formality (F) and normality (N) of the solution. [Density of the saturated
        solution is 1.02 g /mL]

2(a)   Define vapour pressure of a liquid. Explain why the vapour of water decreases   (11)
        when a salt is dissolved into it.

  (b)   What does it mean by elevation of boiling point of a liquid? Derive a   (8)
        mathematical expression which correlates the molecular weight of solute and
        the change of boiling point of the solution.

  (c)   Calculate the boiling point of an aqueous solution containing 3.0 g urea in 75 g   (6)
        water [K_b of water = 0.53].

3 (a) What is absorption coefficient? How could it be measured? Write the   (10)
        mathematical expression of absorption coefficient. Discuss the effect of
        temperature and nature of solute and solvent on the absorption coefficient of a
        gas in water.

  (b)   Write down the postulates of Bohr's atom model and its limitations.   (5+2)

  (c)   Deduce the equations of radius calculation and energy calculation of an   (4+4)
        electron.

4(a) Define the terms 'proton' and 'neutron'. (4)

(b) How can you prove the presence of a nucleus in an atom? (4)

(c) Discuss the Rutherford's atom model and its limitations. (5+4)

(d) How does the concept of energy levels arise by considering the Plank's quantum concept? (4)

(e) Define the terms 'isotope' and 'isobar' with examples. (4)

B.Sc. Engg. (CEE)/1ˢᵗ Sem.   07 March, 2019

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

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO.   : PHY 4153   TIME : 1.5 Hours
COURSE TITLE: Physics I   FULL MARKS: 75

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

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1. (a) Define simple harmonic motion and obtain its differential equation. (05)

   (b) Derive the expression of total energy in a simple harmonic motion and show that this energy is conserved. Obtain the expression of average kinetic energy in simple harmonic motion. (12)

   (c) A spring of force constant 19.6 N/m hangs vertically. A body of mass 0.20 kg is attached to its free end and then released. Assume that the spring was un-stretched before the body was released and find how far below the initial position the body descends. Find also the frequency and amplitude of the resulting simple harmonic motion. (08)

2. (a) Find the displacement, amplitude and phase angle of the resultant motion when two simple harmonic motions acting on a straight line are combined. (07)

   (b) When two simple harmonic motions of same frequency but different amplitudes and phase angles act at right angles on a particle, find the equation of motion of the particle. (09)

   (c) From question 2(b), draw graphs of the resultant motion when phase angles are 0°, 45° and 90°. (09)

3. (a) Define damped harmonic motion and forced oscillation with examples. (04)

   (b) i) Show that the damping force is proportional to the velocity, and ii) Obtain the expression of average power dissipation in damped harmonic motion. (15)

   (c) The equation of displacement of a damped oscillator is given by: $x = 5e^{-0.25t} \sin\frac{\pi}{2}t$, where x is in centimeter and t in second. Find the velocity of oscillator at time $t= 5$s. (06)

4. (a) What is meant by a progressive wave? How can you produce it? (05)

   (b) Derive the differential equation of a progressive wave and solve it. (15)

   (c) Write the equation for a travelling wave in the negative direction along the x-axis and having an amplitude 0.010 m, a frequency 550 Hz and a speed 330 m/s. (05)

B.Sc. Egg. (CEE)/1ˢᵗ Sem.   **11 March, 2019 (Morning)**

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

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO.   : Math 4153   TIME : 1.5 Hours
COURSE TITLE: Differential Calculus, Integral Calculus & Matrix   FULL MARKS: 75

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

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1. (a) Define the followings with example: Explicit function, Implicit function, (12)
   Odd function and Even function. A function $f(x)$ is defined as follows:
   $$f(x) = \begin{cases} 0 & when\ 0 \le x < 3 \\ 4 & when\ x = 3 \\ 5 & when\ 3 < x \le 4 \end{cases}$$
   Test the continuity and differentiability of $f(x)$ at the point $x = 3$.

   (b) If $y^{\frac{1}{m}} + y^{-\frac{1}{m}} = 2x$, then show that,   (13)
   $$\left(x^2 - 1\right)y_{n+2} + \left(2n+1\right)xy_{n+1} + \left(n^2 - m^2\right)y_n = 0.$$

2. (a) Give the statement of first Mean Value Theorem. Verify the Mean Value   (8)
   Theorem for the function $f(x) = x - x^3$ in the interval $(-2, 1)$.

   (b) Evaluate: $\lim\limits_{x \to 1} \left\{ \dfrac{x}{x-1} - \dfrac{1}{\log_e x} \right\}$.   (8)

   (c) If $u = \ln\sqrt{x^2 + y^2 + z^2}$, then show that,   (9)
   $$\left(x^2 + y^2 + z^2\right)\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} \right) = 1.$$

3. Workout the following:

   (a) $\displaystyle\int \frac{dx}{\cos\left(2x-a\right)\cos\left(2x+a\right)}$.   (7)

   (b) $\displaystyle\int \left(x-2\right)^3 \sqrt{4x - x^2}\ dx$.   (8)

   (c) $\displaystyle\int \frac{x^2}{\left(x\sin x + \cos x\right)^2}\ dx$.   (10)

4. (a) Find a reduction formula for $I_n = \displaystyle\int x\sin^n x\ dx$.   (8)

   (b) Find the value of : $\displaystyle\int_0^{16} \frac{x^{\frac{1}{4}}}{1 + x^{\frac{1}{2}}}\ dx$.   (8)

   (c) Find the area enclosed by the curve $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$.   (9)

B.Sc. Egg. (CEE)/ 1ˢᵗ Sem.   **04 March, 2019 (Afternoon)**

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

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO.   : CEE 4311   TIME   : 1.5 Hours
COURSE TITLE: Mechanics of Solids 1   FULL MARKS: 75

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

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1. (a) What do you understand by Skeletal Structures?   (5)

    (b) What is the shear stress in bolt A caused by the applied load shown in Fig. 1? The   (10)
    bolt is 6 mm in diameter, and it acts in double shear. All dimensions are in mm.
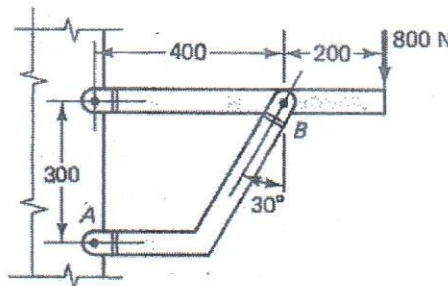
Fig. 1

    (c) A bar of variable cross section, held on the left, is subjected to three forces, $P_1 =$ (10)
    4 kN, $P_2 = -2$ kN, and $P_3 = 3$ kN, as shown in Fig. 2. Plot the axial stress along the
    length of the bar. Let $A_1 = 200$ mm², A2 = 100 mm², and A3 = 150 mm².
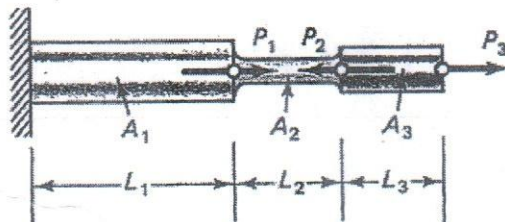

Fig. 2

2. (a) How many types of stresses are there in a stress tensor? What are they?   (5)
    (b) What do understand by Factor of Safety?   (5)

(c) A tower used for a highline is shown in the Fig. 3. If it is subjected to a horizontal (15) force of 540 kN and the allowable stresses are 100 MPa in compression and 140 MPa in tension, what is the required cross-sectional area of member AD? All members are pin-connected.

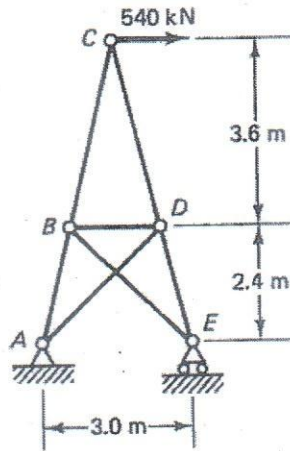Fig. 3

3. (a) Draw the engineering stress-strain diagram and the true stress-strain diagram of (5) mild steel qualitatively.

(b) A wall bracket is constructed as shown in Fig. 4. All joints may be considered (10) pin-connected. Steel rod AB has a cross-sectional area of 5 mm^2. Member BC is a rigid beam. If a 1000-mm diameter frictionless drum weighing 500 kg is placed in the position shown, what will be the elongation of rod AB? Let E = 200 GN/m^2.
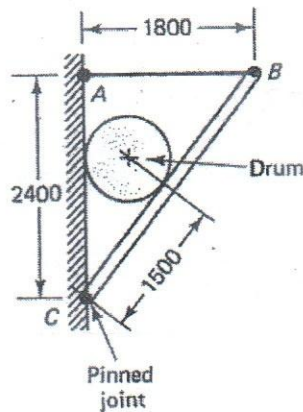

Fig. 4

(c) A steel bar 2 inch wide and 0.5 in thick is 25 inch long, as shown in Fig. 5. On (10) application of force P, the bar width becomes narrower by 0.5 x 10^{-3} in. Estimate the magnitude of applied force P and the axial elongation of the bar. Assume elastic behavior and take E = 30 x 10^3 ksi and v = 0.25.

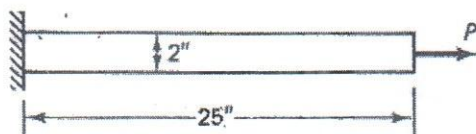Fig. 5

4. (a) Write down the relationships among stress and strain components according to the generalized Hooke's law for isotropic materials. (6)

(b) Derive the relationship among Young's modulus of elasticity, shear modulus of elasticity and Poisson's ratio. (9)

(c) A piece of 50 by 250 by 10 mm steel plate is subjected to uniformly distributed stresses along its edges (Fig. 6). If $P_x = 100$ kN and $P_y = 200$ kN, calculate the change in thickness occurs due to the application of these forces? Let E = 200 GPa and $v = 0.25$. (10)
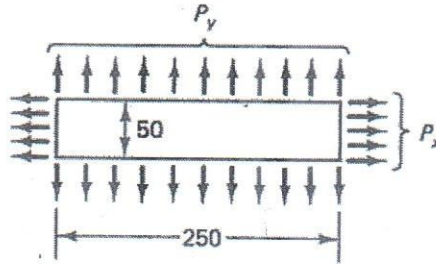

Fig. 6

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

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

1(a) Write the significance of knowledge of Geomorphology in the Civil Engineering sector of (06) Bangladesh.

(b) Write short notes on weathering and erosion.   (05)

(c) Draw schematic diagram showing the effects of land use pattern on runoff. Also briefly describe (08) how you can manage this problem as a Civil Engineer.

(d) Draw flood hydrographs for the following three drainage basins A, B and C of different shapes (06) considering all other factors identical for all the three basins:
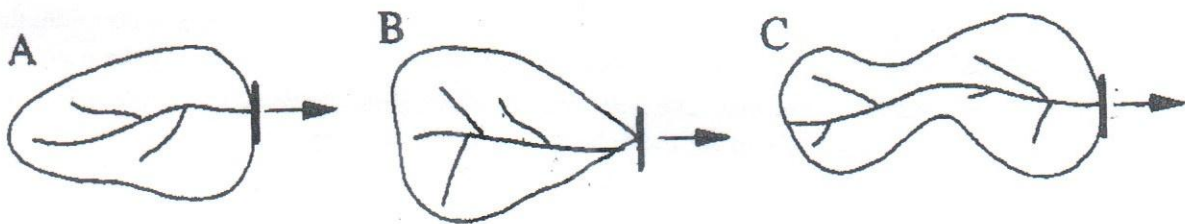
2(a) A drainage basin is found to have the following data: (08)

   Area of the basin = 2500 km^2
   Length of the main stream = 110 km
   Perimeter of the basin = 367 km

Determine the form factor and compactness coefficient of the basin.

What does the value of the two factors indicate about the shape of the basin?
Draw a qualitative diagram of the basin and show its different components.

(b) Drainage basin of which shape (elongated or fan shaped) is more susceptible from a drainage (05) point of view? Explain.

(c) A project is to be built in southwest of Dhaka. The following information was determined from (12) field measurement and proposed design data:

   Total Drainage Area = 60 acres
   Travel time for overland flow = 30 minutes
   Extent of shallow concentrated flow = 600 feet
   Average velocity of shallow concentrated flow = 2.5 feet per second
   Travel time for channel flow = 13 minutes

| Type of Land Use	Percentage of Total Area
Rooftops	40%
Streets (Drive and Walks)	20%
Average lawns on sandy soil	30%
Parks	10%

Using rational method, find the peak discharge of the area for 5-year frequency storm.
[Use Table 1 and Figure 1 for required data]

3(a) Why the earth is called a dynamic planet? How plate movements cause tectonic hazards in Iceland? (05)

(b) What is the connection between earthquake and plate tectonics? (04)

(c) What is a clay mineral? With the help of neat sketches describes the following clay minerals: (06)
  i. Kaolinite
  ii. Illite
  iii. Montmorillonite

(d) India used to be an island 71 million years ago. It was 1700 Km away from Asia at that time. Calculate the depth of the crust at which India was situated at that time and the mean spreading rate (mm/year) at which it crashed into Asia. (07)

(e) Why color is alone not enough to identify a mineral? (03)

4(a) A body of igneous rock was erupted due to volcanic activity and before the eruption, the temperature (t) was held at 25°c and pressure (p) was 1100 KPa. Due to the volcanic eruption, the pressure (p) was reduced by 20% but the temperature (t) remains unchanged during the eruption. Moreover, the temperature (t) of that zone was normally fluctuating between 0°c to 30°c. Draw the melting curve of the rock body using the following relationship between the pressure and the temperature and check whether the body of that rock body will melt or not. (13)

$$p = 2t^2 - 5t$$

(b) Present a neat sketch of Bowen's reaction series. Discuss the formation of minerals at different stages of cooling of magma. (06)

(c) Distinguish between the followings (draw figure and give examples where applicable) : (06)
  i. Magma and lava
  ii. Continental rift and ocean ridge
  iii. Intrusive rock and extrusive rock

Table 1: Runoff Coefficient values for different land uses
[for Question 2(c)]

Land Use	C Value
Business:	
Downtown Areas	0.95
Suburban Areas	0.75
Residential lots (lot area only):	
Single-family	
2.5 acres or larger	0.12
0.75 – 2.5 acres	0.20
0.25 – 0.75 acres	0.30
0.25 acres or less	0.45
Apartments	0.75
Industrial:	
Light areas	0.80
Heavy areas	0.90
Parks, cemeteries	0.10
Playgrounds	0.25
Schools	0.55
Railroad yard areas	0.50
Streets:	
Paved	0.90
Gravel (packed)	0.40
Drive and walks	0.90
Roofs	0.90
Lawns	
Lawns, sandy soil	0.20
Lawns, clayey soil	0.20

270

Figure 1: IDF curve [for Question 2(c)]
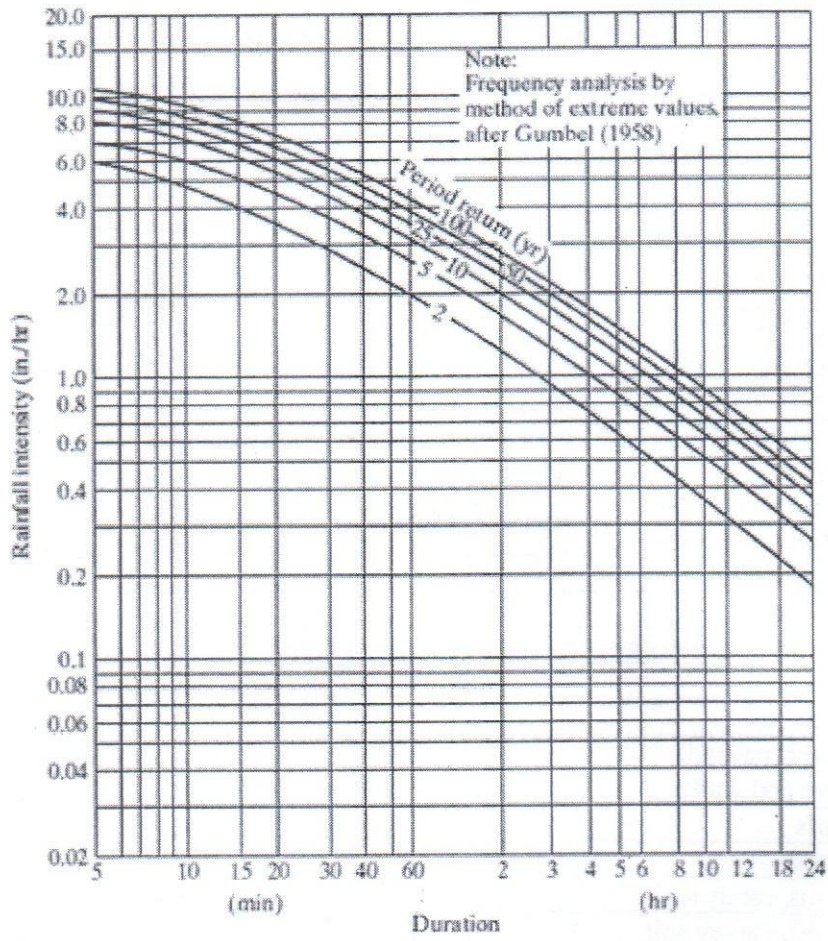
Figure 1: IDF curve [for Question 2(c)]

B.Sc. Egg. (CEE)/ 3rd Sem.   **08 March 2019 (Afternoon)**

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

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO.   : Math 4353   TIME   : 1.5 Hours
COURSE TITLE: Laplace Transformation, Series, PDE   FULL MARKS: 75

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

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1. (a) Define Laplace Transform. Find the Laplace transform of   5+10
$$f(t) = \begin{cases} t, & 0 \le t < 1 \\ 1, & t \ge 1 \end{cases}.$$

    (b) Solve the following Initial Value Problem by Laplace Transform: 10
$$y'' + 9y = e^t, \qquad y(0) = 0, \quad y'(0) = 0.$$

2. A beam of length L is embedded at both ends. Find the deflection of the beam when   25
the load is given by
$$w(x) = \begin{cases} w_0\left(1 - \frac{2}{L}x\right), & 0 < x < L/2 \\ 0, & L/2 < x < L. \end{cases}$$

3. Classify the singular point for the solution of the following differential equation.   5+20
Hence find the series solution of the following differential equation about $x = 0$.

$$x^2 y'' + xy' + (x^2 - 1)y = 0.$$

4. (a) Prove that the general solution of the linear partial differential equation   15
$$Pp + Qq = R$$
       is
$$F(u, v) = 0$$
where F is an arbitrary function and $u(x, y, z) = c_1$ and $v(x, y, z) = c_2$
     form a solution of the equations
$$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}.$$

    (b) Eliminate the arbitrary function f from the equation   10
$$f(x^2 + y^2 - z^2, z^2 - 2xy) = 0$$
to form a Partial Differential Equation.

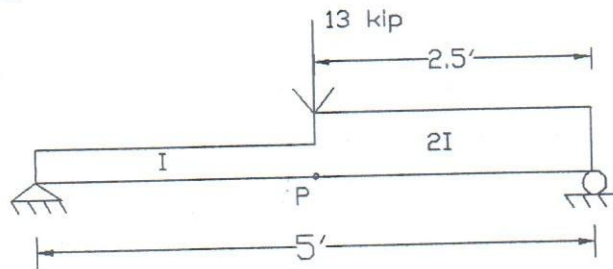1. (a) An equation is given by $g(x) = e^{-x}(3.2 \sin x - 0.5 \cos x)$. Using bisection   (12)
method, find a root of this equation within a range between 3 and 4.
$(\varepsilon_s = 10^{-3}\%)$

   (b) Find out the value of deflection at 'p' of the following simply supported beam   (13)
as shown below:

$E = 29 \times 10^6 \ psi, \ I = 1000 \ inch^4$

Prepare Romberg's table to get satisfactory result until the stopping criteria
$(\epsilon_s = 0.01)$ is satisfied.

2. (a) Use zero through third-order Taylor series expansions to predict $f(3)$ for   (07)

$$f(x) = 25x^3 - 6x^2 + 7x - 88$$

using a base point at $x_i = 1, h = 2$. Compute the true percent relative error ε_t
for each approximation.

   (b) Vertical reactions of a 2D simply supported beam are x_1 and x_2, respectively,   (09)
and horizontal reaction is x_3. Determine the upper triangular matrix and find the
solutions to the system of linear equations of reactions as shown below:

$$\begin{aligned}
2x_1 - 6x_2 - x_3 &= -38 \\
-3x_1 - x_2 + 7x_3 &= -34 \\
-8x_1 + x_2 - 2x_3 &= -20
\end{aligned}$$

   (c) Use Euler's method to numerically integrate $\frac{dy}{dx} = x + 2y$ from x = 0 to x = 1   (09)
using step size of 0.5. Find local and global true errors for each step. Use y(0)=1.

3. (a) Briefly discuss limitations of higher order polynomials. Also discuss problems (04)
of using Newton-Raphson method for determination of roots of equations.

(b) The data below are the Flows of traffic in vehicle per hour for different densities (11)
in the N5 highway of Bangladesh in a particular day:

Density (veh./km)	0	671	1359	1742	2011	2377
Flow (veh./hr.)	0	2201	3303	2745	1895	0

Using second order polynomial regression, find out the equation of the parabola.

(c) The Maclaurin series expansion for e^x is (10)

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

Starting with the simplest version, $e^x = 1$, add terms one at a time to estimate
$e^{0.5}$. After each new term is added, compute the true and approximate percent
relative errors. Add terms until the absolute value of the approximate error
estimate falls below an error criterion conforming to two significant figures.

4. (a) A simply supported beam is loaded in such a way that the value of Shear force (10)
(kip) at a distance x from the beam is,

$$V(x) = \frac{1}{4}Lw - \frac{w}{L}x^2 \ (for \ x = 0 \ to \ x = L/2)$$

L = length of the beam = 5 ft
w = maximum triangular load = 2 kip/ft
Hence, bending moment at the mid-span of the beam is

$$M = \int_0^{L/2} V(x)dx$$

Use 4 areas for both trapezoidal and Simpson's rule to evaluate the bending
moment at mid-span of the beam and compare the results between them. Also
find the exact value of bending moment. (Given, at x = 0, M = 0)

(b) Data of discharge ($m^3/hr.$) of wastewater from an residential area in sewerage (15)
line after certain period of time ($hrs.$) are given below:

Time ($hrs.$)	1	2	3	4	5	6
Discharge($m^3/hr.$)	2	6	19	78	140	241

Use
i) Graphical method
ii) Linear interpolation
iii) Parabolic interpolation of second order
iv) Newton's interpolating polynomial of maximum possible order

to predict discharge of wastewater after 4.6 $hrs.$. Choose appropriate sets of data
in each case to predict more accurate results.

B.Sc. Engg. (BTM)/ 3rd Sem.   12th March, 2019 (Morning)

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

Semester: Mid Semester Examination   Winter Semester: 2018-2019
Course No.: BTM 4361   Full Marks: 75
Course Title: Civil and Environmental Technology I   Time: 1.5 hours

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

1. A sample of fine aggregate of mass of 508.5 g is passed through the sieves shown below and   **(25)**
    the masses retained on each sieve are as shown:

Sieve	Size (mm)	Mass retained, (gm)
3"	76.2	0
1.5"	37.5	0
3/4"	19.05	0
1/2"	12.5	0
3/8"	9.5	0
# 4	4.75	9.2
# 8	2.36	67.6
# 16	1.18	101.2
# 30	0.6	102.2
#40	0.425	0
# 50	0.3	120.5
# 100	0.15	93.1
# 200	0.075	10.2
Pan		4.5
Total		**508.5**

(i)   Calculate FM of the sample.
(ii) Draw grading curve of the sample.
(iii) Comment on the sample based on the sieve analysis data and grading curve.

2 a) Write down the mineral constituents of cement. Why gypsum is added to cement?   **(05)**

   b) Write down the different types of Portland cement according to ASTM and BDS EN 197-1.   **(05)**

   c) Describe the properties of cement in detail.   **(15)**

3 a) Write the field tests of brick.   **(05)**

   b) Explain the common defects in brick masonry.   **(04)**

c) How does brick get strength during burning? (03)

d) Explain bulking of sand. Compare bulking of sand with the variation of fineness of sand. (05)

e) For a road construction project the recommended FM for sand to be used is 2.6. Two sand (08) samples of FM 2.2 and FM 2.8 were collected from two different locations. Find out the mix ratio to get the required FM.

4 a) Draw a labelled diagram of stress-strain curve for steel. (04)

b) Explain the following properties of material : (04)
   (i) Modulus of toughness.
   (ii) Modulus of resilience.
   (iii) Modulus of elasticity.
   (iv) Rigidity modulus.

c) A steel pipe of length 6ft with inner and outer diammeter of 8 in. and 12 in. respectively is (17) under compressive load of 200 kips. Given, modulus of elasticity E= 200 GPa and poisson's ratio v=0.3.
   Find the follwing:
   (i) Change in length of the pipe.
   (ii) Lateral strain.
   (iii) Increase in outer and inner diameters.
   (iv) Increase in wall thickness.

B.Sc. Engg. (CEE)/ 3rd Sem.   11th March, 2018 (Afternoon)

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

Semester: Mid Semester Examination   Winter Semester: 2018-2019
Course No.: CEE 4361   Full Marks: 75
Course Title: Fluid Mechanics   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) Dhaka north city corporation (DNCC) recently agreed on efficient distribution of drinking   (3+2)
        water in the Purbachal area. One of the major strategies is to consider all head losses
        during design period. What losses do you think would be appropriate for this project.
        Justify your answer.

    (b) Water pipe of diameter 150mm has been proposed for the water-distribution project shown   (10)
        in the following figure. The water is going to flow through a 800m long inclined horizontal
        cast iron pipe. At point (1), pressure is 2400kPa at point (2) pressure is atmospheric.
        Assume same velocity exists within the pipe and the kinematic viscosity of water is 1×10^{-6}
        m^2/s. Determine flow rate, maximum velocity, thickness of viscous layer.
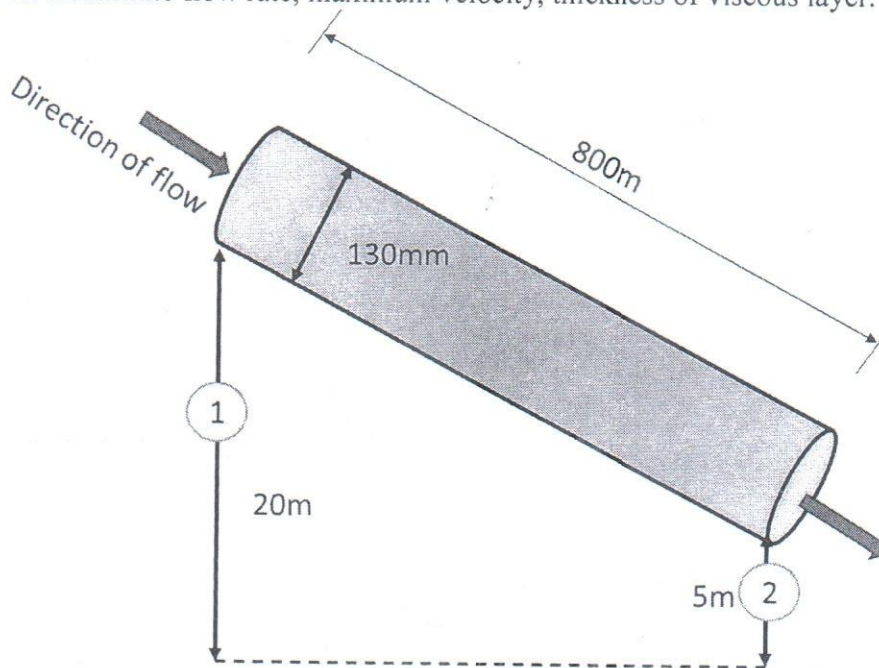
    (c) Derive an equation for determining friction in a circular conduit.   (10)

2. (a) Find the specific gravity of the oil in chamber B shown in the following figure, if the   (12)
        difference in pressure between chamber A and B is 76.24 kN/m^2 .

Oil

B

190mm 190mm

45°

Water

A

450mm

290mm

C

D

Hg
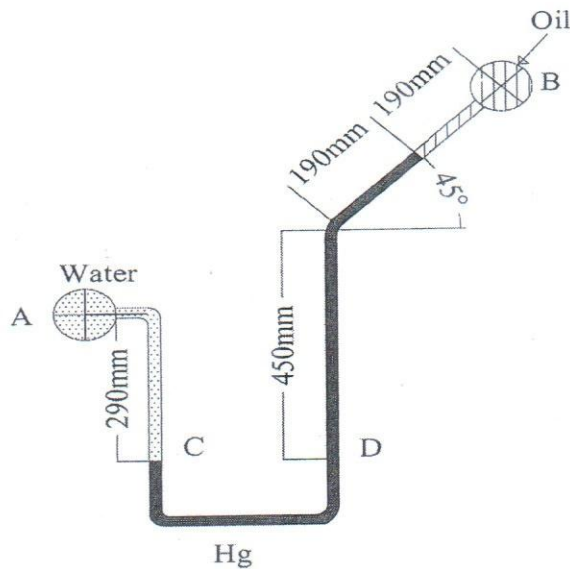
2. (b) A rectangular plate of 3.5 m long and 2.5 m wide is immersed in water in such a way that (13) its plane makes an angle of 45^0 with the free surface of water. If the upper edge of the plate is 1.5m below the free water surface, find the magnitude and location of resultant force acting on the plate.

3. (a) Find the resultant force acting on circular gate AB shown in the following figure. Consider (11) unit depth of the gate.

2m

Water

B

2m

A
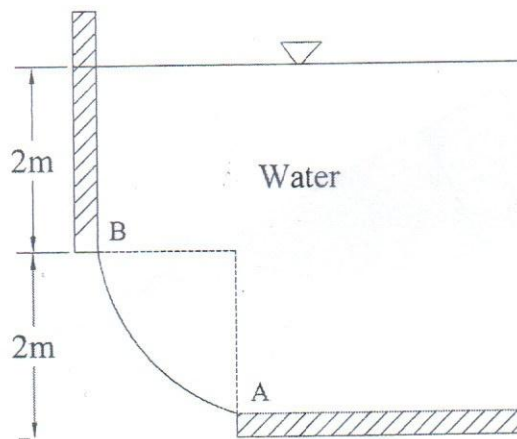
(b) The velocity vector in an incompressible flow is given by (14)

$$\overline{V} = (5xt + yz^2)\overline{i} + (2t + xy^2)\overline{j} + (xy\text{-}2xyz\text{-}5tz)\overline{k}$$

Find the acceleration vector at point P(1,2,3) at t=1.0

4. (a) Define the following terms: Steady flow and Unsteady flow, Uniform flow and Varied (10) flow, Newtonian and Non-Newtonian fluid, Laminar flow and Turbulent flow, Stream line.

(b) Water is flowing through a pipe 10 cm in diameter with an average velocity of 10 m/s. (07) Compute the discharge in liters/sec. Also, determine the velocity at the other end of the pipe, if the diameter of the pipe is gradually changed to 20 cm.

(c) The capillary rise of water in a glass tube ($\theta = 0^0$) is 0.5 mm. Find the diameter of tube if the (08) surface tension of water in contact with air is 0.0728 N/m

Table 1: Values of absolute roughness e for pipes (For question 1(b))

Pipe	Feet	Millimeters
Riveted steel	0.003–0.03	0.9–9.0
Concrete	0.001–0.01	0.3–3.0
Wood stave	0.0006–0.003	0.18–0.9
Cast iron	0.00085	0.26
Galvanized iron	0.0005	0.15
Commercial steel or wrought iron	0.00015	0.045
Drawn tubing	0.000005	0.0015
Plastic, glass	0.0 (smooth)	0.0 (smooth)

Figure 1: Friction factor for pipes (Moody diagram)
*Note: Use the chart for question 1(c). This figure must be attached along with the answer script.

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B. Sc. Engg. (CEE)/ 5th Sem.
(Afternoon)

05 March, 2019

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

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO.   : CEE 4511   TIME   : 1.5 Hours
COURSE TITLE: Design of Reinforced Concrete Structures I   FULL MARKS: 75

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

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1 (a) Refer to the following 16 inch by 22 inch column section. Stress-strain curves   20
of steel and concrete are attached. Given: $f_c' = 3000\ psi, f_y = 40,000\ psi$.
Assume: Tensile strength of concrete = $6.5\sqrt{f_c'}$.

Compute the followings:

(i)   Transformed sectional area of the column,
(ii)   Applied compressive load in column at strain level of 0.0003,
(iii)   Working load that can be applied on the column (strain = 0.0005),
(iv)   Compressive load in column at strain level of 0.001,
(v)   Ultimate load (in compression),
(vi)   Make comments on results (iii), (iv) and (v)
(vii)   Cracking load of the column under tension,
(viii) Ultimate load of the column under tension.

Assume fast rate of loading in calculation.

16 inch

22 inch

5 inch by 10 inch hole at center of the section
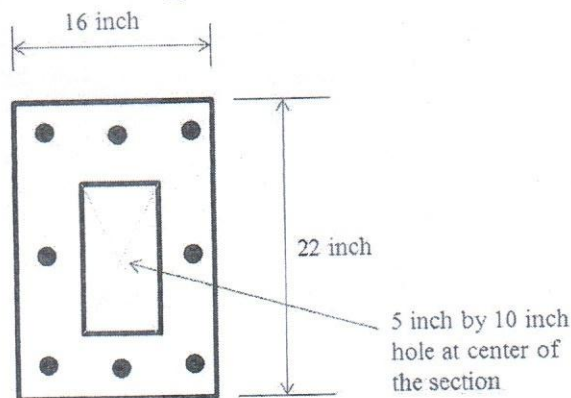
Bars : 8 - #9 bars

(b) Explain the reasons for using steel bars as reinforcement in concrete.   5

1

2(a) Draw the strain and stress variation across the section of a beam due to the   5
      pure flexure for the following conditions:

      (i)   Elastic stress-strain behavior, very low strain level, tensile stress of
              concrete is less than the tensile strength of concrete
      (ii)   Tensile stress is higher than the tensile strength of concrete, elastic
              stress-strain behavior
      (iii)   Tensile stress is higher than the tensile strength of concrete,
              inelastic stress-strain behavior of concrete, stress in steel is less
              than the yield strength of steel

  (b) The cross-section of a reinforced concrete beam is given below. Determine the   20
      following:
      (i)   Cracking moment of the section,
      (ii)   Minimum amount of UDLL to produce crack.
      (iii)   Determine the maximum compressive stress in concrete and stress in
              steel at this condition.

Uniformly Distributed Live Load (UDLL)

Span =25 ft

30 inch

3 inch

4 - #9 bars

16 inch
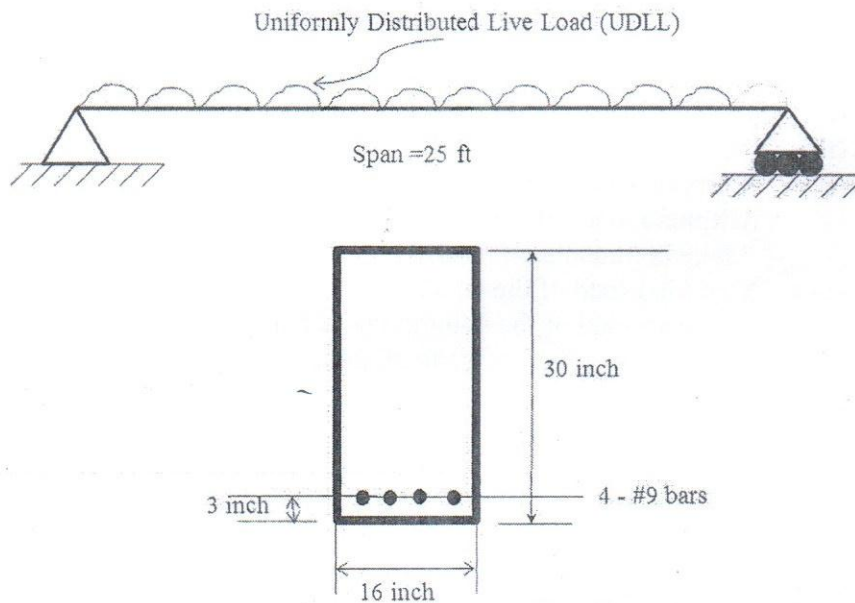
Use f'$_c$ = 4000 psi, f$_t$ = 410 psi, f$_y$ = 60,000 psi, Υ_{con}=150 lb/ft^3

3(a)   "Failure of a beam initiating by yielding of tension steel is preferable to failure   5
       of a beam initiating by crushing of concrete" Explain briefly.

  (b) Refer to the following beam section. Calculate the nominal moment capacity   20
       (ultimate moment capacity) of the beam section using (i) general non-linear
       stress distribution in compression zone of concrete, and (ii) Whitney's
       rectangular stress distribution in compression zone of concrete. Make
       comments on the results.

Use f'$_c$ = 4000 psi, f$_y$=60,000 psi, E$_s$ = 29,000,000 psi.

30 inch

3 inch

4 - #9 bars

16 inch

Section
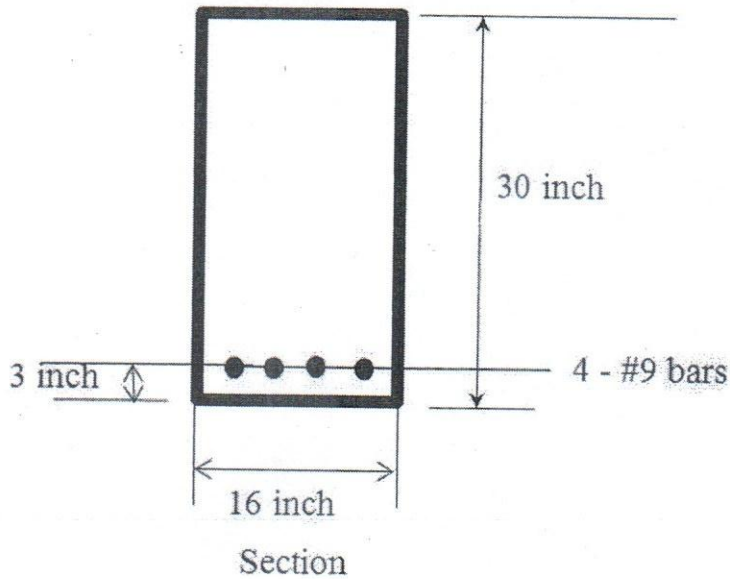
4   Design the following simply supported beam by WSD and USD. Make a brief   25
discussion on the results.

DL=1 k/ft (excluding self weight); LL= 1.5 k/ft

20 ft
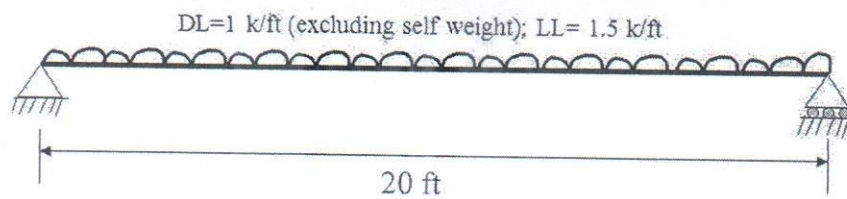
Width of the beam = *12 inch* (architectural requirement)
f$_y$ = 60,000 psi
f$_s$ = 24,000 psi
f'$_c$ = 4,000 psi

Steel stress f_s, ksi — Concrete stress f_c, ksi vs. Steel and concrete strain, ε_s and ε_c

a, steel
b, concrete, fast rate of loading
c, concrete, slow rate of loading
d, concrete, average elastic behavior

α, β vs. f_c', psi (MPa)

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

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO.   : CEE 4563   TIME   : 1.5 Hours
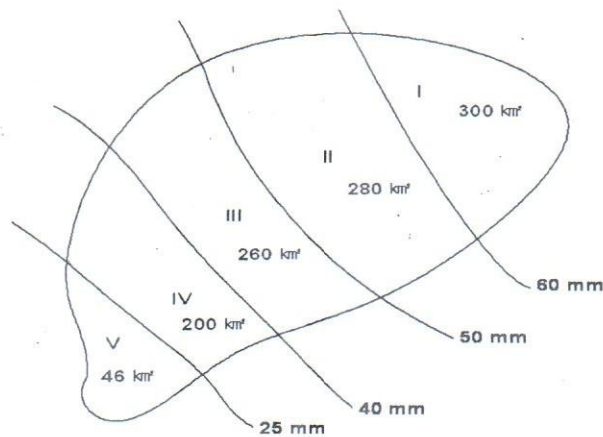COURSE TITLE: Hydrology   FULL MARKS: 75

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

1. (a) Explain with figures the difference between hyetograph and mass curve.   (03)

    (b) What are the advantages and disadvantages of rainfall measurement by radar?   (03)

    (c) Explain with figures the difference between convective and orographic rainfall.   (03)

    (d) What is the difference between infiltration and percolation? What is seepage?   (03)

    (e) The annual rainfall at Nilganj and average annual rainfall of 4 surrounding stations are   (13)
         given in the following table. Check the consistency of data and make necessary
         corrections if necessary.

Year	Annual rainfall of Nilganj (mm)	Average annual rainfall of 4 stations (mm)
1983	95	142
1984	112	123
1985	88	142
1986	68	92
1987	111	131
1988	86	93
1989	97	99
1990	112	112
1991	190	142
1992	126	111
1993	108	107
1994	127	108
1995	172	119

2. (a) What is artificial rainfall and what are its limitations?   (03)

    (b) What is the difference between drizzle and rain?   (03)

    (c) Explain with figures the difference between DAD curve and IDF curve.   (03)

    (d) A 6-hr storm in a basin with rainfall intensities of 7, 18, 25, 12, 10 and 3 mm/hr in   (06)
         successive hours resulted in a total runoff of 33 mm. Determine the Φ index.

    (e) The 24-hr isohyets for the 1086 km^2 watershed are shown in the figure. Develop a 24-hr   (10)
         DAD curve for the watershed.

3. (a) Why is Isohyetal method better than Thiessen polygon method for estimating average rainfall? (03)

(b) Why is infiltration low in a bare soil compared to vegetated soil? (03)

(c) How does air temperature affect the evaporation? (03)

(d) What is the difference between interception and transpiration? (03)

(e) The measured infiltration rates from a double ring infiltrometer are as shown in the following table. Determine the infiltration capacity (Horton's) equation. (13)

Time from the beginning of the experiment (min)	1	3.5	7.5	15	30	45	75	100	150
Infiltration rate (cm/hr)	8.8	7.9	6.5	4.7	2.8	1.8	1.1	1.0	1.0

4. (a) Explain with a figure how the infiltration capacity curve would change if the rainfall intensity is less than the infiltration capacity at the beginning of the storm. (03)

(b) What is pan coefficient and why is it necessary? (03)

(c) Explain with a figure the difference between hydrograph and rating curve. (03)

(d) Explain with a figure why velocity in a river is generally measured at 60% of depth. (03)

(e) Determine the discharge of Turag river from the following data. (13)

Distance from left bank (m)	Depth (d) of water (m)	Velocity (m/sec)		
		At 0.6d	At 0.2d	At 0.8d
0	0			
0.8	0.5	0.125		
1.6	1.0		0.262	0.183
2.4	1.6		0.255	0.200
3.0	2.0		0.268	0.221
3.6	2.0		0.270	0.216
4.2	1.8		0.267	0.208
5.0	1.2		0.260	0.194
5.8	0.6	0.143		
6.6	0	0		

B.Sc. Egg. (CEE)/ 2nd Sem.   4 March, 2019 (Afternoon)

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

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO.   : CEE 4563   TIME   : 1.5 Hours
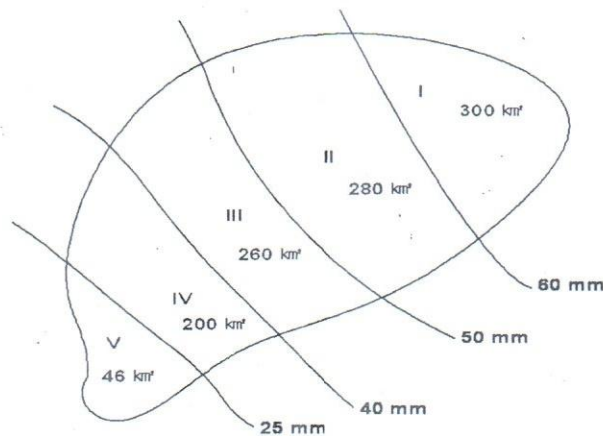COURSE TITLE: Hydrology   FULL MARKS: 75

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

1. (a) Explain with figures the difference between hyetograph and mass curve.   (03)

   (b) What are the advantages and disadvantages of rainfall measurement by radar?   (03)

   (c) Explain with figures the difference between convective and orographic rainfall.   (03)

   (d) What is the difference between infiltration and percolation? What is seepage?   (03)

   (e) The annual rainfall at Nilganj and average annual rainfall of 4 surrounding stations are (13)
        given in the following table. Check the consistency of data and make necessary
        corrections if necessary.

Year	Annual rainfall of Nilganj (mm)	Average annual rainfall of 4 stations (mm)
1983	95	142
1984	112	123
1985	88	142
1986	68	92
1987	111	131
1988	86	93
1989	97	99
1990	112	112
1991	190	142
1992	126	111
1993	108	107
1994	127	108
1995	172	119

2. (a) What is artificial rainfall and what are its limitations?   (03)

   (b) What is the difference between drizzle and rain?   (03)

   (c) Explain with figures the difference between DAD curve and IDF curve.   (03)

   (d) A 6-hr storm in a basin with rainfall intensities of 7, 18, 25, 12, 10 and 3 mm/hr in   (06)
        successive hours resulted in a total runoff of 33 mm. Determine the Φ index.

   (e) The 24-hr isohyets for the 1086 km^2 watershed are shown in the figure. Develop a 24-hr (10)
        DAD curve for the watershed.

3. (a) Why is Isohyetal method better than Thiessen polygon method for estimating average (03) rainfall?

(b) Why is infiltration low in a bare soil compared to vegetated soil? (03)

(c) How does air temperature affect the evaporation? (03)

(d) What is the difference between interception and transpiration? (03)

(e) The measured infiltration rates from a double ring infiltrometer are as shown in the (13) following table. Determine the infiltration capacity (Horton's) equation.

Time from the beginning of the experiment (min)	1	3.5	7.5	15	30	45	75	100	150
Infiltration rate (cm/hr)	8.8	7.9	6.5	4.7	2.8	1.8	1.1	1.0	1.0

4. (a) Explain with a figure how the infiltration capacity curve would change if the rainfall (03) intensity is less than the infiltration capacity at the beginning of the storm.

(b) What is pan coefficient and why is it necessary? (03)

(c) Explain with a figure the difference between hydrograph and rating curve. (03)

(d) Explain with a figure why velocity in a river is generally measured at 60% of depth. (03)

(e) Determine the discharge of Turag river from the following data. (13)

Distance from left bank (m)	Depth (d) of water (m)	Velocity (m/sec)		
		At 0.6d	At 0.2d	At 0.8d
0	0			
0.8	0.5	0.125		
1.6	1.0		0.262	0.183
2.4	1.6		0.255	0.200
3.0	2.0		0.268	0.221
3.6	2.0		0.270	0.216
4.2	1.8		0.267	0.208
5.0	1.2		0.260	0.194
5.8	0.6	0.143		
6.6	0	0		

B.Sc. Engg. (CEE)/ 5th Sem.   **11 March, 2019 (Afternoon)**
ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-19
COURSE NO.   : CEE 4565   TIME   : 1.5 Hours
COURSE TITLE: Open Channel Flow   FULL MARKS: 75

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

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1 (a) List the forces that must be considered in analysis of flow in a trapezoidal   (07)
channel with a slope of 0.006. Identify the location where each force acts, and
its direction. Which forces can be ignored, if the flow is uniform and why can
they be ignored?

(b) For a constant specific energy of 1.8 N.m/N, calculate the maximum discharge   (04)
that may occur in a rectangular channel of 5.0 m wide.

(c) Water is flowing through a sluice gate as shown below. Assuming hydrostatic   (10)
pressure distribution and neglecting the frictional force on the bed, show that
the force F acting on the sluice gate is given by

$$F = \frac{1}{2}\gamma \frac{(y_1 - y_2)^3}{(y_1 + y_2)}$$
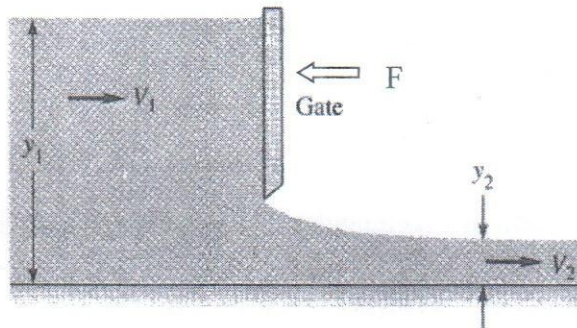
(d) When considering open channel flow, what is the difference between the normal   (04)
depth and the critical depth?

2 (a) As shown in the figure, water flows at a rate of 14 cfs in a very long triangular   (05)
flume that has side slope 1:1. The flume is laid on a slope 0.006 and Manning's
n is 0.012. Is the flow is subcritical or supercritical?
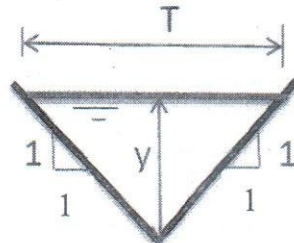
(b) The flow depth at a section in a long rectangular channel changes from 4 ft to 5   (04)
ft. Determine the percent change in the rate of discharge.

1

(c) A channel of trapezoidal section, 2m wide at the base with side sloping 45° to horizontal carries water at a rate of 6 m³/sec find: (06)
   (i) The depth for critical flow and
   (ii) What is the type of flow if the depth of water is 1m?

(d) Deduce the general expression for hydraulic exponent (N) for uniform flow computation based on Manning's formula. Show that the hydraulic exponents for uniform flow computation N for a wide and narrow rectangular channel are 3.33 and 2.0 respectively.   (10)

3 (a) An irrigation channel of trapezoidal section, having size slope 1.5:1 is to carry a flow of 10 cumec on a longitudinal slope of 1 in 5000. The channel is to be lined with materials for which n = 0.012. Find the dimensions of the most economic section of the channel.   (07)

(b) A trapezoidal channel having side slopes of 2H:IV, n = 0.02 and So = 0.0001 carries a discharge of 25 m³/sec at a normal depth of 2.0m. Compute the bottom width of the channel.   (07)

(c) Proved that for a given specific energy, the maximum discharge would occur when the flow condition is critical.   (05)

(d) Why velocity distribution coefficients are used in open channel flow problems? Show that for a channel with large slope, the pressure distribution is less than the hydrostatic pressure.   (06)

4 (a) The channel as shown below is planning to divide into two by placing the proposed barrier at the center. Determine percentage increase or decrease in flow by placing the proposed barrier.   (05)
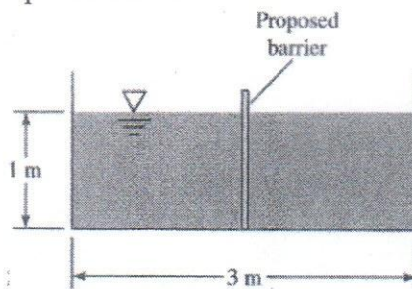
(b) The velocity distribution in a rectangular channel is represented by   (10)

$$\frac{v}{V_{max}} = \left(\frac{y}{y_0}\right)^{1/n}$$

Where n is an exponent. Show that $\alpha = \frac{(n+1)^3}{n^2(n+3)}; \quad \beta = \frac{(n+1)^2}{n(n+2)}$

(c) A broad-crested weir is built in a rectangular channel of width 1.0 m. The height of the weir crest above the channel bed is 0.60 m and the head over the weir is 0.40 m. Calculate the discharge considering the velocity of approach.   (05)

(d) A triangular channel with z =1, n = 0.025 and So = 0.0025 carries a discharge of 5.0 m³/sec. Compute the normal depth.   (05)

2

B.Sc. Engg. (CEE)/ 7th Sem.   March 12, 2019 (Morning)
### ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM   : Mid Semester Examination   WINTER SEMESTER: 2018-2019
COURSE NO.   : CEE 4703   TIME : 1.5 Hours
COURSE TITLE : GIS Application in Civil Engineering FULL MARKS: 75

There are 4 (Four) questions. Answer any 3 (Three) questions. This is an open book exam. Students are allowed to bring lecture notes in the exam hall. 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) Bangladesh government is going to provide free shelters for the homeless people in [20] Dhaka city again. It has been 10 years since the last time the services had been established. However, there are still structural barriers, (i.e. obstacles that prevent an eligible person from getting available benefits), such as where program locations and the atmosphere or environments of these offices and shelters. You have been appointed as a Geographic Information System (GIS) analyst to find out the location of the homeless in relation to where housing and service providers are located. The objective is to place the resources where it is needed. Using GIS software, how can you solve this problem?

   (b) Why buffer zones are used in GIS? Give an example when a buffer zone could be [5] used?

2. (a) Using your imagination, make a map of Islamic University of Technology (IUT) and [20] represent it using a vector model and a raster model.

   (b) GIS has been able to answer a lot of complex questions which assisted for the [5] development of the civilization. However, there are some questions that GIS is not particularly good at answering. What are those questions?

3. (a) In the following figure, find the shortest path from node A to every other vertex using [15] Dijkstra's Shortest Path Algorithm.
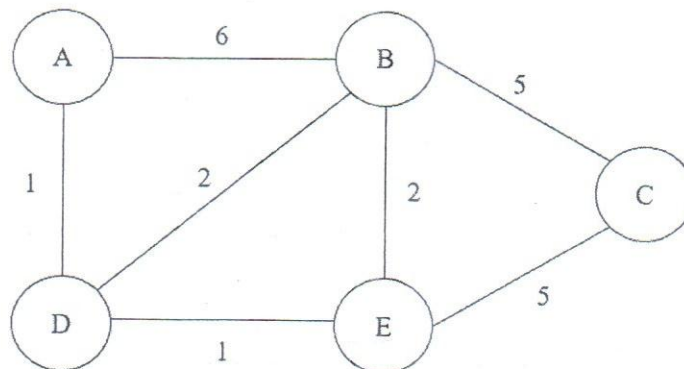
(b) Explain with figures, the three different types of vector data structures. [10]

4. (a) The following map shows the restaurants, clothing shops, hospitals and diagnostic [15] centres around 'Indira Gandhi Cultural Centre' (marked with a red rectangle), Bangladesh. A raster/matrix/grid with a fixed cell size is placed over the area for raster model. If you are asked to choose the closest restaurant from 'Indira Gandhi Cultural Centre', which one would you choose and why?
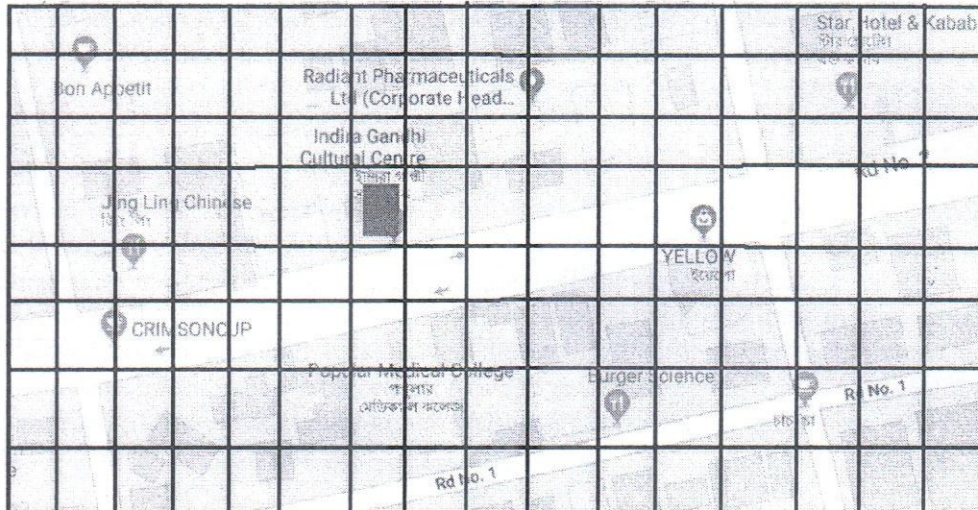
(b) What are the different Symbology methods available in ESRI's ArcGIS? What are [10] the applications of SQL expressions in ArcGIS?

B.Sc. Egg. (CEE)/7th Sem. **04 March 2019 (Morning)**

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

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO. : CEE 4711   TIME : 1.5 Hours
COURSE TITLE: STRUCTURAL ANALYSIS AND DESIGN II   FULL MARKS: 75

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

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1. Analyze the following beam using Moment Distribution Method. Draw bending moment (25) diagram. EI is constant.
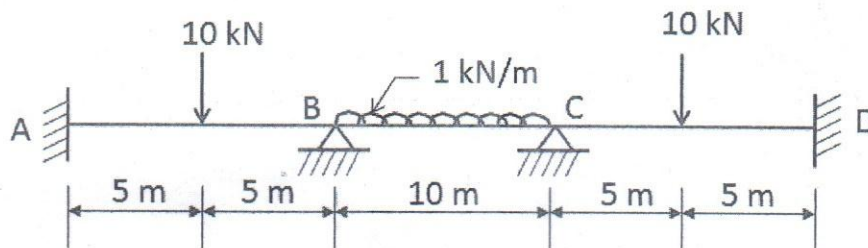
2. Analyze the following frame by Moment Distribution Method. Draw bending moment (25) diagram. Given: $I_1 = 5760$ mm^4, $I_2 = 7200$ mm^4, $I_3 = 9600$ mm^4, $I_4 = 4320$ mm^4, and E is constant.
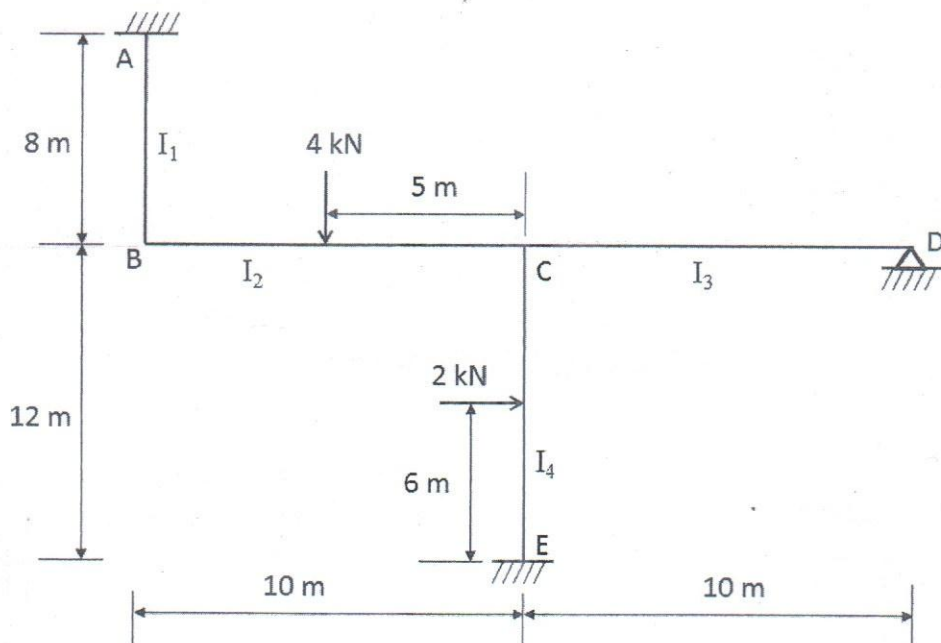
3. (a) Draw qualitative influence lines of the following beam for　(12)
　　(i)　　reactions at supports *A* and *B*,
　　(ii)　　shear and moment at '*a*',
　　(iii)　　shear and moment at '*b*'.
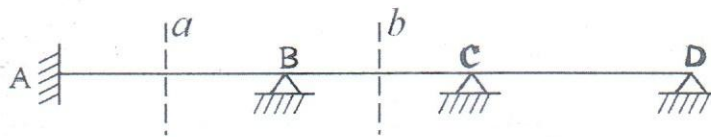
(b) Compute the ordinates, at intervals of 2.5 m, of the influence line for reaction at *C* of the　(13)
following beam. *EI* is constant.
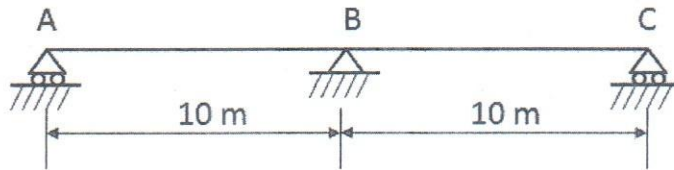
4. (a) Compute the ordinates, at intervals of 2 m, of the influence line for moment at the midpoint　(12)
of span AB for the beam shown in the following figure. *EI* is constant.
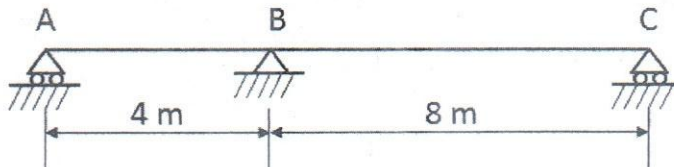
(b) Compute the ordinates, at intervals of 2 m, of the influence line for shear at the midpoint of　(13)
span BC for the beam shown in the following figure. *EI* is constant.
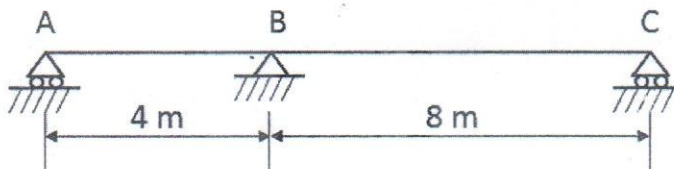
Given Fixed-End Moments
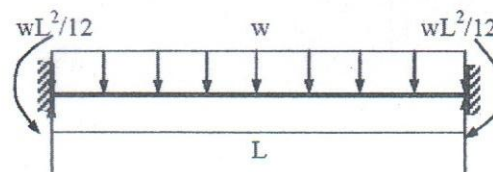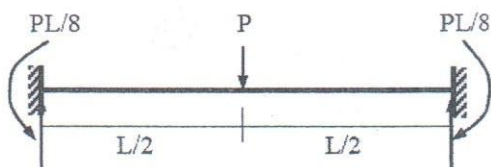
B.Sc. Engg. (CEE)/ 7th Sem.   March 8, 2019 (Morning)

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

Semester: Mid Semester Examination   Winter Semester: 2018-2019
Course No.: CEE 4733   Full Marks: 75
Course Title: Industrial Wastewater 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. Assume reasonable data if needed.

1(a) You are asked to characterize wastewater that generates from a paper and pulp industry. What (05)
      parameters do you need to address for suggesting any treatment plant?

(b)   What are the options available for the secondary treatment of industrial wastewater? (05)

(c)   The pulp and paper industry generates 20lps wastewater that has an average BOD of 250 mg/l. (05)
      The authority wants to establish a small unit that will treat wastewater biologically in a batch
      system. Suggest an appropriate treatment facility with proper justification.

(d)   How do you determine sludge characteristics in activated sludge process? Determine sludge (10)
      quality index (in ml/g) using following values-

| Time (min)	0	5	10	20	40	60	80
Sludge volume (ml/l)	1000	800	720	650	430	350	200

Given, total solid= 5000 mg/l, Total dissolved solid= 1000mg/l.

2(a) Write short notes on-   (3+4)

      I.   Wasting

      II. Significance of low F/M ratio

(b)   Find the terminal velocity of a spherical discrete particle with diameter of 0.75mm and specific (8)
      gravity of 2.5 settling through water at 25°C. Use figure 1 for answering this question.

(c)   How much oxygen per unit cell is consumed by the microorganism during aerobic oxidation (10)
      process? Establish the relationship from stoichiometry.

3(a) Name three oxidizing agents that can be used in WWTP?   (03)

(b)   A new effluent treatment plant (ETP) needs to be constructed for EOS textile group. The (04)
      authority asked for a typical flow diagram for their unit system. You are considering a
      completely mixed activated sludge process for secondary treatment of wastewater. Draw a
      typical diagram showing all the units with provision of wasting from aeration tank.

(c)   A textile industry discharges its effluent to Tista River after treating through an activated-sludge (18)
      process (completely mixed) that receives 220 lps in the system. After primary clarification, the
      BOD has been found 250 mg/ L and the effluent BOD has been limited to 10 mg/L. Consider,
      wasting is collected from sludge return line. Plant analysis has established the following kinetic

values $Y = 0.5 \cdot kg/kg$, $kd = 0.045 \; d^{-1}$. Assuming an MLSS concentration of 5000 mg/L and an underflow concentration of 10,000 mg/L from the secondary clarifier, determine

    I.   the volume of the reactor
    II.   Substrate utilization rate
    III.   the mass and volume of solids that must be wasted each day
    IV.   the recycle ratio
    V.   Is the reactor efficient? Comments on the result

4(a)   Define hinder settling and solid flux.   (05)

(b)   You are working as an environmental consultant for RCO tannery group. The existing treatment   (4+4)
plant has a grit chamber, primary and secondary treatment units. What type of settling would
you expect in these units? Explain with proper sketch.

(c)   Compute the removal efficiency of the basin when Q = 1.5 cfs and A = 360 ft². Assume ideal   (12)
settling. The settling characteristics of a suspension at 2 ft depth are as follows:

Time (min)	Suspended solids (mg/l)
0	300
5	210
10	156
20	90
40	50
60	40
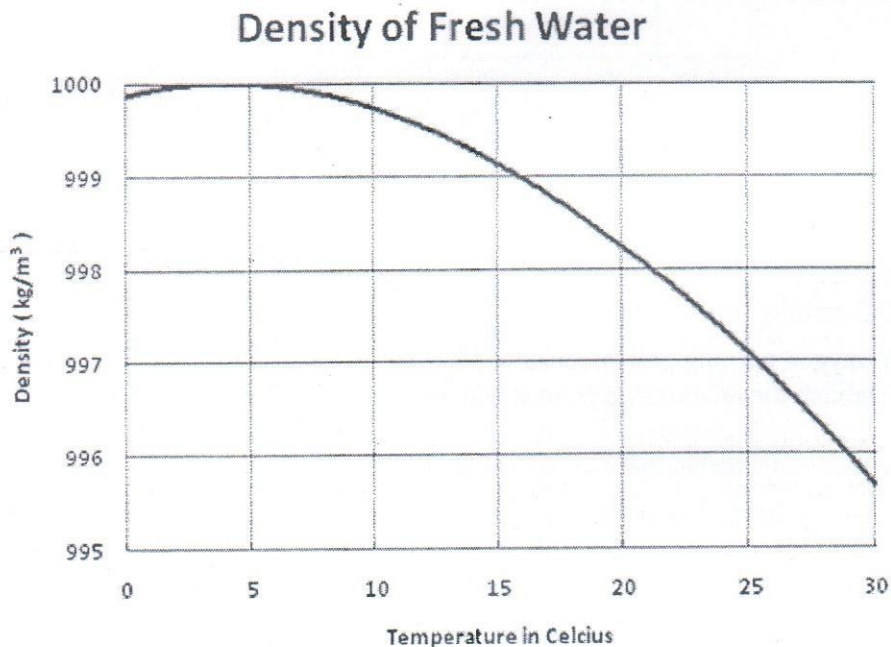
Figure 1: Density of freshwater at standard atmospheric pressure (for question 2b)

B.Sc. Engg (CSE) 7th Semester   **05 March 2019 (Afternoon)**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION   **WINTER SEMESTER, 2018-2019**
DURATION: 1 Hour 30 Minutes   **FULL MARKS: 75**

Math 4741: Mathematical Analysis

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **4 (four)** questions. Answer any **3 (three)** of them.
Figures in the right margin indicate marks.

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1. a) In a sequence of independent flips of a biased coin(probability of a head is .6), let N denote the   6+4
    number of flips until there is a run of three consecutive heads. Find
         i. $P(N \le 8)$
         ii. $P(N = 8)$

    b) Define the following terms: 1.5x4
         i.   Accessible
         ii.   Communicate
         iii.   Transient State
         iv.   Recurrent State

    c) Let the Markov chain consisting of the states 0, 1, 2, 3 have the transition probability matrix: 4

    $$P = \begin{Vmatrix} 0 & 0 & \frac{1}{2} & \frac{1}{2} \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{Vmatrix}$$

    Determine which states are transient and which are recurrent.

    d) Let the Markov chain consisting of the states 0, 1, 2, 3, 4 have the transition probability matrix: 5

    $$P = \begin{Vmatrix} \frac{1}{2} & \frac{1}{2} & 0 & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} & 0 \\ \frac{1}{4} & \frac{1}{4} & 0 & 0 & \frac{1}{2} \end{Vmatrix}$$

    Determine which states are transient and which are recurrent.

2. For a given Bonus Malus system, let $s_i(k)$ denote the next state of a policyholder who was in
    state i in the previous year and who made a total of k claims in that year. If we suppose that the
    number of yearly claims made by a particular policyholder is a Poisson random variable with
    parameter λ, then the successive states of this policyholder will constitute a Markov chain with
    transition probabilities

    $$P_{i,j} = \sum_{k:s_i(k)=j} e^{-\lambda}\frac{\lambda^k}{k!}, \quad j \geqslant 0$$

Consider Table 1, which specifies a hypothetical Bonus Malus system having four states.

Table 1

State	Annual Premium	Next state if			
		0 claim	1 claim	2 claims	≥ 3 claims
1	200	1	2	3	4
2	250	1	3	4	4
3	400	2	4	4	4
4	600	3	4	4	4

Thus, for instance, the table indicates that $s_2(0) = 1$; $s_2(1) = 3$; $s_2(k) = 4$, $k \geq 2$. Consider a policyholder whose annual number of claims is a Poisson random variable with parameter λ. If a_k is the probability that such a policyholder makes k claims in a year, then

$$a_k = e^{-\lambda} \frac{\lambda^k}{k!}, \quad k \geq 0$$

Considering $\lambda = .5$ determine the following:

a) Determine the transition matrix.   10
b) Draw the transition diagram.   5
c) If the process runs for a long time, determine the long term proportions of all of the states.   10

3.   Assume a football game of penalty shootout where goals are scored with $\lambda = .6$/min. You will play the game for at least two minutes and if there is a goal scored within this interval, you will stop playing after two minutes. Otherwise, you will continue until there is at least a goal scored (no matter how long it takes past the first two minutes). Answer the following based on this scenario:

a) P(play for more than two minutes)   5
b) P(play for more than two minutes and less than five minutes)   5
c) P(scoring at least two goals)   5
d) E[number of fish]   5
e) E[total fishing time]   5

4. a) State the differences between Bernoulli process and Poisson process.   5
b) There are four light bulbs burning with Poisson rate $\lambda_1, \lambda_2, \lambda_3, \lambda_4$. What is the expected time until the last light bulb burns out? Show necessary calculation with proper explanation.   8
c) Consider, two different color light bulbs are blinking with Poisson rate λ_1 and λ_2 respectively. A colorblind person observes the experiment and tells you that the blink came from the bulb with λ_1 rate. What is the probability that he is right? Show justification for your answer.   7
d) "An average family size is four and an average person comes from a family size of six" – is the quote contradictory? Show justification for your answer.   5

B.Sc. Engg. (CEE), 7th Sem.   March 5, 2019(Morning)

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

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

There are **4 (four)** questions. Answer **any 3 (three)** of them (**Question Number 1 is Mandatory**). All questions carry equal marks. Marks in the margin indicate full marks. Programmable calculators are not allowed. Do not write on this question paper.

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1. a) Fahim is your friend who wants to know the particular rules for describing the Debit   3
        and Credit procedure of three different types of accounts. What will be your
        explanation?

    b) What is the relation between a "Business Event" and a "Business Transaction"?   2
        Explain with example.

    c) On June 1, Jennifer Farrin started Sparkle Creations Co., a company that provides   14
        craft opportunities, by investing $15,200 cash in the business. Following are the
        assets and liabilities of the company at June 30 and the revenues and expenses for the
        month of June.

Cash	$13,750
Equipment	10,000
Accounts Receivable	3,000
Craft Supplies	2,000
Accounts Payable	1,200
Notes Payable	9,000
Service Revenue	7,000
Supplies Expense	1,600
Gas and Oil Expense	200
Advertising Expense	400
Utilities Expense	150

   Jennifer made no additional investment in June, but withdrew $1,300 in cash for
   personal use during the month.

   Required:
   Prepare an **Income Statement** and **Owner's Equity Statement** for the month of
   June and a **Balance Sheet** at June 30, 2018.

    d) Konerko Enterprises had the following events for the month March 2018:   6
        March 1: Borrowed $5,000 from the bank by signing a note.
        March 8: Performed services on account $5,200.
        March 15: Hired a Receptionist at a salary of $1,000 per month.
        March 22: Received $500 cash advance for services that are expected to be

completed by May 31.

March 25: Purchased Supplies on account for $1,200.

March 28: Paid $1,800 cash for a one-year insurance policy on the furniture and equipment.

Required:

Journalize the above transactions of Konerko Enterprises for the month March 2018.

2. a) What is Engineering Economy? State the seven principles of Engineering Economy.   5

   b) What is Islamic Banking and how does it work? Explain the Islamic banking principles with examples.   7

   c) Determine the present worth of a geometric gradient series with a cash flow of $50,000 in year 1 and increases of 6% each year through year 8. The interest rate is 10% per year.   5

   d) A low-cost noncontact temperature measuring tool may be able to identify railroad car wheels that are in need of repair long before a costly structural failure occurs. If BNF Railroad saves $100,000 in years 1 through 5, $110,000 in year 6, and constant amounts increasing by $10,000 each year through year 20, what is the equivalent annual worth over the 20 years of the savings? The interest rate is 10% per year.   8

3. a) Accurate airflow measurement requires straight unobstructed pipe for a minimum of 10 diameters upstream and 5 diameters downstream of the measuring device. In a field application, physical constraints compromise the pipe layout, so the engineer is considering installing the airflow probes in an elbow, knowing that flow measurement will be less accurate but good enough for process control. This is plan 1, which will be in place for only 3 years, after which a more accurate flow measurement system with the same costs as plan 1 will be available. This plan will have a first cost of $26,000 with an annual maintenance cost estimated at $5000.   10

   Plan 2 involves installation of a recently designed submersible airflow probe. The stainless steel probe can be installed in a drop pipe with the transmitter located in a waterproof enclosure on the handrail. The first cost of this system is $83,000, but because it is accurate and more durable, it will not have to be replaced for at least 6 years. Its maintenance cost is estimated to be $1400 per year plus $2500 in year 3 for replacement of signal processing software. Neither system will have a salvage value. At an interest rate of 10% per year, which one should be selected on the basis of a present worth comparison?

   b) Applications of green, lean manufacturing techniques coupled with value stream mapping can make large financial differences over future years while placing greater emphasis on environmental factors. Engineers with Monarch Paints have recommended to management an investment of $200,000 now in novel methods that will reduce the amount of wastewater, packaging materials, and other solid waste in their consumer paint manufacturing facility. Estimated savings are $15,000 per year for each of the next 10 years and an additional savings of $300,000 at the end of 10 years in facility and equipment upgrade costs. Determine the rate of return using hand.   8

   c) Environmental Recovery Company RexChem Partners plans to finance a site reclamation project that will require a 4-year cleanup period. The company plans to borrow $3.6 million now. How much will the company have to get in a lump-sum payment when the project is over in order to earn 24% per year, compounded quarterly, on its investment?   7

4. a) Describe the following terms   5
        I.   MARR
       II.   Rule of 72
      III. Discounting
      IV. P2P Banking
       V.   Payback Period

b) Handheld fiber-optic meters with white light polarization interferometry are useful   6
for measuring temperature, pressure, and strain in electrically noisy environments.
The fixed costs associated with manufacturing are $800,000 per year. If a base unit
sells for $2950 and its variable cost is $2075, (a) how many units must be sold each
year for breakeven and (b) what will the profit be for sales of 3000 units per year?

c) Julian Browne, owner of Clear Interior Environments, purchased an air scrubber,   7
HEPA vacuum, and other equipment for mold removal for $15,000 eight months ago.
Net cash flows were $−2000 for each of the first 2 months, followed by $1000 per
month for months 3 and 4. For the last 4 months, a contract generated a net $6000 per
month. Julian sold the equipment yesterday for $3000 to a friend. Determine the
nominal 18%-per-year payback period.

d) The offshore design group at Bechtel just purchased upgraded CAD software for   7
$5000 now and annual payments of $500 per year for 6 years starting 3 years from
now for annual upgrades. What is the present worth if the interest rate is 10% per
year?

Compound Interest Factor Tables
Interest rate 6%

	Single Payments		Uniform Series Payments				Arithmetic Gradients	
n	Compound Amount F/P	Present Worth P/F	Sinking Fund A/F	Compound Amount F/A	Capital Recovery A/P	Present Worth P/A	Gradient Present Worth P/G	Gradient Uniform Series A/G
1	1.0600	0.9434	1.00000	1.0000	1.06000	0.9434		
2	1.1236	0.8900	0.48544	2.0600	0.54544	1.8334	0.8900	0.4854
3	1.1910	0.8396	0.31411	3.1836	0.37411	2.6730	2.5692	0.9612
4	1.2625	0.7921	0.22859	4.3746	0.28859	3.4651	4.9455	1.4272
5	1.3382	0.7473	0.17740	5.6371	0.23740	4.2124	7.9345	1.8836
6	1.4185	0.7050	0.14336	6.9753	0.20336	4.9173	11.4594	2.3304
7	1.5036	0.6651	0.11914	8.3938	0.17914	5.5824	15.4497	2.7676
8	1.5938	0.6274	0.10104	9.8975	0.16104	6.2098	19.8416	3.1952
9	1.6895	0.5919	0.08702	11.4913	0.14702	6.8017	24.5768	3.6133
10	1.7908	0.5584	0.07587	13.1808	0.13587	7.3601	29.6023	4.0220
11	1.8983	0.5268	0.06679	14.9716	0.12679	7.8869	34.8702	4.4213
12	2.0122	0.4970	0.05928	16.8699	0.11928	8.3838	40.3369	4.8113
13	2.1329	0.4688	0.05296	18.8821	0.11296	8.8527	45.9629	5.1920
14	2.2609	0.4423	0.04758	21.0151	0.10758	9.2950	51.7128	5.5635
15	2.3966	0.4173	0.04296	23.2760	0.10296	9.7122	57.5546	5.9260
16	2.5404	0.3936	0.03895	25.6725	0.09895	10.1059	63.4592	6.2794
17	2.6928	0.3714	0.03544	28.2129	0.09544	10.4773	69.4011	6.6240
18	2.8543	0.3503	0.03236	30.9057	0.09236	10.8276	75.3569	6.9597
19	3.0256	0.3305	0.02962	33.7600	0.08962	11.1581	81.3062	7.2867
20	3.2071	0.3118	0.02718	36.7856	0.08718	11.4699	87.2304	7.6051

Interest rate 8%

	Single Payments		Uniform Series Payments				Arithmetic Gradients	
n	Compound Amount F/P	Present Worth P/F	Sinking Fund A/F	Compound Amount F/A	Capital Recovery A/P	Present Worth P/A	Gradient Present Worth P/G	Gradient Uniform Series A/G
1	1.0800	0.9259	1.00000	1.0000	1.08000	0.9259		
2	1.1664	0.8573	0.48077	2.0800	0.56077	1.7833	0.8573	0.4808
3	1.2597	0.7938	0.30803	3.2464	0.38803	2.5771	2.4450	0.9487
4	1.3605	0.7350	0.22192	4.5061	0.30192	3.3121	4.6501	1.4040
5	1.4693	0.6806	0.17046	5.8666	0.25046	3.9927	7.3724	1.8465
6	1.5869	0.6302	0.13632	7.3359	0.21632	4.6229	10.5233	2.2763
7	1.7138	0.5835	0.11207	8.9228	0.19207	5.2064	14.0242	2.6937
8	1.8509	0.5403	0.09401	10.6366	0.17401	5.7466	17.8061	3.0985
9	1.9990	0.5002	0.08008	12.4876	0.16008	6.2469	21.8081	3.4910
10	2.1589	0.4632	0.06903	14.4866	0.14903	6.7101	25.9768	3.8713
11	2.3316	0.4289	0.06008	16.6455	0.14008	7.1390	30.2657	4.2395
12	2.5182	0.3971	0.05270	18.9771	0.13270	7.5361	34.6339	4.5957
13	2.7196	0.3677	0.04652	21.4953	0.12652	7.9038	39.0463	4.9402
14	2.9372	0.3405	0.04130	24.2149	0.12130	8.2442	43.4723	5.2731
15	3.1722	0.3152	0.03683	27.1521	0.11683	8.5595	47.8857	5.5945
16	3.4259	0.2919	0.03298	30.3243	0.11298	8.8514	52.2640	5.9046
17	3.7000	0.2703	0.02963	33.7502	0.10963	9.1216	56.5883	6.2037
18	3.9960	0.2502	0.02670	37.4502	0.10670	9.3719	60.8426	6.4920
19	4.3157	0.2317	0.02413	41.4463	0.10413	9.6036	65.0134	6.7697
20	4.6610	0.2145	0.02185	45.7620	0.10185	9.8181	69.0898	7.0369

Interest rate 10%

n	Single Payments		Uniform Series Payments				Arithmetic Gradients	
	Compound Amount F/P	Present Worth P/F	Sinking Fund A/F	Compound Amount F/A	Capital Recovery A/P	Present Worth P/A	Gradient Present Worth P/G	Gradient Uniform Series A/G
1	1.1000	0.9091	1.00000	1.0000	1.10000	0.9091		
2	1.2100	0.8264	0.47619	2.1000	0.57619	1.7355	0.8264	0.4762
3	1.3310	0.7513	0.30211	3.3100	0.40211	2.4869	2.3291	0.9366
4	1.4641	0.6830	0.21547	4.6410	0.31547	3.1699	4.3781	1.3812
5	1.6105	0.6209	0.16380	6.1051	0.26380	3.7908	6.8618	1.8101
6	1.7716	0.5645	0.12961	7.7156	0.22961	4.3553	9.6842	2.2236
7	1.9487	0.5132	0.10541	9.4872	0.20541	4.8684	12.7631	2.6216
8	2.1436	0.4665	0.08744	11.4359	0.18744	5.3349	16.0287	3.0045
9	2.3579	0.4241	0.07364	13.5795	0.17364	5.7590	19.4215	3.3724
10	2.5937	0.3855	0.06275	15.9374	0.16275	6.1446	22.8913	3.7255
11	2.8531	0.3505	0.05396	18.5312	0.15396	6.4951	26.3963	4.0641
12	3.1384	0.3186	0.04676	21.3843	0.14676	6.8137	29.9012	4.3884
13	3.4523	0.2897	0.04078	24.5227	0.14078	7.1034	33.3772	4.6988
14	3.7975	0.2633	0.03575	27.9750	0.13575	7.3667	36.8005	4.9955
15	4.1772	0.2394	0.03147	31.7725	0.13147	7.6061	40.1520	5.2789
16	4.5950	0.2176	0.02782	35.9497	0.12782	7.8237	43.4164	5.5493
17	5.0545	0.1978	0.02466	40.5447	0.12466	8.0216	46.5819	5.8071
18	5.5599	0.1799	0.02193	45.5992	0.12193	8.2014	49.6395	6.0526
19	6.1159	0.1635	0.01955	51.1591	0.11955	8.3649	52.5827	6.2861
20	6.7275	0.1486	0.01746	57.2750	0.11746	8.5136	55.4069	6.5081

Interest rate 18%

n	Single Payments		Uniform Series Payments				Arithmetic Gradients	
	Compound Amount F/P	Present Worth P/F	Sinking Fund A/F	Compound Amount F/A	Capital Recovery A/P	Present Worth P/A	Gradient Present Worth P/G	Gradient Uniform Series A/G
1	1.1800	0.8475	1.00000	1.0000	1.18000	0.8475		
2	1.3924	0.7182	0.45872	2.1800	0.63872	1.5656	0.7182	0.4587
3	1.6430	0.6086	0.27992	3.5724	0.45992	2.1743	1.9354	0.8902
4	1.9388	0.5158	0.19174	5.2154	0.37174	2.6901	3.4828	1.2947
5	2.2878	0.4371	0.13978	7.1542	0.31978	3.1272	5.2312	1.6728
6	2.6996	0.3704	0.10591	9.4420	0.28591	3.4976	7.0834	2.0252
7	3.1855	0.3139	0.08236	12.1415	0.26236	3.8115	8.9670	2.3526
8	3.7589	0.2660	0.06524	15.3270	0.24524	4.0776	10.8292	2.6558
9	4.4355	0.2255	0.05239	19.0859	0.23239	4.3030	12.6329	2.9358
10	5.2338	0.1911	0.04251	23.5213	0.22251	4.4941	14.3525	3.1936
11	6.1759	0.1619	0.03478	28.7551	0.21478	4.6560	15.9716	3.4303
12	7.2876	0.1372	0.02863	34.9311	0.20863	4.7932	17.4811	3.6470
13	8.5994	0.1163	0.02369	42.2187	0.20369	4.9095	18.8765	3.8449
14	10.1472	0.0985	0.01968	50.8180	0.19968	5.0081	20.1576	4.0250
15	11.9737	0.0835	0.01640	60.9653	0.19640	5.0916	21.3269	4.1887
16	14.1290	0.0708	0.01371	72.9390	0.19371	5.1624	22.3885	4.3369
17	16.6722	0.0600	0.01149	87.0680	0.19149	5.2223	23.3482	4.4708
18	19.6733	0.0508	0.00964	103.7403	0.18964	5.2732	24.2123	4.5916
19	23.2144	0.0431	0.00810	123.4135	0.18810	5.3162	24.9877	4.7003
20	27.3930	0.0365	0.00682	146.6280	0.18682	5.3527	25.6813	4.7978

M. Sc. Engg. (CEE)   08 March, 2019 (Afternoon)

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

TERM   : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO.   : CEE 6109   TIME   : 1.5 Hours
COURSE TITLE: Advance Concrete Technology   FULL MARKS: 75
There are 4 (Four) questions. Answer ALL 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   The specified FM of fine aggregate of a bridge project is 2.65. The sieve   (20) analysis data of a fine aggregate sample collected for the bridge project are summarized below:

ASTM Sieve	Materials Retained (g)
3 inch	0
1.5 inch	0
1.0 inch	0
¾ inch	0
½ inch	0
3/8 inch	0
#4	70
#8	70
#12	60
#16	30
#30	0
#40	0
#50	0
#100	30
#200	20
Pan	90

(i)   Calculate the FM of the sample,
(ii)   Draw the grading curve of the sample,
(iii)   Make a brief discussion on the FM, sieve analysis data, and grading curve,
(iv)   What measures are necessary to improve the grading of the sand sample?
(v)   In what ratio the sand sample is to be mixed with another sand sample of FM 2.0 to obtain the required fineness modulus of 2.65?

1

Sieve openings for ASTM sieves are provided in the attached table.

2(a)   Explain the role of aggregate in concrete. You are a consultant of a mega   (10)
        project in Bangladesh. List the tests of aggregate that you will plan to
        control the quality of aggregate.

(b)   "Cement industries are polluting our environment significantly" – Justify.   (5)

3   28 g of water was mixed with 100 g of cement. For sealed curing condition,   (20)
        calculate the following:

        (i)   Amount of un-hydrated cement, and
        (ii)   Gel-to-space ratio.

        If underwater curing is followed instead of sealed curing condition, what
        will be the changes in the results of the above questions? Assume reasonable
        data.

        "Underwater curing is beneficial for a low W/C" – Justify.

4   Solve Question 3 considering 50 g of water was mixed with 100 g of cement.   (20)
        Also, consider sealed curing condition. Compare the results of Question 3
        and Question 4. Make a brief discussion on the results keeping in mind
        strength and durability of concrete.

Table Traditional American and British Sieve Sizes

Aperture mm or μm	Approximate Imperial equivalent in.	Previous designation of nearest size BS	ASTM
125 mm	5	—	5 in.
106 mm	4.24	4 in.	4.24 in.
90 mm	3.5	$3\frac{1}{2}$ 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

M.Sc. Egg. (CEE)/1ˢᵗ Sem.   **04 March, 2019 (Afternoon)**

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

TERM : MID SEMESTER EXAMINATION   WINTER SEMESTER: 2018-2019
COURSE NO.   : CEE 6303   TIME: 1.5 Hours
COURSE TITLE: Municipal Wastewater Treatment and Process Design   FULL MARKS: 75

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

1. (a) Define and classify sewage with example. Why wastewater treatment is required? (08)

   (b) What is meant by wastewater characterization? Why it is required? (08)

   (c) What is oxygen demand? Explain the ways of expressing oxygen demand. Why COD is always greater than BOD? (09)

2. (a) Explain briefly the role of micro-organisms in waste stabilization. Differentiate between BOD loading and hydraulic loading. (07)

   (b) Differentiate between 'pathogenic bacteria' and 'coliform bacteria'. Explain with neat sketch 'the batch culture curve of bacteria'. (10)

   (c) Differentiate between a bar screen and a comminutor. (08)

   Design a Screen for an average discharge of 0.2 m³/sce. Aussme: fluctuation factor = 2; Velocity of flow = 1m/sec and assume any other data, if required.

3. (a) Describe the equation to find top width and length of a constant velocity grit channel. (06)

   (b) Draw the cross section of a typical sedimentation tank and explain the necessity of its different parts. (10)

   (c) A grit chamber is designed to remove particles with a diameter of 0.2mm, specific gravity 2.65. Settling velocity for these particles has been found to range from 0.016 to 0.022 m/s depending on their shape factor. A flow-through velocity of 0.3 m/s will be maintained by a proportioning weir. Determine the channel dimensions for a maximum wastewater flow of 10,000 m³/d. (09)

4. (a) Differentiate between primary treatment and secondary treatment. What does unit operation and unit process mean in wastewater treatment? (08)

   (b) What are the benefits of primary treatment? How can we accomplish the task of primary treatment? (07)

   (c) Design a circular sedimentation tank of radial flow (with necessary checkings) for a flow of 2500 m³/day. Assume, reasonable data if required. (10)

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

Mid Semester Examination   Winter Semester: 2018-2019
Course No.: CEE 6701   **Full Marks: 75**
Course Title: Advanced Soil Mechanics I   **Time: 1.5 Hours**

There are 3 (Three) questions. Answer all 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) Define (i) Uniformity Coefficient, (ii) Coefficient of curvature, and (iii)   (6)
        Activity of soil

  (b) Derive the equations of primary settlement for both normally and over-   (6)
        consolidated soils.

  (c) Derive the finite difference equation for determination of consolidation rate in   (13)
        one-dimensional and two-dimensional conditions.

2(a)   Draw typical particle-size distribution curves for well graded, poorly graded   (5)
        and gap graded soils. Also, explain which soil type is suitable in earthquake-
        resistant design among the three types?

  (b) A clay layer of 5.0 m thick is drained out on its top surface and has a uniform   (20)
        initial excess pore water pressure distribution over the depth is 100 kPa. The
        coefficient of consolidation of the clay is 0.12 m^2/month. Using the finite
        difference method determine the degree of consolidation that the layer will have
        undergone 24 months after the commencement of consolidation.

3 (a) Briefly describe the mechanism of Unconfined Compression Test.   (5)

  (b) An excavation work with water is done to build a building in the ground shown   (20)
        in Fig.1, where clay layer is bounded by sand layers. Due to the excavation
        work, piezometer reading at the bottom of the excavation is dropped by 5.0 m.
        Neglecting the settlement of sand layer, answer the following question regarding
        the consolidation of clay layer. Here, for clay layer, e_0 =1.2, c_c=0.5, c_v=2.5
        m^2/year. Unit weight of water γ_w=9.8 kN/m^3. Consider the clay is normally
        consolidated.
        (i) Draw distribution of total stress, effective stress and pore water pressure
        before and after the excavation work.
        (ii) Calculate the settlement of the clay layer.
        (iii) Calculate time required for 90% consolidation for the same piezometer
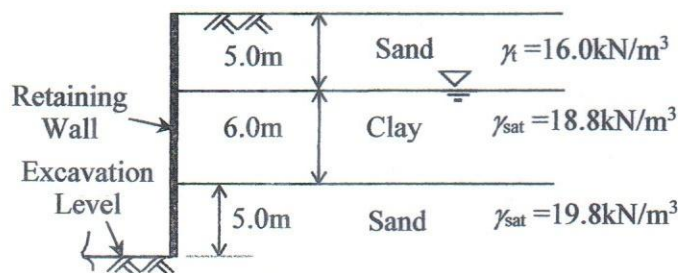   reading. (Time factor for 90% consolidation, T_v=0.848.

Fig.1 for Q.3(b)