B. Sc. Engg. (CEE)/ 1th Sem. 24 February, 2020 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Semester Examination **Summer Semester: 2019-2020**
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 3 horizontal to 1 vertical. Using the prismoidal rule, determine the volume of earthwork for the following data: (20)

Chainage(m)	0	50	100	200	300
Ground level(m)	9.0	6.0	8.0	9.0	9.0
Formation level(m)	6.0	6.0	6.0	6.0	6.0

(b) What is "Orientation of a Plane Table?" Discuss the methods of orientation of a Plane Table Surveying. Write down the advantages and disadvantages of plane table surveying. ($13\frac{1}{3}$)

2(a) A closed traverse was conducted round an obstacle and the followings measurements were made. Find out the missing lengths ST and TP. Draw the traverse. (20)

Line	Length, m	Bearing
PQ	500	98°30'
QR	620	N 30°20' E
RS	468	N 61°30' W
ST	?	S 50°0' W
TP	?	N 59°50' E

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

(b) The following gives the values of the offsets in meters taken from a chain line to an irregular boundary: ($13\frac{1}{3}$)

Distance (m)	0	40	50	60	70	80	110	140	150
Offset (m)	10.6	15.4	20.2	18.7	16.4	20.8	22.4	19.3	17.6

Compute the area in square metres included between the chain line, the irregular boundary, and the first and last offsets, by Trapezoidal and Simpson's rule.

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

(b) The distance between two stations was found to be 1200 m when chained with a 20 m chain. The same distance when measured with a 30 m chain was 1195 m. If the 20 m chain was 0.04 m too long, what was the error in 30 m chain? $(13\frac{1}{3})$

(c) Define: (i) True Meridian and True Bearing (ii) Magnetic Meridian and Magnetic Bearing (iii) Arbitrary Meridian and Arbitrary Bearing (10)

4(a) Compute the area of the closed traverse ABCDA from the following data: (10)

Side	Latitude	Departure
AB	-116.1	-44.4
BC	+6.8	+58.2
CD	+80.5	+17.2
DA	+28.8	-31

(b) The following are bearings taken on a closed compass traverse: $(18\frac{1}{3})$

Line	F. B	B.B.
AB	$80^0 10'$	$259^0 0'$
BC	$120^0 20'$	$301^0 50'$
CD	$170^0 50'$	$350^0 50'$
DE	$230^0 10'$	$49^0 30'$
EA	$310^0 20'$	$130^0 15'$

Compute the interior angles and find the total angular error in the measurement.

(c) Discuss the uses of following instruments in plain table survey. (05)
(i) Alidade (ii) Sprit Level and (iii) Plumbing Fork or U fork

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. $\Delta = \frac{d}{3}[(O_0 + O_n) + 4(O_1 + O_3 + \cdots + O_{n-1}) + 2(O_2 + O4 + \ldots + On-2)$
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. $V = \frac{d}{3}[(A_0 + A_n) + 4(A_1 + A_3 + \cdots + A_{n-1}) + 2(A_2 + A4 + \ldots + An-2)$
5. $C_p = \frac{(P-P_o)L}{AE}$	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. $C_R = \frac{1}{7}.\frac{d^2}{2R}$ (add)
9. B.B of AB = F.B of BA	26. $C_c = \frac{6}{7}.\frac{d^2}{2R}$
10. include angle=(2N-4)× 90^o	27. $H = \frac{1}{2}[(h_a - h_b) + (h_{\acute{a}} - h_{\acute{b}})]$
11. exclude angle=(2N+4)× 90^o	28. D=(b+scot α_2) $\frac{\tan\alpha_2}{\tan\alpha_1 - \tan\alpha_2}$
12. $\sum L = l_1\cos\theta_1 + l_2\cos\theta_2 + l_3\cos\theta_3 + \ldots = 0$	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=Lsin $\theta = KS\ \sin\theta + C\ \sin\theta$
15. $A = \lvert\sum M_i L_i\rvert$	32. D=Lcos $\theta = KS\ (\cos\theta)^2 + C\ \cos\theta$
16. $M_i = M_{i-1} + \frac{D_{i-1}+D_i}{2}$	33. H=Lsin $\theta = KS\frac{\sin 2\theta}{2} + C\sin\theta$
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. 02 March, 2020 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION WINTER SEMESTER: 2019-2020
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) Write down the characteristics of simple harmonic motion. (03)

   (b) Derive the differential equation of simple harmonic motion and solve it. (14)

   (c) A horizontal spring is found to be stretched 2.0 in. from the equilibrium position when a force of 0.75 lb acts on it. Then a 1.5-lb body is attached to the end of the spring and is pulled 4.0 in. along a horizontal frictionless table from the equilibrium position. The body is then released and executes simple harmonic motion. Compute the velocity and the acceleration when it has moved in halfway from its initial position toward the center of motion. (08)

2. (a) i) Define spring constant and effective mass of a spring and ii) A spring of mass 'm' is attached to a load 'm_o'. The mass-spring system is freely hung from a suspension and elongated by a force and then released. If the system executes simple harmonic motion, then show that its kinetic energy will be $\frac{1}{2}(m_o + \frac{m}{3})v_o^2$, where '$v_o$' is the speed of '$m_o$'. (10)

   (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) Draw a Lissajous figure from the following equations: $x = A_x \cos(\omega t + \pi/4)$ and $y = A_y \cos 2\omega t$. (06)

3. (a) What is damped harmonic motion? Give an example of it. (04)

   (b) Obtain the differential equation of damped harmonic motion and show that under critical damping condition the solution of the differential equation of damped harmonic motion is not a harmonic function. (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= 2s. (06)

4. (a) What is a standing wave? How can you produce it? (05)

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

   (c) The equation of a transverse wave travelling in a rope is given by: $y = 10\sin\pi(0.01x - 2.00t)$, where y and x are in centimeters and t in seconds. Find out the frequency and velocity of the wave. (05)

3. a) An annular disk of inner radius R_a and outer radius R_b is placed on the xy plane as shown in Fig. 3(a). If the disk carries a uniform charge density ρ_s C/m^2, find the potential V at P and corresponding $\vec{E}$ using V. 13

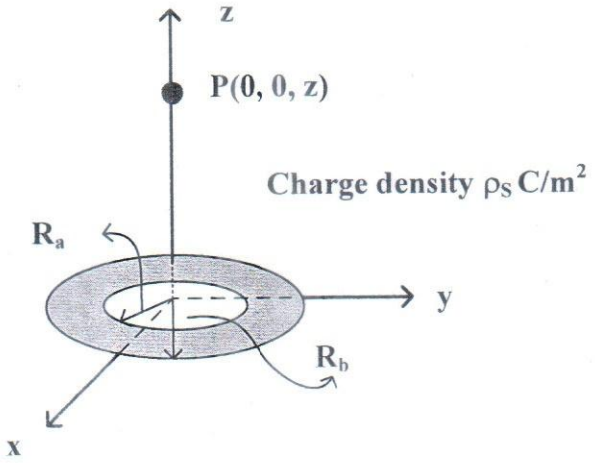

Fig. 3(a)

b) Electric flux density in free space is given by $\vec{D} = 2xyz\hat{a}_x + x^2z\hat{a}_y + x^2y\hat{a}_z$ V/m. Caulculate the amount of work necessary to move a 2μC charge form (2, 1, -1) to (5, 1, 2). All distance coordinates are in meters. 12

4. a) If the potential distribution in a region is $V = x - y + xy + 2z$ V, find $\vec{E}$ at (1,2,3) and the elctrostatic energy stored in a cube of side 4 m centered at the origin. 10

b) How is the resistance of a conductor with nonuniform cross section calculated? 5

c) In a dielectric material $E_x = 10$ kV/m and polarization $\vec{P} = \frac{1}{10\pi}(3\vec{a}_x - \vec{a}_y + 4\vec{a}_z)$ nC/m^2. Calculate (i) χ_e (ii) $\vec{E}$ and (iii) $\vec{D}$. 10

B.Sc. Engg. (CEE)/1st Sem. 02 March, 2020 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION WINTER SEMESTER: 2019-2020
COURSE NO. : PHY 4153 TIME : 1.5 Hours
COURSE TITLE: Physics I FULL MARKS: 75

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ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Mid-Semester Examination — Winter Semester, A.Y. 2019-2020
Course No.: Math 4123 — Time: 90 Minutes
Course Title: Matrix and Differential Equation — 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) Show that every square matrix can be expressed in one and only one way as he sum of a symmetric and skew-symmetric. 5

   b) Verify that $(AB)^T=B^TA^T$, where 10

$$A=\begin{bmatrix}1 & 0 & 2\\ -1 & 1 & 3\\ 2 & 0 & 1\end{bmatrix} \text{ and } B=\begin{bmatrix}2 & -1 & 0\\ 0 & 2 & 1\\ 1 & 2 & 1\end{bmatrix}.$$

   c) Find the adjoint of the matrix, $A=\begin{bmatrix}1 & 0 & 2 & 1\\ 0 & 1 & 1 & 0\\ 2 & 0 & 1 & 0\\ 0 & 0 & 0 & 1\end{bmatrix}$. 10

2. a) Find the differential equation of the family of following curves, where A and B are arbitrary constants. 8

$$y=e^x(A\cos x+B\sin x).$$

   b) Solve: $\cos x\,dx + (1+\frac{2}{y}\sin x)\,dy = 0.$ 8

   c) Solve: $\frac{dP}{dt}+2tP=P+4t-2.$ 9

3. a) Solve the initial value problem: $(x+1)y'+y=\ln x$, $y(1)=10.$ 8

   b) Solve: $(x-y^3+y^2\sin x)\,dx=(3xy^2+2y\cos x)\,dy$. 8

   c) Solve: $y\,dx+x(\ln x-\ln y-1)\,dy=0$, $y(1)=e.$ 9

4. a) Solve: $y'-y\sec x=y^2\sin x\cos x.$ 8

   b) A body at a temperature of 50° F is placed outdoors where the temperature is 100° F. If after 5 minutes, the temperature of the body is 60° F. Derive the differential equation and find (i) how long it will take the body to reach a temperature of 75° F and (ii) the temperature of the body after 20 minutes. 8

   c) A 12-volt battery is connected to a series circuit in which the inductance is 0.5 henry and the resistance is 15 ohms. Derive the differential equation of the circuit and determine the current i if the initial current is zero. 9

B.Sc. Engg. SWE 5th Semester — 02 March 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

Math 4543: Numerical Methods

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) When approximating any mathematical model using numerical methods, how can you use relative approximate errors to minimize the error? Explain your answer with the help of Tailor's Remainder Theorem. 5

   b) What do you understand by truncation error and round off error? Explain both of them with the MacLaurin Series expansion of $sin(\frac{\pi}{3})$. Your error should be calculated up to four significant digits. 10

   c) Given that $f(3) = 7$, $f'(3) = 4$, $f''(3)+1=11$, $f'''(3) = f''(3) + 3$ and that all other higher order derivatives of $f(x)$ are zero at x = 3, and assuming the function and all its derivatives exist and are continuous between x = 3 and x = 4.5. Find out the value of $f(4.3)$. Also provide an upper bound for the error with Taylor's remainder theorem if you used only 2 terms of the series. 10

2. a) Explain the advantages and drawbacks of bisection method for solving nonlinear equations. 6

   b) Solve the following non-linear equation within the range [-1, 0] and [0, 1] with at least 3 iterations. 12

   $$f(x) = 230x^4 + 18x^3 + 9x^2 - 221x - 9$$

   In each of the iterations, calculate the relative approximate error. Your answer should be correct up to 4th digit.

   c) Why do we need to use Spline interpolation over Lagrange interpolation for higher order approximation? Explain with appropriate logic. Use figure if necessary. 7

3. a) In order to find out the values of $3n$ number of unknowns, you need $3n$ number of equations. How can you get $3n$ number of simultaneous equations from $(n+1)$ data points in the Quadratic Spline method of interpolation? 10

   b) A thermistor is a special kind of thermometer that is able to calculate the temperature of a body using the value of the resistance attached to it. A manufacturer of thermistors makes several observations with a thermistor which are given in Table1. 8

   Table 1: Observations

R (ohm)	T (°C)
1101.0	25.113
911.3	30.131
636.0	40.120
451.1	50.128

   Determine the temperature corresponding to 758.8 ohms using a second order Lagrange polynomial. Your result should be correct up to 3 digits.

c) Generalize the n^{th} order form of Newton's Divided difference method of interpolation. Use figures or sketches if necessary. 7

4. a) Derive the coefficients of the linear regression model $y = a_0 + a_1 x$ using root mean square minimization of the residuals. 9

b) The progress of a homogeneous chemical reaction is followed and it is desired to evaluate the rate constant and the order of the reaction. The rate law expression for the reaction is known to follow the power function form: 10

$$-r = kC^n.$$

From the given data in Table 2. Calculate the value of n and k.

Table 2: Chemical Kinetics

C_A(gmol/l)	4	2.25	1.45	1.0	0.65	0.25	0.006
$-r_A$(gmol/l·s)	0.398	0.298	0.238	0.198	0.158	0.098	0.048

c) Convert the following nonlinear regression model into linear regression problem. 6

i. $y = Ae^{\lambda t}$ Where A and e are the regression coefficients.

ii. $y = \frac{ax}{b+x}$ Where a and b are the regression coefficients.

B.Sc. Engg. SWE 5th Semester — 02 March 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

Math 4543: Numerical Methods

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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ii. $y = \frac{ax}{b+x}$ Where a and b are the regression coefficients.

B.Sc. Egg. (CEE)/1st Sem. 27 February, 2020 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

MID SEMESTER EXAMINATION WINTER SEMESTER: **2019-2020**

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.

1. Workout the following integrals:

   (a) $\int \frac{dx}{\cos(2x-a)\cos(2x+a)}$. (8)

   (b) $\int \frac{dx}{\sqrt[4]{\sin^{15} x \cos x}}$. (8)

   (c) $\int \frac{x^2 dx}{x^4 - x^2 - 12}$. (9)

2. Compute the following:

   (a) $\int \frac{x^2 dx}{(x\sin x + \cos x)^2}$. (9)

   (b) $\int (x-3)\sqrt{\frac{2x^3 - 3x + 1}{x-1}} dx$. (8)

   (c) Find a reduction formula for $I_n = \int x\cos^n x\, dx$ and hence obtain $I_3 = \int x\cos^3 x\, dx$. (8)

3. Evaluate the following:

   (a) $\int_3^{29} \frac{(x-2)^{\frac{2}{3}}}{(x-2)^{\frac{2}{3}} + 3} dx$. (8)

   (b) Prove that $\int \frac{x^3 \cos^4 x \sin^2 x}{\pi^2 - 3\pi x + 3x^2} dx = \frac{\pi^2}{32}$, (using properties). (8)

   (c) Define gamma function and beta function. Find a relation between gamma function and beta function. (9)

4. (a) Define symmetric matrix and skew symmetric matrix with example. (8)
   Show that any square matrix can be expressed as the sum of two matrices, one symmetric and the other anti-symmetric.

   (b) Solve, with the help of matrices, the simultaneous equations, (8)

   $$x + y + z = 3,\quad x + 2y + 3z = 4,\quad x + 4y + 9z = 6$$

(c) Define rank of a matrix. Find the rank of the matrix, (9)

$$A=\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}.$$

Library

B.Sc. Engg. (CEE)/1st Sem. 03 March, 2020 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester: **Mid Semester Examination** Winter Semester: 2019-2020
Course No.: **Chem 4153** Full Marks: 75
Course Title: **Chemistry I** 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.

Q.1 (a) Write a clear definition of solution and explain why milk is not considered as a true solution although it is homogeneous mixture of protein, fat and water in different composition in different milk. 5

(b) What do you understand by solubility and solubility curve? Explain why for some solute solubility increases with the increase of temperature but for other it decreases with increase of temperature and for a limited number of solute it remains constant. 12

(c) At 25°C the concentration of a saturated solution of Na_2CO_3 is 3.2 N. Calculate the solubility of Na_2CO_3 at 25°C. 8

Q.2 (a) What do you understand by vapor pressure of a liquid? How is it related with the mole fraction of solute of a liquid solution? 5

(b) Define boiling point of a liquid with respect to vapor pressure. Derive a mathematical expression which correlates the elevation of boiling point of a solution with the molecular weight of its solute. 10

(c) An aqueous solution of an unknown solute contains 0.06 g solute in 1.0 dm^3 solution. If the solution boils at 1.02°C then what will be molecular weight of its solute? The sp. gravity and ebullioscopy constant of the solution and its solvent are 1.05 and 0.53 respectively. 10

Q.3 (a) Define super-saturated solution. Discuss the preparation of a super-saturated solution. 6

(b) What is osmotic pressure of a solution? How it is related to the concentration of the solution? 7

(c) Draw the pictorial structure of d-orbital's. "Hydrogen atom has only one electron but exhibits many spectral lines", explain with energy diagram. 12

Q.4 (a) Explain the limitations of Rutherford's atom model. 5

(b) Discuss the postulates of Bohr's atom model. 6

(c) Derive the equation for energy calculation on the basis of Bohr's atom model. 10

(d) Derive an equation that proves $mvr = nh/2\pi$. 4

B.Sc. Engg. (CEE)/ 3rd Sem. 25th February, 2020 (Afternoon)

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

Semester: Mid Semester Examination **Winter Semester: 2019-2020**
Course No.: GS 4351 **Full Marks: 75**
Course Title: Engineering Geology and Geomorphology **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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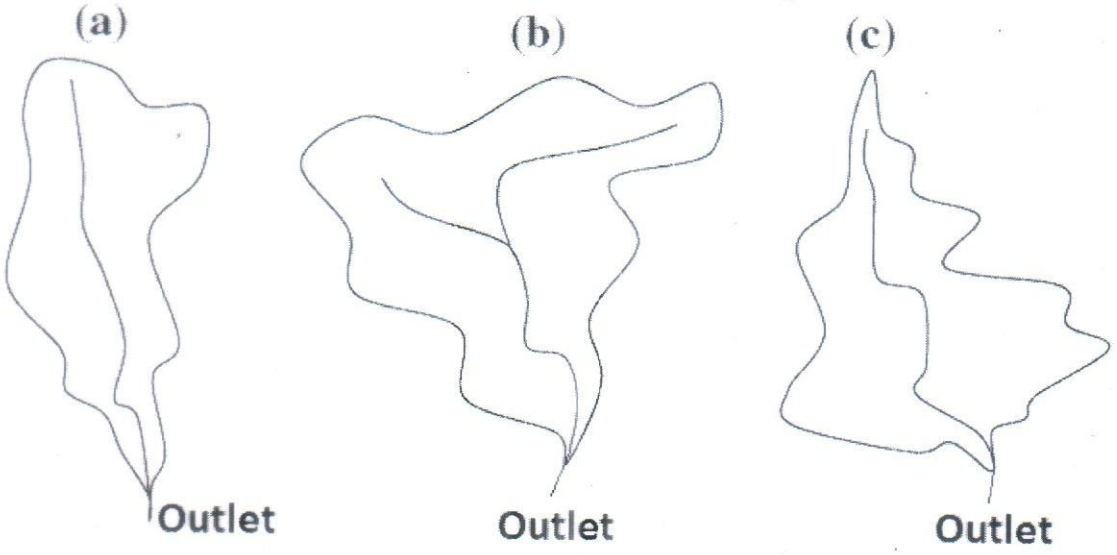
1(a) Draw a schematic diagram showing how the runoff pattern of an area changes with the change in its land use. Write down the problems encountered because of such changes, and briefly describe how you can solve the problems as a Civil Engineer. (15)

(b) What are the three criteria for being geomorphic agent? Can Gravity be called a geomorphic agent? Explain your answer. (06)

(c) Write the differences between land sliding and erosion. (04)

2(a) Draw flood hydrographs for the following three drainage basins (a), (b), and (c) of different shapes, considering all other factors identical for all the three basins. (09)



(b) A hilly area with comparatively steeper slope covers a drainage basin of area 10 acres. You, as a civil engineer, are planning to construct three rain water reservoirs within the basin, each having an area of 5000 sq. meter. Draw a hydrograph showing the current runoff pattern, and also draw a comparative hydrograph showing the change in overall runoff pattern in that drainage basin after the construction of the reservoirs. Consider all other factors identical. (04)

(c) Write short notes on the following drainage patterns with neat sketch: (12)

(i) Dendritic Pattern

(ii) Trellis Pattern

(iii) Annular Pattern

3(a) A drainage basin covers a project to be built in the southwest of Dhaka. The following information was determined from field measurement and proposed design data: (16)

Total Drainage Area = 80 acres
Perimeter of the basin = 10 km
Extent of overland flow = 1000 ft
Travel time for overland flow = 34 minutes
Extent of shallow concentrated flow = 900 feet
Average velocity of shallow concentrated flow = 2.5 feet per second
Travel time for channel flow = 20 minutes
Average velocity in channel = 3.0 feet per second

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

(i) Determine the form factor and compactness coefficient of the basin.
(ii) What does the value of the two factors indicate about the shape of the basin?
(iii) Using rational method, find the peak discharge of the area for 2-year frequency storm.
[Use Table 1 and Figure 1 for required data]

(b) The stream network of a drainage basin is given below. Do the stream ranking for this network by both Horton's method and Strahler's method. Also calculate the Bifurcation Ratio for both the cases. Which method do you think is more realistic? (09)

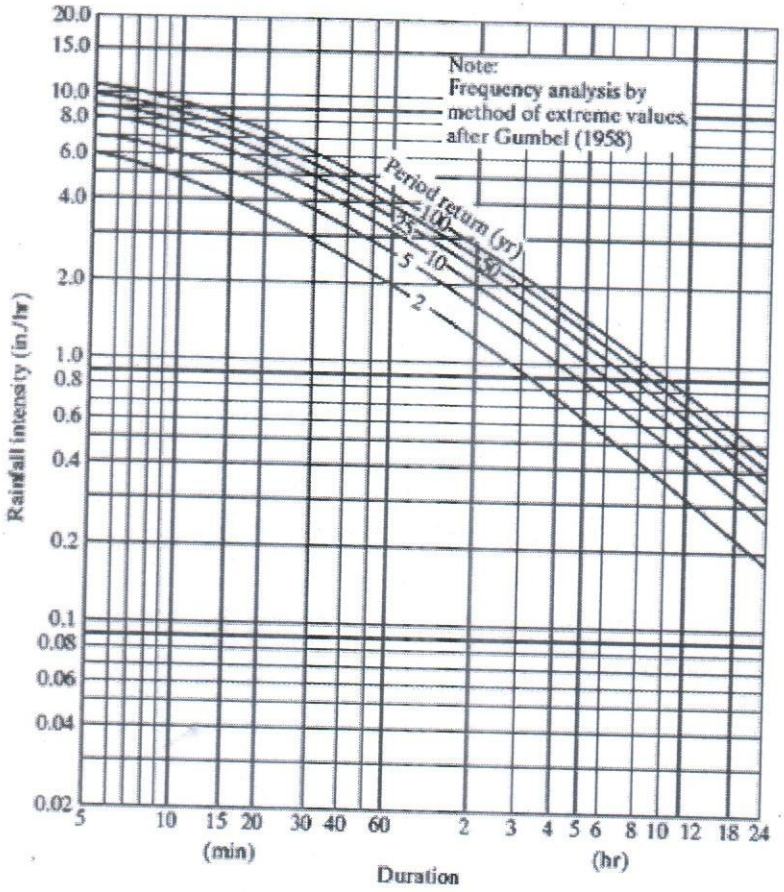
4(a) What is valley? Describe the development process of valley with neat sketches. Also write down the name of factors affecting the three processes related to valley development. (15)

(b) Three drainage basins A, B, and C have drainage density of 10.5 km/km^2, 24.1 km/km^2 and 0.51 km/km^2 respectively and drainage area of 0.5 km^2, 1 km^2 and 2 km^2 respectively. (10)
Find the length of the channels, constant of channel maintenance, and length of overland flow of the channels.
Which stream is likely to have rapid stream response and which one is likely to have least stream frequency?

Table 1: Runoff Coefficient values for different land uses
[for Question 3(a)]

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

Figure 1: IDF curve [for Question 3(a)]



B.Sc. Engg. (CEE)/3rd Sem. **02 March, 2020 (Afternoon)**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIROMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION WINTER SEMESTER: 2019-2020
COURSE NO. : Math-4353 TIME: 90 Minutes
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) Find the Laplace transform (i) $L\{\sin at\}$ and then find (ii) $L\left\{\frac{\sin t}{t}\right\}$ and $L\left\{\int_0^t \frac{\sin u}{u} du\right\}$. (15)

(b) Show that, $L\left\{\sin\sqrt{t}\right\} = \frac{\sqrt{\pi}}{2s^{3/2}} e^{-\frac{1}{4s}}$. (10)

2. (a) If F(t) is a periodic function of period T > 0 then prove that (12)

$$L\{F(t)\} = \frac{\int_0^T e^{-st} F(t)dt}{1-e^{-sT}}.$$

(b) Find the Laplace transforms (i) $L\left\{\sin\sqrt{t}\right\}$ and (ii) $L\left\{\frac{\cos\sqrt{t}}{\sqrt{t}}\right\}$ (13)

3. Evaluate the following:

(a) $L^{-1}\left\{\frac{6s^2+22s+18}{s^3+6s^2+11s+6}\right\}$ (12)

(b) Using convolution theorem, evaluate $L^{-1}\left\{\frac{1}{s^2(s^2+4)}\right\}$. (13)

4. Solve the following using Laplace transform and its inverse

(a) $Y'' + 2Y' + 5Y = e^{-t}\sin t$, $Y(0) = 0$, $Y'(0) = 1$; (12)

(b) $tY'' + 2Y' + tY = 0$, $Y(0+) = 1$, $Y(\pi) = 0$. (13)

B.Sc. Engg. (CEE)/ 3rd Sem. February 27, 2020 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester: Mid Semester Examination **Winter Semester: 2019-2020**
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. Assume reasonable data if needed.

1(a) Why mercury is used in thermometer? (02)

(b) Provide a simple example of the followings- (05)
- i. Ideal fluid
- ii. Newtonian fluid
- iii. Non-Newtonian fluid
- iv. Laminar flow
- v. Turbulent flow

(c) Establish a fundamental relationship between frictional factor (f) and Reynolds number (R) which only applicable for laminar flow only. (06)

(d) A velocity distribution is shown in the **fig. 1** which is a parabola having vertex 10 cm from the boundary. Consider a dynamic viscosity of 0.5 poise. Answer the followings- (12)
- i. Calculate velocity gradient and shear stress for y= 0, 4, 8 and 10 cm.
- ii. Show all the results in a table
- iii. Draw the velocity gradient and the shear stress profile in a plain paper.

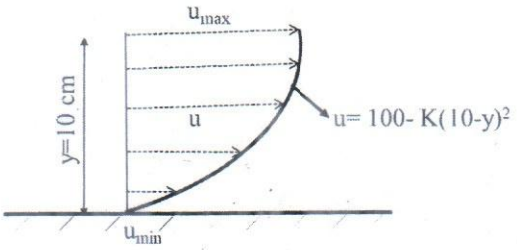

Fig:1

2(a) Show in a diagram of the development of the boundary layer in a pipe showing all the zones. (05)

(b) The capillary depression of mercury in the 5 mm diameter capillary glass tube is 2.5 mm. Find the angle of contact, θ. The surface tension of the mercury in contact with air is 0.50 N/m. (07)

(c) Find the flow rate when 15°C water causes a head loss of 0.25 m in 100 m of average cast iron pipe diameter of pipe is 15 cm. Consider, $\upsilon = 1.25X10^6$ m^2/s. (13)

3(a) Define the followings and draw proper figures: (03)
- i. Streak Line
- ii. Stream line.

(b) A stream function of a stream line is given as $\psi = 2x^2-y^2$. Find the velocity at point (2,3). (04)

(c) Find the magnitude and location of the resultant force acting on the cylinder shown in **fig. 2**. Also find the magnitudes and the locations of horizontal and vertical components of the resultant force. The length of the cylinder is 3m. (18)

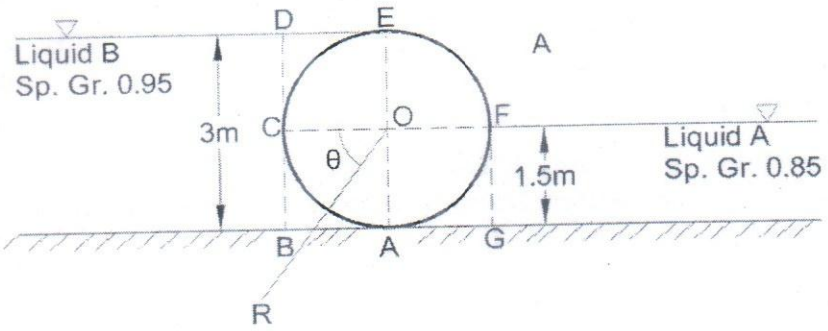

Fig: 2

4(a) Write down the limitations of Continuity Equation. (03)

(b) For a two dimensional flow show that stream line and potential line are orthogonal with each other. (07)

(c) Water flows at a rate of 150 l/s through a reducer as shown in the **fig. 3.** Find the deflection in the mercury manometer. Neglect frictional loss. (15)

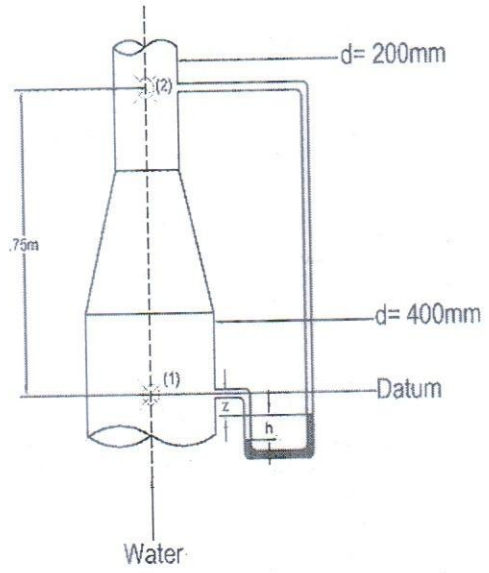

Fig: 3

Table 1: Values of absolute roughness e for pipes [question 2c]

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)

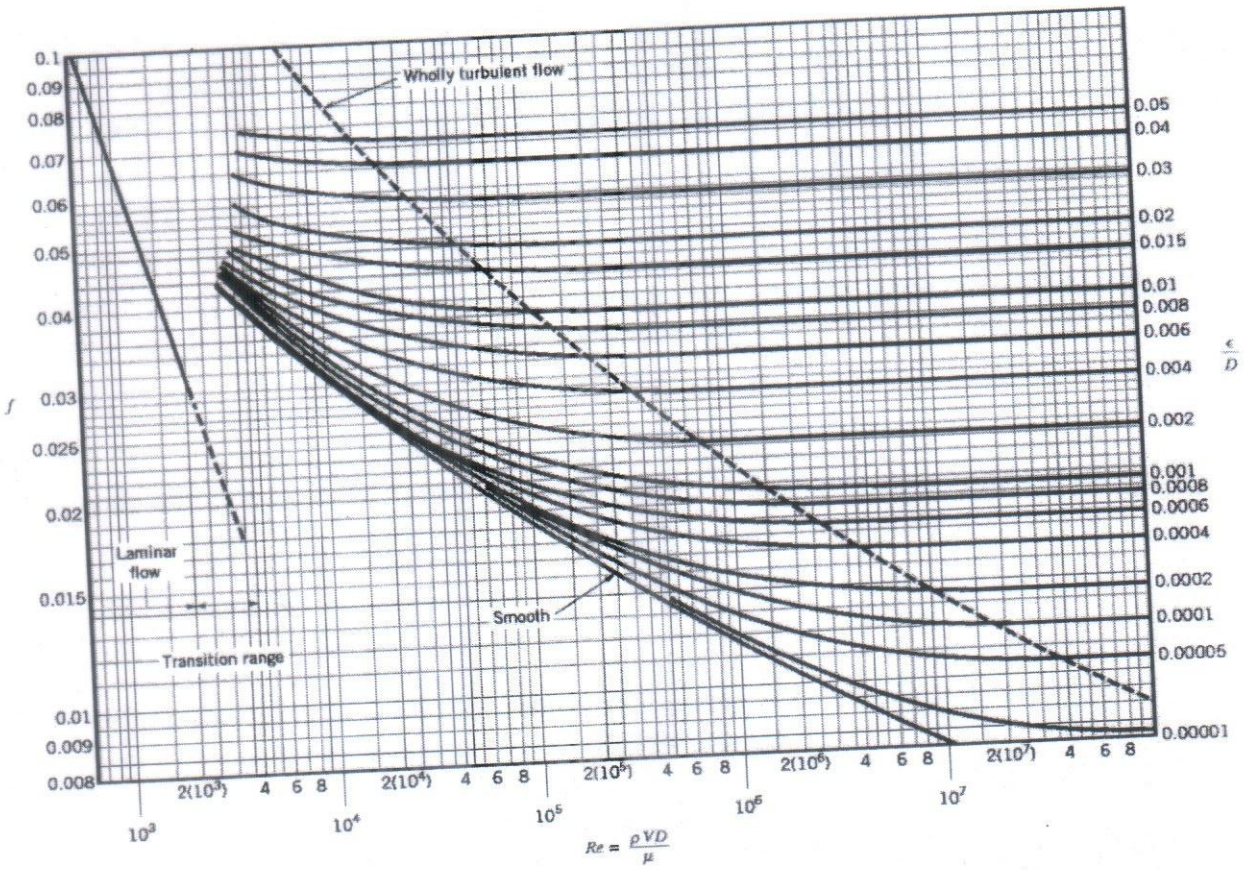

Figure 1: Friction factor for pipes (Moody diagram) [question 2c]

***Note: Use the chart for question 2c. This figure must be attached along with the answer script.**

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4361: Computer Science and Technology I

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **4 (four)** questions. Answer **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) What is the basic definition of a computer? Describe different types of computers based on number of persons using at the same time and their sub categories. 2+6

   b) What are the fundamental parts of a computer system? 4

   c) Perform the following operations: 9

      i. $(26B.C12)_{16}$ (Convert from Hexadecimal to Decimal)

      ii. $(101001.010011101)_2$ (Convert from Binary to Decimal)

      iii. $(917.25)_{10}$ (Convert from Decimal to Octal)

   d) What would be the output of the program in Figure 1? 4

```
#include <stdio.h>
#include <math.h>
int main()
{
      int a, b;
      a = 2;
      b = 5;
      int temp;
      temp = a;
      a = b;
      b = temp;
      a++;
      b--;
      temp = a+b;
      temp+=2;
      temp = sqrt(temp);
      printf("%d %d %d",a, b, temp);
      return 0;
}
```

Figure 1: Code for question no. 1(d)

2. a) What is software? Describe different types of softwares with examples. 5

   b) Write short notes on different types of *Memory* and *Storage* devices. Give an example of Infinite loop using FOR and WHILE loop separately. 6+6

   c) What would be the output of the program in Figure 2? 8

```
#include <stdio.h>
int main()
{
    int i;
    for(i=1;i<100;i++)
    {
        if(i%5==0 && i%3==0) printf("%d\n",i);
        else if(i%5==0) printf("?\n");
        if(i>45)break;
    }
    return 0;
}
```

Figure 2: Code for question no. 2(c)

3. a) Write short notes on the Information Processing Cycle. What is the significance of comments in code? 4+3

b) Perform binary subtraction on the following numbers and convert the binary result into decimal for justifying your answer. 7

$$(-21)_{10} - (5)_{10}$$

c) Write a C program to find whether a given year is a leap year or not. If it is a leap year print YES, otherwise print NO. You have to take input from the user. 5

d) Take an integer N as input. Print all the numbers divisible by 7 from 1 to N. Use FOR loop to do the task. 6

4. a) Sakib likes to throw balls into the air with all his might. He becomes happy if the ball reaches greater heights. However, he does not know how to calculate the maximum height his ball attains. Write a C program that will help him find the height of his projected ball. Assume that the ball is thrown in the direction perpendicular to the earth surface with an initial velocity of V ms^{-1} (V is the only input provided by the user and you have to print the maximum height of the ball). 7

[**Hint**: Use the formula $v^2 = u^2 + 2as$, where u is the initial velocity, v is the final velocity, s is the displacement and a is the acceleration, and the acceleration due to gravity is 9.8 ms^{-2}]

b) Write a C program to find whether a given number is prime or not. If prime, then print YES, otherwise, print NO. You have to take input from the user. 10

c) Find out the number of bugs in the following program. Briefly explain about each bug in one or two sentences. 8

```
#include <stdio.h>

int main()
{
    float a,b;
    a = 6.0;
    b = 5.0;
    int c = a % b;
    printf("%f",c);
    int num1 = 10;
    int num2 = 5/10;
    int res = num1/num2;
    print("%d",res);
    return 0;
}
```

Figure 3: Code for question no. 4(c)

BBA (TM)/ 3rd Sem. **24 February , 2020 (Morning)**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : Mid Semester Examination WINTER SEMESTER: 2019-2020
COURSE NO. : CEE 4361 TIME: 1.5 Hours
COURSE TITLE: Civil and Environmental Technology 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.

1.(a) Engineering stress-strain data from a tension test on AISI 4140 steel are tabulated in Table 1. The diameter of the steel before testing was 8.56 mm, and after fracture, the minimum diameter in the necked region was 6.17 mm. Draw the stress-strain curve of the steel and determine: (22)

i. The elastic modulus
ii. 0.2% offset yield strength
iii. Proportional limit
iv. Modulus of resilience
v. Ultimate tensile strength
vi. Failure strength
vii. Ratio between yield strength and ultimate strength.

Table 1: Stress-strain data for AISI 4140 Steel

Strain (%)	Stress (MPa)
0	0
0.156	331
0.315	669
0.493	1022
0.554	1140
0.581	1175
0.776	1167
1.294	1177
2.16	1193
2.98	1207
3.85	1217
4.77	1221
6.02	1200
7.51	1129
9.03	1045
10.60	944
12	829

(b) Among the cities in Bangladesh, Dhaka is most vulnerable for earthquake. Which types of steel you would suggest for using in the construction work of Dhaka city? (3)

2.(a) Using schematic diagram, make the comparison between ductility and brittleness of the materials. (4)

(b) Write short note on the followings: (12)

i. Field test of brick
ii. Efflorescence of brick
iii. Frog mark of brick
iv. Functions of lime and alumina on brick.

(c) Write down the differences between: (9)

i. Kiln burning and Clamp Burning
ii. First class brick and Second class brick
iii. English bond and Flemish bond.

3.(a) Explain the hydration process of cement with schematic figure. (8)

(b) Write down the significance of initial setting time and final setting time of cement. (3)

(c) Write down the differences between fine cement and coarse cement. (4)

(d) Write down the different factors affecting the setting of cement. (4)

(e) Calculate the Lime saturation factor (LSF), Alumina ratio and Silica ratio of the following Portland cements (A, B, and C). Which of these cements will give the higher strength of concrete? (6)

Oxide Content	**Percentage in cement**		
	A	**B**	**C**
CaO	68.2	61	64.2
SiO_2	22.4	25	20.7
Al_2O_3	4.6	4	3.9
Fe_2O_3	0.3	3	5.3
MgO	1.3	1.1	1.4
SO_3	2.4	2.5	2
K_2O	0.3	0.2	0.5
Na_2o	0.3	0.3	0.4
Loss in ignition	0.2	2.9	1.6

4. Lightweight Concrete (LWC) has recently gained popularity not only in abroad but also in Bangladesh due to reduction in the dead load of the building and providing more space due to the reduction in size of the structural members. Due to the aforementioned issues, an industrial concrete slab having with length 20m, width 15m, and thickness 0.2m will be constructed. In order to better investigation and to finalize the mix design, the materials are collected and different physical tests are performed. The test data of sieve analysis of fine sands are given in Table 2. Draw the grading curve of sand samples. Based on the grading curve of two sand samples, proposed the suitable sand for LWC and justify your selection. Also calculate Fineness Modulus (FM) of the sand samples. (25)

Table 2: Sieve analysis results of fine sands.

ASTM Sieve	Sieve Opening (mm)	Materials Retained (gm)	
		Sand-A	Sand-B
3 inch	76.2	0	0
1.5 inch	38.1	0	0
3/4 inch	19.05	0	0
3/8 inch	9.5	0	0
#4	4.75	0	0
#8	2.36	50	0
#12	1.7	100	0
#16	1.19	100	0
#30	0.59	50	200
#40	0.425	50	300
#50	0.3	50	0
#100	0.15	75	0
#200	0.075	25	0
Pan	-	0	0

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

02 March, 2020

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

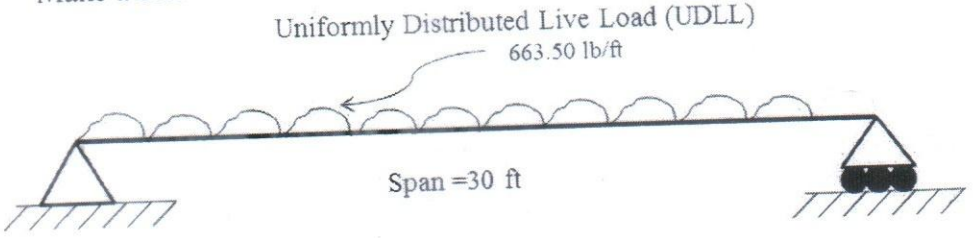
TERM : MID SEMESTER EXAMINATION WINTER SEMESTER: 2019-2020
COURSE NO. : CEE 4511 TIME : 1.5 Hours
COURSE TITLE: Design of Reinforced Concrete Structures I FULL MARKS: 75

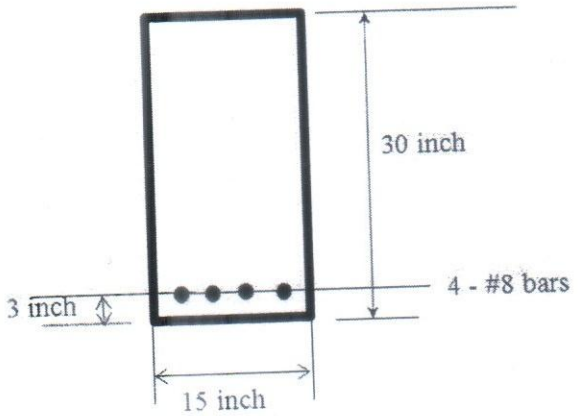
There are 4 (Four) questions. Answer any 3 (Three) questions. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning. Assume reasonable data, if necessary.

1(a) Compare WSD and USD. (5)

(b) The cross-section of a reinforced concrete beam is given below. Determine the following: (20)

(i) Transformed area of the un-cracked section,
(ii) Moment of inertia of the un-cracked transformed section about NA,
(iii) Cracking moment,
(iv) Stress and strain distributions at the mid-span section of the beam due to the applied loads (UDLL + DL),
(v) Make a brief discussion on the results.





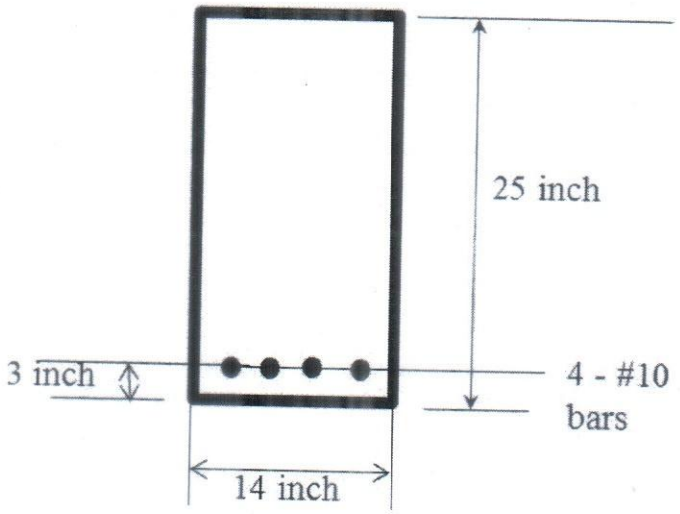
Beam Section

Use $f'_c = 5000$ psi, $f_t = 450$ psi, $f_y = 60{,}000$ psi, $\Upsilon_{con}=150$ lb/ft^3.

2(a) Discuss stress block factors ($\alpha, \beta, \gamma,$ and β_1) for RC beams. (5)

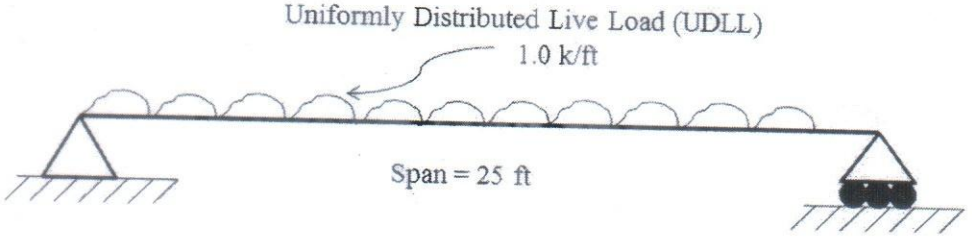
(b) Refer to the following beam section. Calculate the nominal moment capacity of the beam section using (i) general non-linear stress distribution in compression zone of concrete, and (ii) Whitney's rectangular stress block in compression zone of concrete, (iii) Make a brief discussion on the results, and (iv) If the steel ratio of the beam exceeds the balanced steel ratio, write the steps to solve the problem. (20)

Use f'_c = 6,000 psi, f_y=60,000 psi, E_s = 29,000,000 psi.



Beam Section

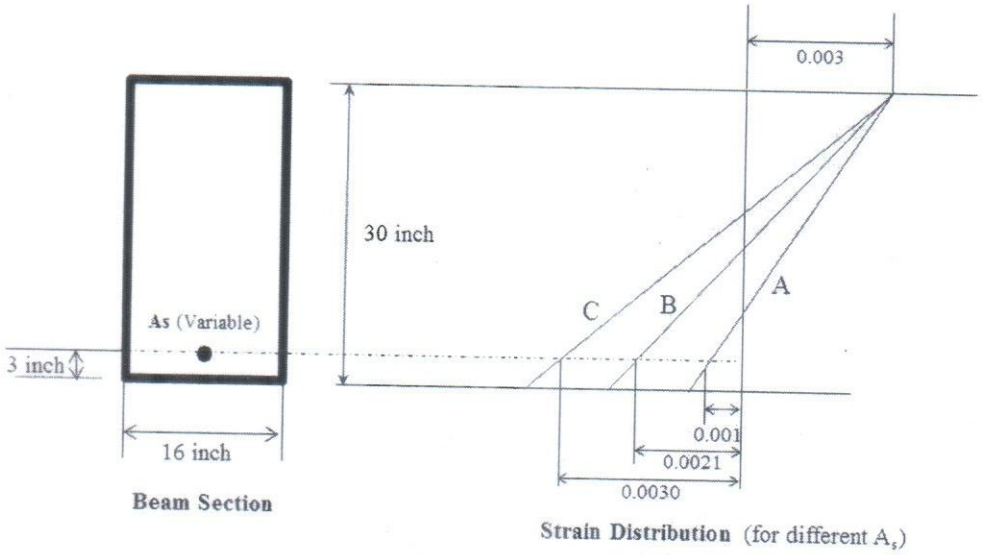
3 Design the following simply supported beam by WSD and USD. Make a brief discussion on the results. Assume width of the beam = 12 inch (architectural requirement). (25)



Super Imposed Dead Load (SIDL) = 1.0 k/ft
Self-weight (SW) = As per beam section
Load Combination = UDLL + SIDL+SW

f'_c = 4,000 psi
f_y = 60,000 psi
f_s= 24,000 psi

4 (a) Refer to the following beam section and strain distribution at failure due to the imposed loads. Given : $f'_c = 4000$ psi, $f_y = 60{,}000$ psi. Do the following: (20)



Beam Section **Strain Distribution** (for different A_s)

(i) Discuss the failure modes of the beam for different strain distributions (A, B, and C),
(ii) Locate the NA for different strain distributions,
(iii) Calculate the balanced steel ratio of the beam section,
(iv) Calculate the stress in steel bars for different failure strains of steel (make reasonable assumptions),
(v) Calculate the amount of steel in balanced condition and compare it with the amount of steel areas that will be required for different strain distributions (A, B, and C),
(vi) Make a brief discussion on the above results, and
(vii) If yield strength of steel is changed to 100,000 psi instead of 60,000 psi, what changes will be observed in failure modes of the beam. Discuss the results keeping in mind the ductility of the beam.

(b) Discuss the reasons for using steel bar as reinforcement for concrete. (5)

B.Sc. Engg. (CEE)/ 5th Sem. 25th February, 2020 (Afternoon)

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

Semester: Mid Semester Examination **Winter Semester: 2019-2020**
Course No.: CEE 4513 **Full Marks: 75**
Course Title: Structural Analysis and Design I **Time: 1.5 hours**

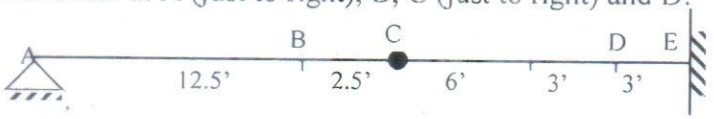
There are **4 (Four)** Questions. Answer any **3 (Three)** questions. All questions carry equal marks. Programmable calculators are not allowed. Do not write on this questions paper. The symbols have their usual meaning and assume reasonable values for missing information.

1(a) Explain how BNBC incorporates geographical, structural and soil conditions into Equivalent static load method of earthquake lateral force estimation. (8)

(b) What are the exposure types in BNBC wind load calculation? In your opinion, what should be the exposure type of IUT and Uttara 3rd phase? Provide explanation. (5)

(c) For a simply supported beam of L length, find moment and shear influence line diagram at mid-span using free-body technique (show diagrams and equations developed for each section). (12)

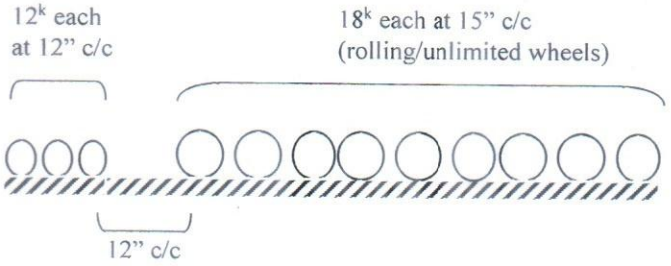
2(a) Find influence lines for moment at location B, D and E of the beam shown in Figure 1; also find influence lines for shear at A (just to right), B, C (just to right) and D. (21)



(Figure 1)

(b) What is the significance of Base shear and Force at the top in Earthquake analysis? Which one is controlled more prominently by weight and which one is by height? (4)

3. A wheel load system is shown below. Find maximum and minimum shear at the mid-span of a 24'-span simply supported beam for the wheel system if the wheels move right to left. (25)



(Figure 2)

4(a) Find lateral total load for each floor of a 6-storied building at a location near seashore where wind speed 280 km/h. Building has 3m floor height on each floor and has 60m x 30m floor area (wind is coming perpendicular to the 30m side). (13)

(b) 2nd Academic Building of IUT has an (assumed) structural system is RCC OMRF (R=5) and the soil is medium stiff clay. EQ dead load is 5 kN/sq. meter with floor height of 4m. The building is 50.5 m long and 20.25 m wide and has six floors. Find Lateral forces due to earthquake at each floor level. (12)

Combined Height and Exposure Coefficient, C_z

Height above ground level, z (metres)	Coefficient, C_z [1]		
	Exposure A	Exposure B	Exposure C
0-4.5	0.368	0.801	1.196
6.0	0.415	0.866	1.263
9.0	0.497	0.972	1.370
12.0	0.565	1.055	1.451
15.0	0.624	1.125	1.517
18.0	0.677	1.185	1.573
21.0	0.725	1.238	1.623
24.0	0.769	1.286	1.667
27.0	0.810	1.330	1.706
30.0	0.849	1.371	1.743
35.0	0.909	1.433	1.797
40.0	0.965	1.488	1.846
45.0	1.017	1.539	1.890
50.0	1.065	1.586	1.930
60.0	1.155	1.671	2.002
70.0	1.237	1.746	2.065
80.0	1.313	1.814	2.120
90.0	1.383	1.876	2.171
100.0	1.450	1.934	2.217
110.0	1.513	1.987	2.260
120.0	1.572	2.037	2.299
130.0	1.629	2.084	2.337
140.0	1.684	2.129	2.371
150.0	1.736	2.171	2.404
160.0	1.787	2.212	2.436
170.0	1.835	2.250	2.465
180.0	1.883	2.287	2.494
190.0	1.928	2.323	2.521
200.0	1.973	2.357	2.547
220.0	2.058	2.422	2.596
240.0	2.139	2.483	2.641
260.0	2.217	2.541	2.684
280.0	2.910	2.595	2.724
300.0	2.362	2.647	2.762

Note : (1) Linear interpolation is acceptable for intermediate values of z.

Gust Response Factors, G_h and G_z [1]

Height above ground level (metres)	G_h [2] and G_z		
	Exposure A	Exposure B	Exposure C
0-4.5	1.654	1.321	1.154
6.0	1.592	1.294	1.140
9.0	1.511	1.258	1.121
12.0	1.457	1.233	1.107
15.0	1.418	1.215	1.097
18.0	1.388	1.201	1.089
21.0	1.363	1.189	1.082
24.0	1.342	1.178	1.077
27.0	1.324	1.170	1.072
30.0	1.309	1.162	1.067
35.0	1.287	1.151	1.061
40.0	1.268	1.141	1.055
45.0	1.252	1.133	1.051
50.0	1.238	1.126	1.046
60.0	1.215	1.114	1.039
70.0	1.196	1.103	1.033
80.0	1.180	1.095	1.028
90.0	1.166	1.087	1.024
100.0	1.154	1.081	1.020
110.0	1.114	1.075	1.016
120.0	1.134	1.070	1.013
130.0	1.126	1.065	1.010
140.0	1.118	1.061	1.008
150.0	1.111	1.057	1.005
160.0	1.104	1.053	1.003
170.0	1.098	1.049	1.001
180.0	1.092	1.046	1.000
190.0	1.087	1.043	1.000
200.0	1.082	1.040	1.000
220.0	1.073	1.035	1.000
240.0	1.065	1.030	1.000
260.0	1.058	1.026	1.000
280.0	1.051	1.022	1.000
300.0	1.045	1.018	1.000

Note : (1) For main wind-force resisting systems, use building or structure height h for z.
(2) Linear interpolation is acceptable for intermediate values of z.

Overall Pressure Coefficients, $\bar{C}_p$ [2] for Rectangular Buildings with Flat Roofs

h/B	L/B					
	0.1	0.5	0.65	1.0	2.0	≥ 3.0
≤0.5	1.40	1.45	1.55	1.40	1.15	1.10
10.0	1.55	1.85	2.00	1.70	1.30	1.15
20.0	1.80	2.25	2.55	2.00	1.40	1.20
≥40.0	1.95	2.50	2.80	2.20	1.60	1.25

Note:(1) These coefficients are to be used with Method-2 given in Sec 2.4.6.6a(ii). Use $\bar{C}_p = \pm 0.7$ for roof in all cases.
(2) Linear interpolation may be made for intermediate values of h/B and L/B.

B.Sc. Engg. (CEE)/ 5th Sem. 25th February, 2020 (Afternoon)

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

Semester: Mid Semester Examination **Winter Semester: 2019-2020**
Course No.: CEE 4513 **Full Marks: 75**
Course Title: Structural Analysis and Design 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 and assume reasonable values for missing information.

1(a) Explain how BNBC incorporates geographical, structural and soil conditions into Equivalent static load method of earthquake lateral force estimation. (8)

(b) What are the exposure types in BNBC wind load calculation? In your opinion, what should be the exposure type of IUT and Uttara 3rd phase? Provide explanation. (5)

(c) For a simply supported beam of L length, find moment and shear influence line diagram at mid-span using free-body technique (show diagrams and equations developed for each section). (12)

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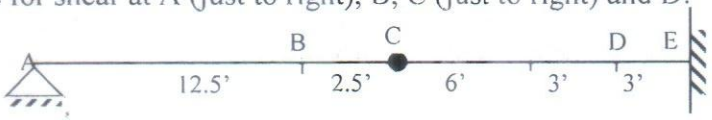
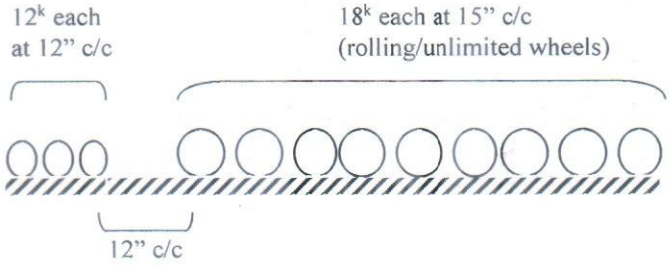


(Figure 1)

(b) What is the significance of Base shear and Force at the top in Earthquake analysis? Which one is controlled more prominently by weight and which one is by height? (4)

3. A wheel load system is shown below. Find maximum and minimum shear at the mid-span of a 24'-span simply supported beam for the wheel system if the wheels move right to left. (25)



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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 4539: Web Programming

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) Write the necessary HTML codes for creating the following table 15

Day	Seminar		
	Schedule		Topic
	Begin	End	
Monday	8:00 a.m	5:00 p.m	Introduction to XML
			Validity: DTD and Relax NG
Tuesday	8:00 a.m	11:00 a.m	XPath
	11:00 a.m	2:00 p.m	XSL transformation
	2:00 p.m	5:00 p.m	
Wednesday	8:00 a.m	12:00 p.m	

Figure 1

b) Differentiate between Responsive and Adaptive Web sites. 4

c) What are the differences between GET method and POST method in PHP? Explain where to use and where not to use each one of these methods with examples. 6

2. a) What will be the output of the following JavaScript code? 7

```
var text = "";
var i;
for (i = 0; i < 5; i++) {
      if(i==3)
          text += "The number is " + i + "<br><br>";
      else
           text += "The number is " + i + "<br>";
}
document.getElementById("demo").innerHTML = text;
```

b) Write the necessary HTML codes for creating the following page. (Give proper names to each input fields so that they can be later accessed easily for validation.) 10

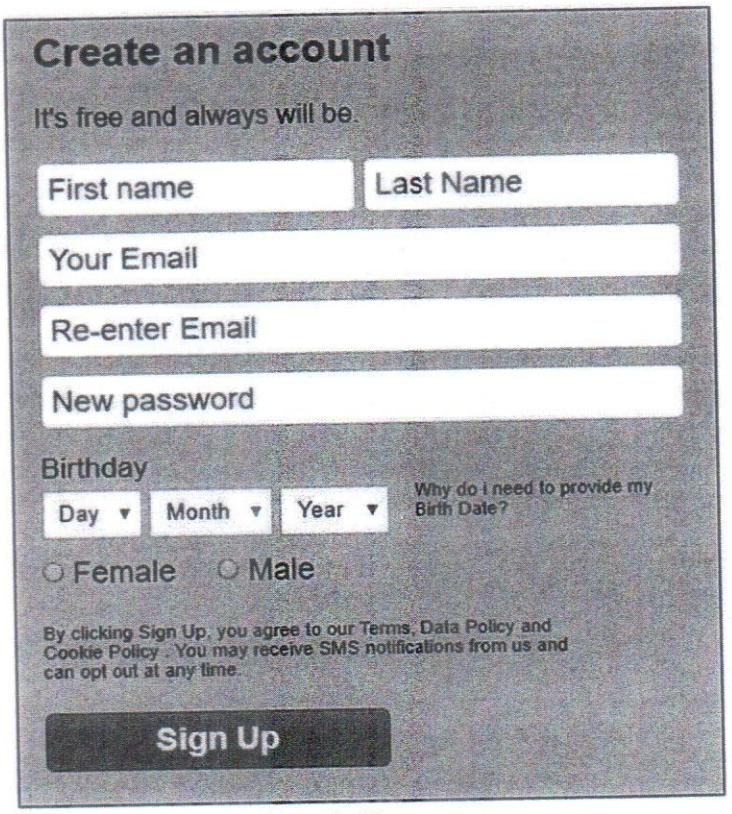

Figure 2: Sign up page

c) What are *meta* tags? Explain how they can be used to enhanced Search Engine Optimization. 8

3. a) Write short notes on the following: 5+2+2
   i. CSS Position property (Static, Relative, Absolute, Fixed, Sticky)
   ii. visibility: hidden; and display: none;
   iii. Block elements and inline elements

   b) Given the following unordered list: 6

- Home
- About
- Services
- Contact

Write CSS code required to transform the above list into a navigation bar list as follows. Assume the normal tags where used to create the list (**Note**: Only the CSS is required)

Home About Services Contact

c) What is Name Space in a DNS system? Explain the Name Resolution Process in DNS. 2+4

d) Compare between HTTP Request Messages and HTTP Response Messages. 4

4. a) What are web safe colors? Give an example of such colors. Is # FFCC99 a web safe color? 7

   b) Write the HTML code to generate the web page given in Figure 3 below. 18

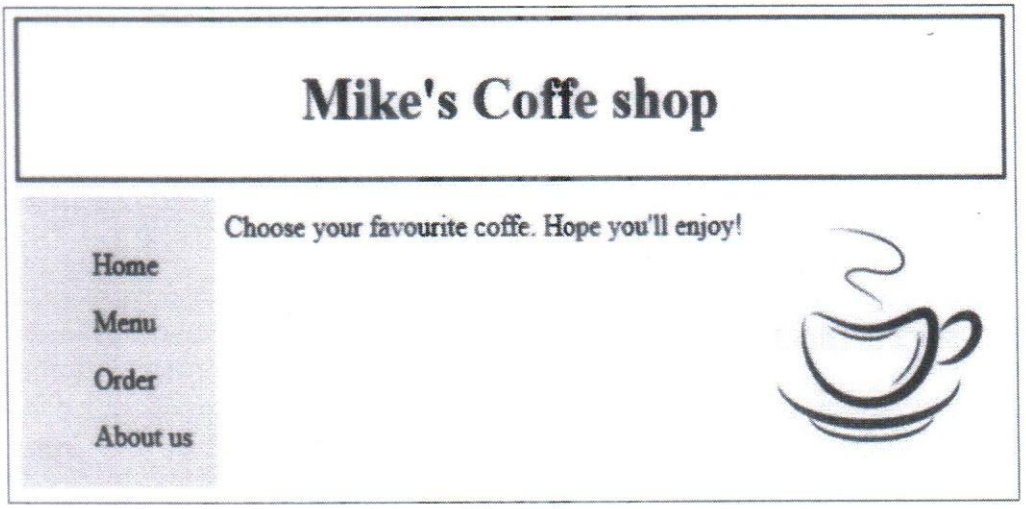

Figure 3

Instructions:

- The name of the image is 'coffee.jpg'
- Make proper use of margins, padding and borders if necessary.
- The left section (Home, Menu, Order and About us) is an unordered list and each of the elements is containing links.

B. Sc. Engg. (CEE)/ 5th Sem. 28 February 2020 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Semester Examination **Winter Semester: 2019-2020**
Course No.: CEE 4543 **Full Marks: 75**
Course Title: Foundation 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 question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning.

1(a) Briefly describe the shear failures in shallow foundation with net sketches of failure pattern and load-settlement curve. (8)

(b) What is the principle of virtual work? Explain the limitations of Upper Bound Theory and Lower Bound Theory. (5)

(c) Compute the dimensions of a trapezoidal combined footing (B_1, B_2, and L) for supporting two columns (in column 1, Q_1= 8.0 MN, in column 2, Q_2=6.0 MN). The spacing between the columns is 6.0 m center to center. The first column is located at 1.2 m from the property line. The net allowable bearing capacity of the ground is 400 kPa. Use the relation $B_1 = 1.5B_2$. (12)

2(a) A footing of 2.0m X 2.4m is placed at a depth of 1.6m from the ground surface. It is loading with an axial load of 2000 kN, bending moments about the shorter direction is 500 kN-m and about the longer direction is 400 kN-m. The ground conditions are shown in Fig.1. Calculate the ultimate bearing capacity of the footing for both general and local shear failures using Meyerhof equations for bearing capacity factors, shape factors and depth factors. (20)

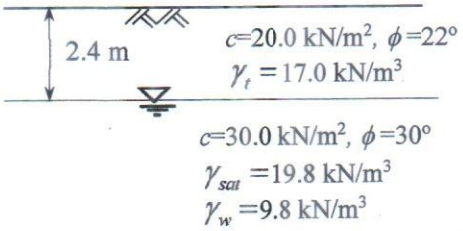

Fig.1

(b) Briefly describe negative skin friction in pile foundation and its effect in pile design. (5)

3(a) Compute the foundation depth (D_f) for a partially compensated mat foundation (32m X 48m) in fully saturated soils ($\phi = 25^O$, c = 30.0 kN/m², γ_{sat} =19.8kN/m³). Consider factor of safety, FS=2.0; dead load, DL=1200 MN; live load, LL=800 MN. Use, Meyerhof shape and depth factors. Use, γ_w =9.8kN/m³. (13)

(b) Estimate the foundation depth (D_f) for the same conditions of question 3(a) except the soil parameters $\phi = 0$ and c = 50.0 kN/m². (10)

(c) Comment on the depths of the mat foundation obtained from questions 3(a) and 3(b) based on the variation of soil type. (2)

4(a) Briefly describe the types of pile based on different classification systems. (7)

(b) Calculate the ultimate bearing capacity of a reinforced concrete pile (diameter = 0.80 m) with a total length of 30.0m driven in medium dense c-ϕ soil. The water table is at a depth of 8.0m from the ground surface. The K and δ values are found to be 0.80 and 0.90ϕ, respectively. The soil profile is shown in Fig.2. Use, γ_w =9.8kN/m^3. Use, Meyerhof equation for the end bearing capacity factors N_c and N_q. Use, Fig.3 where required. (18)

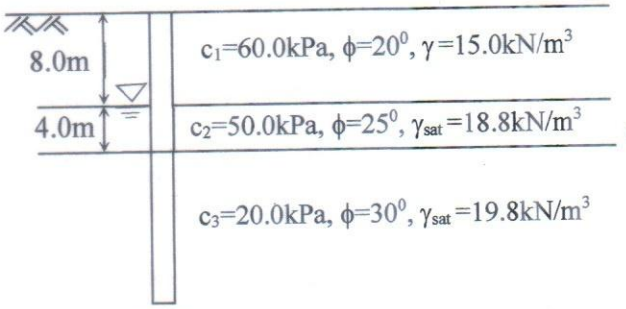

Fig.2

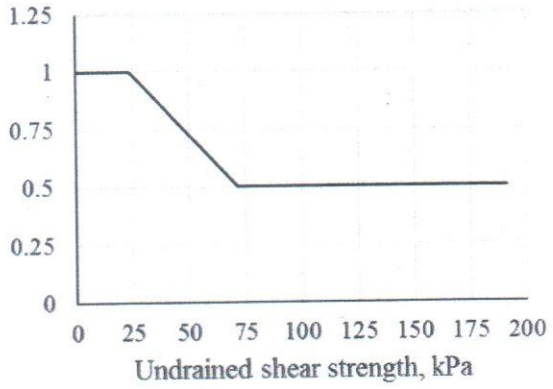

Fig.3

B.Sc. Engg. SWE 5th Semester — 02 March 2020 (Morning)

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

MID SEMESTER EXAMINATION — **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes — **FULL MARKS: 75**

Math 4543: Numerical Methods

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) When approximating any mathematical model using numerical methods, how can you use relative approximate errors to minimize the error? Explain your answer with the help of Tailor's Remainder Theorem. 5

   b) What do you understand by truncation error and round off error? Explain both of them with the MacLaurin Series expansion of $sin(\frac{\pi}{3})$. Your error should be calculated up to four significant digits. 10

   c) Given that $f(3) = 7$, $f'(3) = 4$, $f''(3)+1=11$, $f'''(3) = f''(3) + 3$ and that all other higher order derivatives of $f(x)$ are zero at x = 3, and assuming the function and all its derivatives exist and are continuous between x = 3 and x = 4.5. Find out the value of $f(4.3)$. Also provide an upper bound for the error with Taylor's remainder theorem if you used only 2 terms of the series. 10

2. a) Explain the advantages and drawbacks of bisection method for solving nonlinear equations. 6

   b) Solve the following non-linear equation within the range [-1, 0] and [0, 1] with at least 3 iterations. 12

   $$f(x) = 230x^4 + 18x^3 + 9x^2 - 221x - 9$$

   In each of the iterations, calculate the relative approximate error. Your answer should be correct up to 4th digit.

   c) Why do we need to use Spline interpolation over Lagrange interpolation for higher order approximation? Explain with appropriate logic. Use figure if necessary. 7

3. a) In order to find out the values of $3n$ number of unknowns, you need $3n$ number of equations. How can you get $3n$ number of simultaneous equations from $(n+1)$ data points in the Quadratic Spline method of interpolation? 10

   b) A thermistor is a special kind of thermometer that is able to calculate the temperature of a body using the value of the resistance attached to it. A manufacturer of thermistors makes several observations with a thermistor which are given in Table1. 8

   Table 1: Observations

R (ohm)	T (°C)
1101.0	25.113
911.3	30.131
636.0	40.120
451.1	50.128

   Determine the temperature corresponding to 758.8 ohms using a second order Lagrange polynomial. Your result should be correct up to 3 digits.

c) Generalize the n^{th} order form of Newton's Divided difference method of interpolation. Use figures or sketches if necessary. 7

4. a) Derive the coefficients of the linear regression model $y = a_0 + a_1 x$ using root mean square minimization of the residuals. 9

b) The progress of a homogeneous chemical reaction is followed and it is desired to evaluate the rate constant and the order of the reaction. The rate law expression for the reaction is known to follow the power function form: 10

$$-r = kC^n.$$

From the given data in Table 2. Calculate the value of n and k.

Table 2: Chemical Kinetics

C_A(gmol/l)	4	2.25	1.45	1.0	0.65	0.25	0.006
$-r_A$(gmol/l·s)	0.398	0.298	0.238	0.198	0.158	0.098	0.048

c) Convert the following nonlinear regression model into linear regression problem. 6

i. $y = Ae^{\lambda t}$ Where A and e are the regression coefficients.

ii. $y = \frac{ax}{b+x}$ Where a and b are the regression coefficients.

B.Sc. Engg. (CEE)/ 3rd Sem. **February 28, 2020 (Afternoon)**

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION WINTER SEMESTER: 2019-2020
COURSE NO. : GS 4353 TIME : 1.5 Hours
COURSE TITLE: Numerical Methods and Computer Programming 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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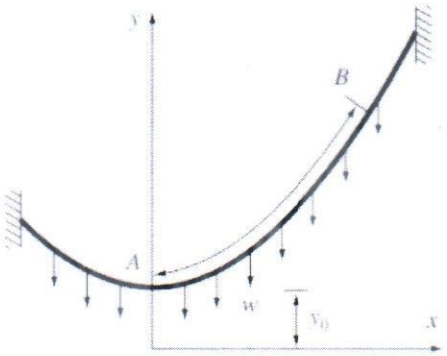
1. (a) A flexible chord carries $W = 0.1\ kN/m$ load and has $y_0 = 5\ m$. Determine tension T (within a range between 10 and 15 using Bisection method) at location where, $x = 50\ m$, $y = 15\ m$ and approximate error should be less than 1 percent. (12)



Given that, the cable follows the equation,

$$y = \frac{T}{W}\cosh\left(\frac{W}{T}x\right) + y_0 - \frac{T}{W}$$

(b) The following equation expresses oxygen level c (mg/L) in a river downstream from a sewage discharge site, where x is the distance downstream in kilometers. (13)

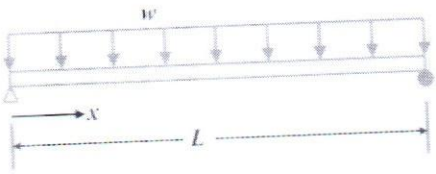
$$c = 10 - 20(e^{-0.2x} - e^{-0.75x})$$

Use Newton-Raphson method to determine the distance downstream where the oxygen level first falls to a reading of 5 mg/L. Your answer should be accurate up to a 1% approximate error.

2. (a) Write a short note on 'Different Errors in Numerical Methods'. (05)

(b) The simply supported beam shown in the following figure is subjected to uniform distributed load w. The deflection of the beam y is given by: (10)

$$y = -\frac{w}{24\,EI}(x^4 - 2Lx^3 + L^3x)$$



Develop a Taylor series expansion of y for three terms (second-order approximation) and then calculate the amount of deflection along the entire length of the beam using the following values:
$w = 14\ lb/in\ ;\ L = 360\ in\ ;\ E = 29{,}000{,}000\ lb/in^2\ ;\ I = 166\ in^4$
Tabulate and plot your results at an interval of $h = 45$, using a base point at $x_i = 90$

(c) The following differential equation represents instantaneous change of rabbit (x) and fox (y) of a certain ecosystem where time (t) is expressed in weeks. (10)

$$\frac{dx}{dt} = 4.5x - 0.9xy$$

$$\frac{dy}{dt} = -0.16y + 0.08xy$$

Determine the number of rabbit and fox after t = 2 weeks. Use Euler method and given that, h = 1 week, number of rabbit at initial condition is 4 and the number of fox at initial condition is also 4.

3. (a) Briefly discuss limitations of higher order polynomials. Also discuss problems of using Newton-Raphson method for determination of roots of equations. (05)

(b) The data below are the Flows of traffic in vehicle per hour for different densities in the N5 highway of Bangladesh in a particular day: (10)

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) An engineer involved in construction requires 4800 m^3, 5810 m^3 and 5690 m^3 of sand, fine gravel and coarse gravel, respectively for a building project. There are three pits from which these materials can be obtained. The composition of these pits in percentage is given in **Table-01**. How many cubic meters must be hauled from each pit in order to meet the engineer's needs? (By Gaussian Elimination method) (10)

	Sand	Fine Gravel	Coarse Gravel
Pit 1	52	30	18
Pit 2	20	50	30
Pit 3	25	20	55

Table-01

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

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

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. Also find the exact value of bending moment. (Given, at x = 0, bending moment M = 0)

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

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

Predict the discharge of wastewater after 4.6 $hrs.$ using the following methods.

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

Choose appropriate sets of data in each case to predict more accurate results.

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

Semester: **Mid Semester Examination** Winter Semester: **2019-2020**
Course No.: **CEE 4563** Full Marks: 75
Course Title: **Hydrology** 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) Define precipitation. State the formation of precipitation process and types of precipitation with diagram. (06)

b) On a winter day, the air temperature is reported to be 285 K with a relative humidity of 78%. (06)
(i) What is the saturated vapor pressure in Pascal?
(ii) What is the dew point temperature in Kelvin?

c) A 20 year study was conducted in a watershed area of 482 km^2. The precipitation was 101 cm/yr and the average stream flow was 5.32m^3/sec. What is the annual evapotranspiration for this area over the 20 year study? Assume net groundwater flows and the changes in storage are negligible. Also, assume the density of water is constant. (03)

d) In a rectangular area four rain gauges A, B, C and D are located as given in Figure 1. The recorded rainfall for December is as follows: Station A: 125mm, Station B: 165mm, Station C: 80mm and Station D: 50mm. Use the Thiessen method to compute the areal rainfall of the rectangle for the month of December. (Attach the figure to your answer script). (10)

2 a) Explain how water quality and atmospheric pressure affect evaporation? (04)

b) Why is there little regional variation of evaporation in Bangladesh? (02)

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

d) Develop the Horton's infiltration equation from the following data of an infiltrometer. Calculate the volume of infiltration 2 hours after the start of the test. (16)

Time from the start of test (min)	Infiltration Capacity (cm/hr)
5	3.6
15	3.1
25	2.6
50	2.5
75	2.33
100	2.25
130	2.1
150	2.1

3 a) Why is evapotranspiration generally more important than evaporation and how is it measured? (04)

b) Explain with a figure how the infiltration rate varies with the intensity of rainfall. (05)

c) Explain how a perennial river can be both influent and effluent. (02)

d) Calculate the cumulative infiltration, infiltration rate and the depth of the wetting front 1.5 hours after a rain if the hydraulic conductivity, suction at wetting front, porosity and initial moisture content are 1.80 cm/hr, 3.7 cm, 39% and 18% respectively. (14)

4 a) Explain with figures the difference between a hydrograph and a rating curve. (04)

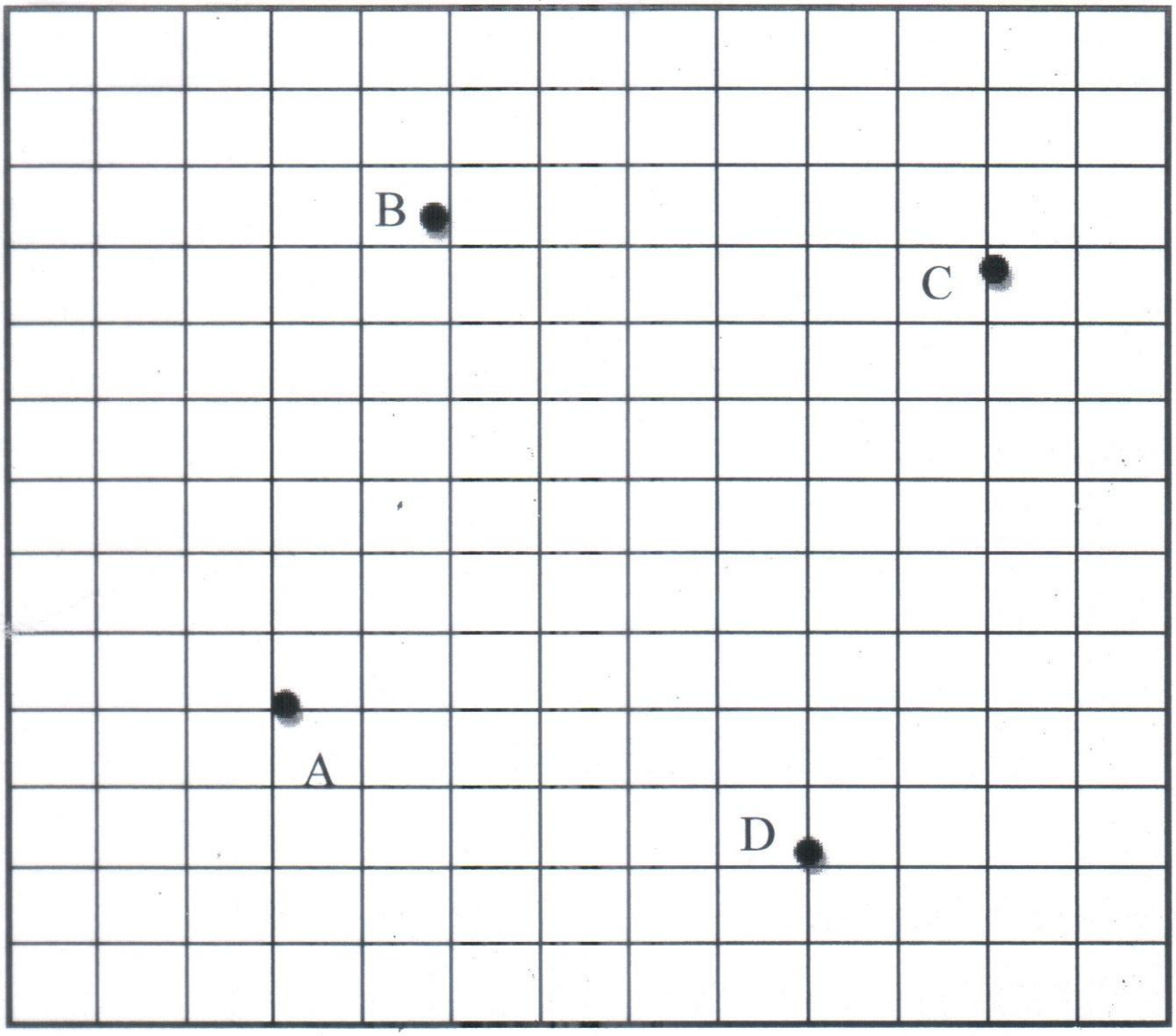
b) What are the differences between 'area velocity method' and 'moving boat method' of discharge measurement? (03)

c) What is ADCP and how does it function? (04)

d) The stage-discharge data of Sonali River are shown in the following table. If the water level at zero discharge is 1.62 m, then develop the stage-discharge relationship and calculate the discharge if the stage is 10.5 m. (14)

Stage (m)	4.42	5.33	6.46	7.19	7.50	7.74	8.05	8.47
Discharge (m^3/sec)	319.8	455.6	650.9	820.7	905.6	984.8	1098.0	1296.1

Figure 1



B.Sc. Engg. (CEE)/ 7th Sem. 27 February, 2019 (Morning)

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Semester: Mid Semester Examination **Winter Semester: 2019-2020**
Course No.: CEE 4703 **Full Marks: 75**
Course Title: GIS Application in Civil 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) A road network is shown in **Fig. 1** where circular nodes represent the destination points and numbers in square boxes represent the distance between connected nodes. If the objective is to travel from point **C** to point **I**, then find the shortest path between these points using Dijkstra's shortest path algorithm. Show step by step calculation. **(20)**

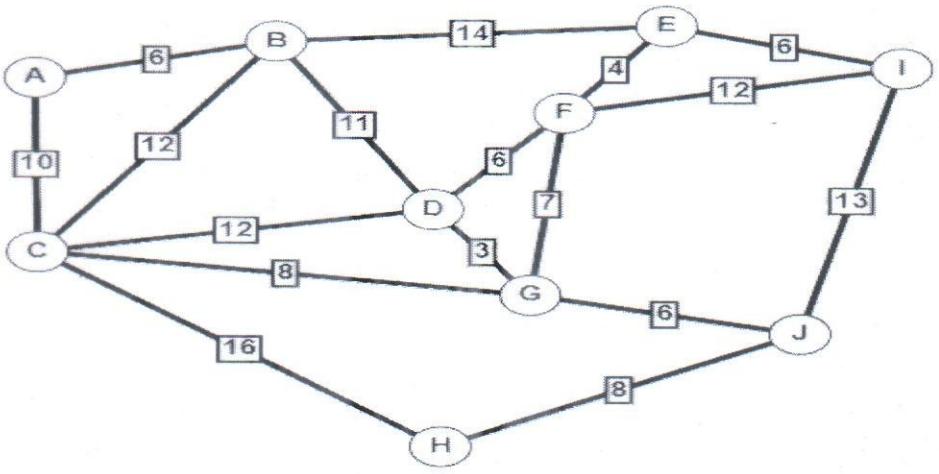

Fig. 1

(b) How many different numbers can be stored in 2 bytes of memory? Which are most commonly compressed, raster data or vector data? Why? **(5)**

2. (a) Consider the vector map in **Fig. 2**. Only the nodes have been coded. Name the existing lines and polygons. Then demonstrate how the data of this map will be stored in Topological and Spaghetti model (Simple polygon structure) **(22)**

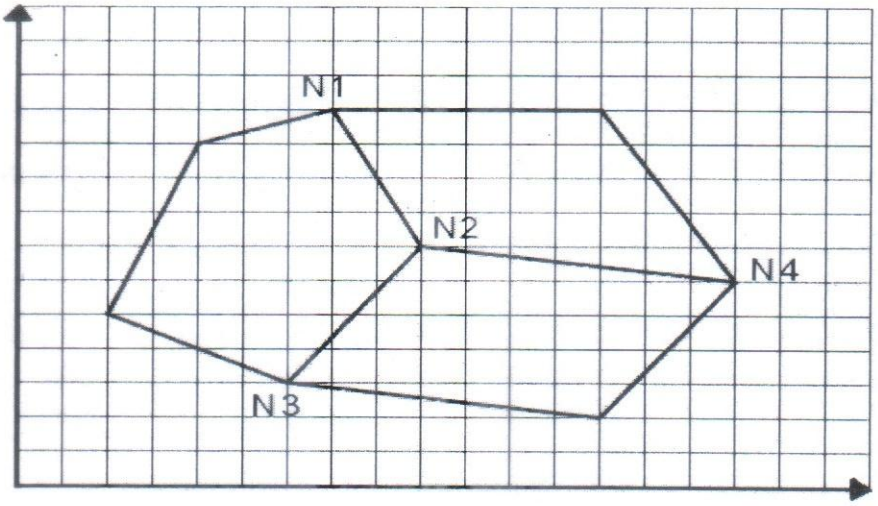

Fig. 2

(b) What are the advantages of using UTM projection system? **(3)**

3. **(a)** Locate your geographical position on x, y, z coordinate system from the following information. **(22)**

Satellite name	Location (x,y.z)	Signal interval with clock error (t_1-t_2+b)
A	15000, 7500 , 20000	0.067
B	18000, 2500, 19000	0.069
C	17000, 14500, 13000	0.073

(b) Is it possible to transform the projection system of a map without knowing it's original projection system using GIS software? If yes, mention the procedure. **(3)**

4. Two thematic maps are shown in **Fig.3** and **Fig. 4**. The attribute table for the maps are also provided. Perform the following analysis. **(25)**

   i. Combine the two vector map layers and show the geometric changes. Also, create the new attribute table for the combined map.

   ii. Convert the two vector maps into a raster maps maintaining the 8 x 6 grid system as shown. Mention the method used to resolve mixed cells. Show the necessary raster analysis to find out the regions where both agricultural land and loam soil exists.

   iii. Find out the area of polygon 3 in **Fig.4** from both vector and raster analysis. Calculate the percentage error between the two calculations. Consider cell size= 1 km.

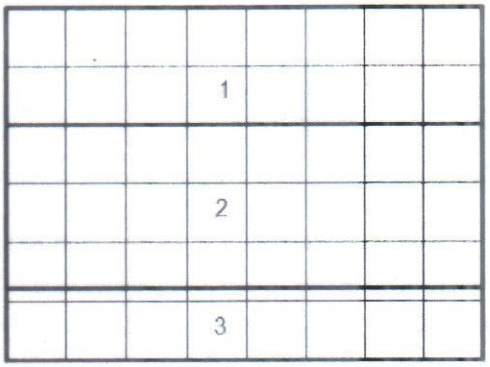

Fig. 3

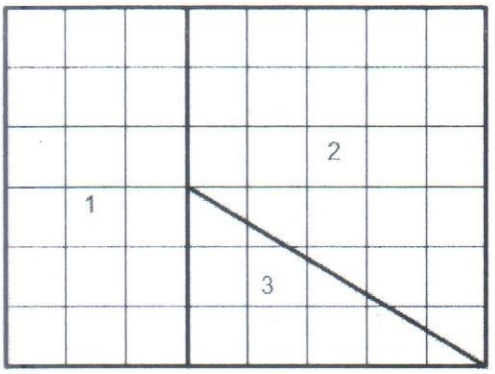

Fig. 4

Attribute Table for Fig 3	
ID	**Land use**
1	Agricultural
2	Urban
3	Forest

Attribute Table for Fig 4	
ID	**Soil type**
1	Loam Soil
2	Clay Soil
3	Sandy Soil

B.Sc. Engg. (CEE)/ 7th Sem. February 28, 2020 (Morning)

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION WINTER SEMESTER: 2019-2020
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. (a) Derive expression of Fixed End Moment for a span with length of L meter and with a uniformly distributed load of w KN/m throughout the span. (8)

   (b) Prove that, Distribution Factor is the ratio of member stiffness and joint stiffness for the joint B of the structure shown in Figure 01. (17)

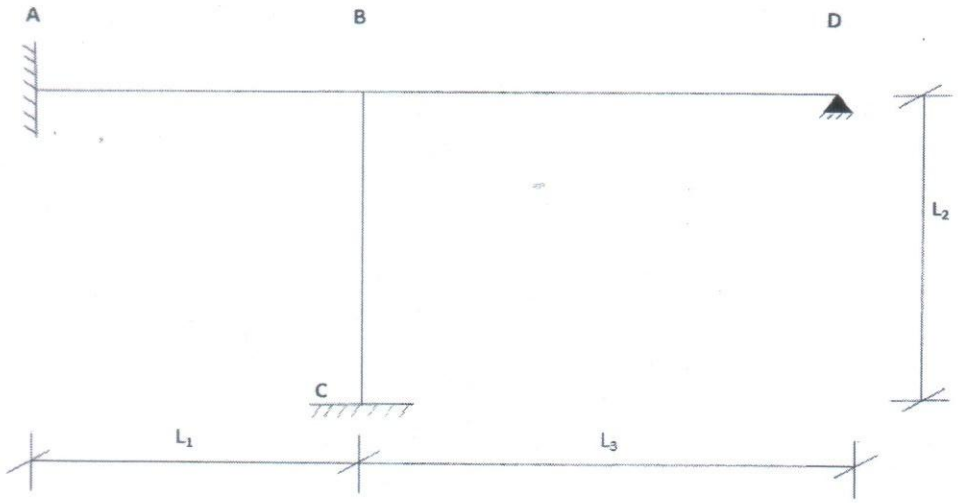

Figure 01 for question 1(b)

2. (a) Derive equations for Influence line of Reaction at A and Moment at A for the following beam shown in Figure 02. (25)

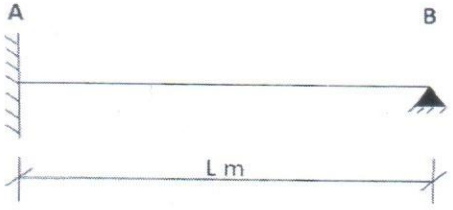

Figure 02 for question 2(a)

3. (a) Draw Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) for the following beam as shown in Figure 03. Assume that EI is constant. (25)

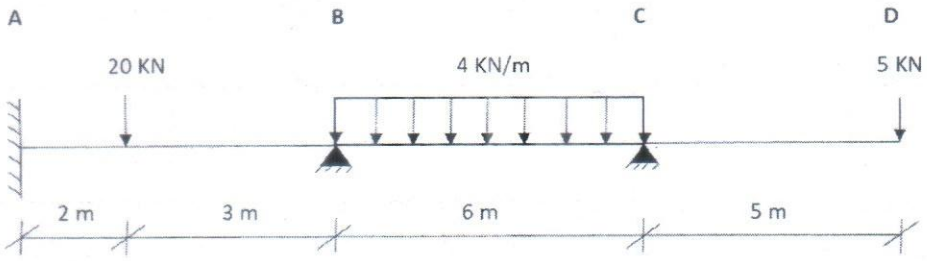

Figure 03 for question 3(a)

4. (a) Determine the support Reactions at point A and D of the structure as shown in Figure 04. Assume that EI is constant. (25)

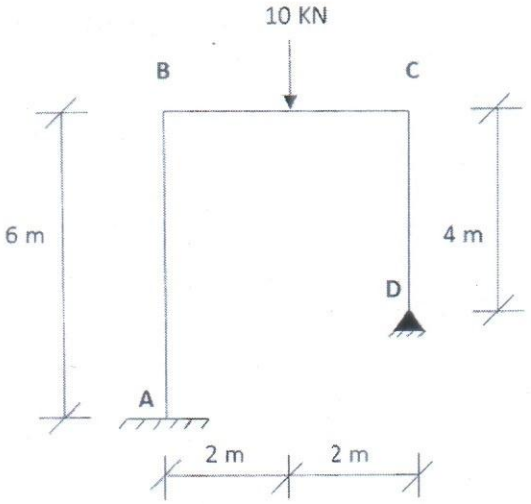

Figure 04 for question 4(a)

B.Sc. Engg. (CEE)/ 7th Sem. 27 February, 2020 (Morning)

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION WINTER SEMESTER: 2019-2020
COURSE NO. : CEE 4713 TIME : 1.5 Hours
COURSE TITLE: **Design of Steel Structures** 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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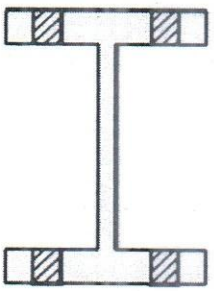
1. (a) Write the advantages and disadvantages of structural steel as a building material. (05)

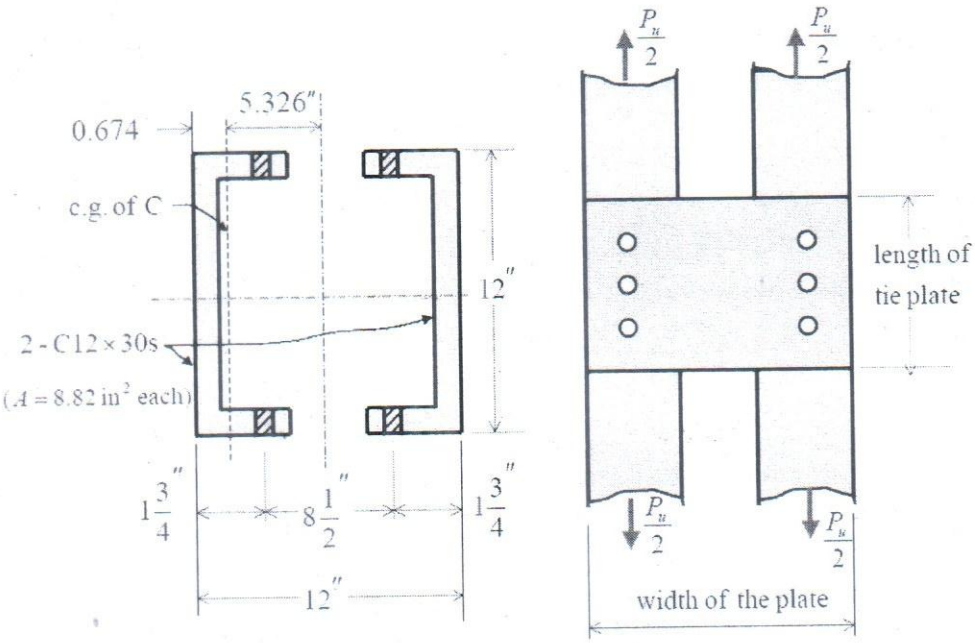
   (b) Select a 30-ft-long W12 lightest section of A992 steel to support a tensile service dead load of 130 kip and a tensile service live load of 110 kip. As shown in the following figure, the member is to have two lines of bolts in each flange for 7/8-in. bolts (at least three in a line 4 in. on center). Assume $U = 0.90$. (20)



2. (a) What is limit state? Explain strength, serviceability and special limit states. (05)

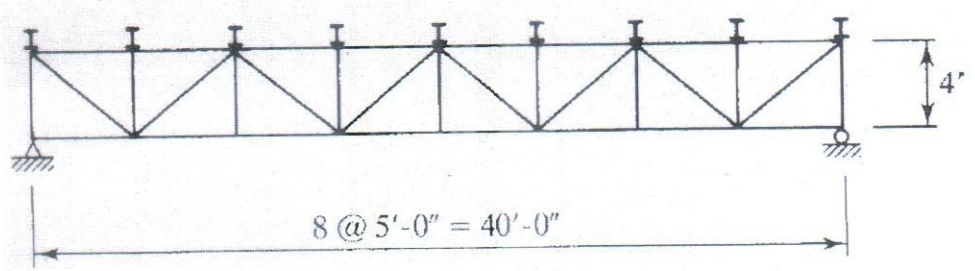
   (b) What do you mean by ASD and LRFD? Write down the differences between them. (05)

   (c) Two C12×30s, as shown in the following figure, have been selected to support a dead tensile working load of 120 kip and a live tensile working load of 240 kip. The member is 30 ft long and consists of A36 steel (F_y = 36 ksi, F_u = 58 ksi). The member has one line of at least three 7/8-in bolts in each channel flange 3 in. on center. Using the LRFD Specification, determine whether the member is satisfactory or not. Also design the necessary tie plates. Assume, U = 0.85. The following dimensions and properties of C12×30 sections are given: A_g = 8.82 in^2 each, t_f = 0.501 in., I_x = 162 in^4 each, I_y = 5.12 in^4 each, y axis 0.674 in. from back of C, and r_y = 0.762 in. (15)

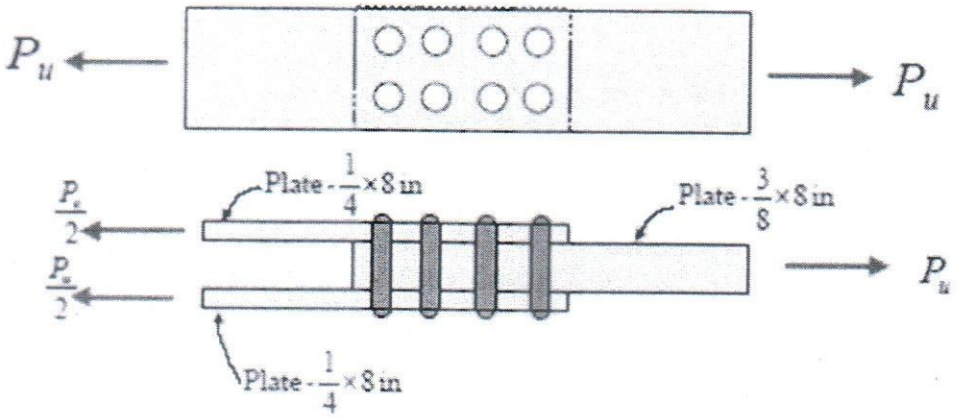


3. Select a structural tee for the bottom chord of the Warren roof truss shown in the following figure using LRFD specification. The trusses are welded and spaced at 20 feet. Assume that the bottom chord connection is made with 9-inch-long longitudinal welds at the flange. Use A992 steel and the following load data: (25)

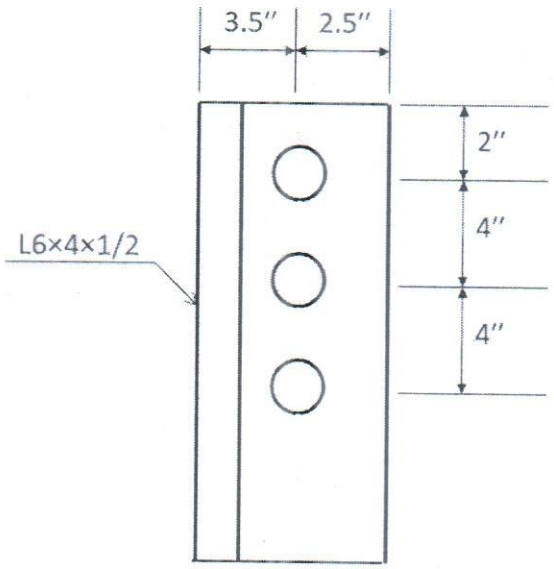
Purlins: M8 × 6.5
Snow: 20 psf of horizontal projection
Metal deck: 2 psf
Roofing: 4 psf
Insulation: 3 psf.



4. (a) Determine the net area of the 3/8×8-in plate shown in the following figure. The plate is connected at its ends with two lines of ¾-in bolts. (10)



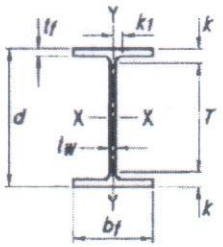
(b) The A572 Grade 50 (F_u = 65 ksi) tension member shown is connected with three ¾-in bolts. Determine the block shearing strength of the member and its tensile strength. Given: A_g = 4.72 in^2, and x in unconnected leg = 0.986 in. (15)



Applicable ASTM Specifications for Various Structural Shapes

Steel Type	ASTM Designation		F_y Min. Yield Stress (ksi)	F_u Tensile Stress[a] (ksi)	Applicable Shape Series									
					W	M	S	HP	C	MC	L	HSS Rect.	HSS Round	Pipe
Carbon	A36		36	58-80[b]	■	■	■	■	■	■	■			
	A53 Gr. B		35	60										■
	A500	Gr. B	42	58									■	
			46	58								■		
		Gr. C	46	62									⊡	
			50	62								⊡		
	A501		36	58								⊡	⊡	
	A529[c]	Gr. 50	50	65-100	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
		Gr. 55	55	70-100	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
High-Strength Low-Alloy	A572	Gr. 42	42	60	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
		Gr. 50	50	65[d]	⊡	⊡	⊡	■	⊡	⊡	⊡			
		Gr. 55	55	70	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
		Gr. 60[e]	60	75	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
		Gr. 65[e]	65	80	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
	A618[f]	Gr. I & II	50[g]	70[g]								⊡	⊡	
		Gr. III	50	65								⊡	⊡	
	A913	50	50[h]	60[h]	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
		60	60	75	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
		65	65	80	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
		70	70	90	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
	A992		50-65[i]	65[i]	■	⊡	⊡	⊡	⊡	⊡	⊡			
Corrosion Resistant High-Strength Low-Alloy	A242		42[j]	63[j]	⊡									
			46[k]	67[k]	⊡			⊡			⊡			
			50[l]	70[l]	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
	A588		50	70	⊡	⊡	⊡	⊡	⊡	⊡	⊡			
	A847		50	70								⊡	⊡	

■ = Preferred material specification.
⊡ = Other applicable material specification, the availability of which should be confirmed prior to specification.
□ = Material specification does not apply.



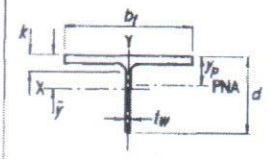
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web			Flange				Distance				
				Thickness, t_w		$\frac{t_w}{2}$	Width, b_f		Thickness, t_f		k		k_1	T	Work-able Gage
											k_{des}	k_{det}			
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W12×58	17.0	12.2	12 1/4	0.360	3/8	3/16	10.0	10	0.640	5/8	1.24	1 1/2	15/16	9 1/4	5 1/2
×53	15.6	12.1	12	0.345	3/8	3/16	10.0	10	0.575	9/16	1.18	1 3/8	15/16	9 1/4	5 1/2
W12×50	14.6	12.2	12 1/4	0.370	3/8	3/16	8.08	8 1/8	0.640	5/8	1.14	1 1/2	15/16	9 1/4	5 1/2
×45	13.1	12.1	12	0.335	5/16	3/16	8.05	8	0.575	9/16	1.08	1 3/8	15/16	↓	↓
×40	11.7	11.9	12	0.295	5/16	3/16	8.01	8	0.515	1/2	1.02	1 3/8	7/8	↓	↓
W12×35[c]	10.3	12.5	12 1/2	0.300	5/16	3/16	6.56	6 1/2	0.520	1/2	0.820	1 3/16	3/4	10 1/8	3 1/2
×30[c]	8.79	12.3	12 3/8	0.260	1/4	1/8	6.52	6 1/2	0.440	7/16	0.740	1 1/8	3/4	↓	↓
×26[c]	7.65	12.2	12 1/4	0.230	1/4	1/8	6.49	6 1/2	0.380	3/8	0.680	1 1/16	3/4	↓	↓
W12×22[c]	6.48	12.3	12 1/4	0.260	1/4	1/8	4.03	4	0.425	7/16	0.725	15/16	5/8	10 3/8	2 1/4[g]
×19[c]	5.57	12.2	12 1/8	0.235	1/4	1/8	4.01	4	0.350	3/8	0.650	7/8	9/16	↓	↓
×16[c]	4.71	12.0	12	0.220	1/4	1/8	3.99	4	0.265	1/4	0.565	13/16	9/16	↓	↓
×14[c,v]	4.16	11.9	11 7/8	0.200	3/16	1/8	3.97	4	0.225	1/4	0.525	3/4	9/16	↓	↓

W Shapes
Properties

W12 – W10

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
58	7.82	27.0	475	78.0	5.28	86.4	107	21.4	2.51	32.5	2.82	11.6	2.10	3570
53	8.69	28.1	425	70.6	5.23	77.9	95.8	19.2	2.48	29.1	2.79	11.5	1.58	3160
50	6.31	26.8	391	64.2	5.18	71.9	56.3	13.9	1.96	21.3	2.25	11.6	1.71	1880
45	7.00	29.6	348	57.7	5.15	64.2	50.0	12.4	1.95	19.0	2.23	11.5	1.26	1650
40	7.77	33.6	307	51.5	5.13	57.0	44.1	11.0	1.94	16.8	2.21	11.4	0.906	1440
35	6.31	36.2	285	45.6	5.25	51.2	24.5	7.47	1.54	11.5	1.79	12.0	0.741	879
30	7.41	41.8	238	38.6	5.21	43.1	20.3	6.24	1.52	9.56	1.77	11.9	0.457	720
26	8.54	47.2	204	33.4	5.17	37.2	17.3	5.34	1.51	8.17	1.75	11.8	0.300	607
22	4.74	41.8	156	25.4	4.91	29.3	4.66	2.31	0.848	3.66	1.04	11.9	0.293	164
19	5.72	46.2	130	21.3	4.82	24.7	3.76	1.88	0.822	2.98	1.02	11.8	0.180	131
16	7.53	49.4	103	17.1	4.67	20.1	2.82	1.41	0.773	2.26	0.982	11.7	0.103	96.9
14	8.82	54.3	88.6	14.9	4.62	17.4	2.36	1.19	0.753	1.90	0.962	11.7	0.0704	80.4



MT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem: Thickness, t_w		Stem: $\frac{t_w}{2}$	Stem: Area	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k	Distance: Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.
MT6.25×6.2[c,v]	1.80	6.27	6 1/4	0.1550	1/8	1/16	0.971	3.75	3 3/4	0.228	1/4	9/16	—
×5.8[c,v]	1.69	6.25	6 1/4	0.155	1/8	1/16	0.969	3.50	3 1/2	0.211	3/16	9/16	
MT6×5.9[c]	1.72	6.00	6	0.177	3/16	1/8	1.06	3.07	3 1/8	0.225	1/4	9/16	—
×5.4[c,v]	1.58	5.99	6	0.160	3/16	1/8	0.958	3.07	3 1/8	0.210	3/16	9/16	—
×5[c,v]	1.46	5.99	6	0.149	1/8	1/16	0.892	3.25	3 1/4	0.180	3/16	1/2	—
MT5×4.5[c]	1.32	5.00	5	0.157	3/16	1/8	0.785	2.69	2 3/4	0.206	3/16	9/16	—
×4[c]	1.17	4.98	5	0.141	1/8	1/16	0.701	2.69	2 3/4	0.182	3/16	9/16	—
MT5×3.75[c,v]	1.10	5.00	5	0.130	1/8	1/16	0.649	2.69	2 3/4	0.173	3/16	7/16	—
MT4×3.25[c,v]	0.953	4.00	4	0.135	1/8	1/16	0.540	2.28	2 1/4	0.189	3/16	9/16	—
×3.1[c]	0.904	4.00	4	0.129	1/8	1/16	0.516	2.28	2 1/4	0.177	3/16	7/16	—
MT3×2.2[c]	0.643	3.00	3	0.114	1/8	1/16	0.342	1.84	1 7/8	0.171	3/16	3/8	—
×1.85[c]	0.540	2.96	3	0.0980	1/8	1/16	0.290	2.00	2	0.129	1/8	5/16	—
MT2.5×9.45[f]	2.76	2.50	2 1/2	0.316	5/16	3/16	0.790	5.00	5	0.416	7/16	13/16	2 3/4[g]
MT2×3[f]	0.855	1.90	1 7/8	0.130	1/8	1/16	0.247	3.80	3 3/4	0.160	3/16	1/2	—

MT Shapes
Properties

MT SHAPES

Nominal Wt.	Compact Section Criteria: $\frac{b_f}{2t_f}$	Compact Section Criteria: $\frac{h}{t_w}$	Axis X-X: I	Axis X-X: S	Axis X-X: r	Axis X-X: $\bar{y}$	Axis X-X: Z	Axis X-X: y_p	Axis Y-Y: I	Axis Y-Y: S	Axis Y-Y: r	Axis Y-Y: Z	Q_s F_y = 36 ksi	Torsional Properties: J	Torsional Properties: C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
6.2	8.22	40.4	7.29	1.61	2.01	1.74	2.92	0.372	1.00	0.536	0.746	0.839	0.340	0.0246	0.0284
5.8	8.29	40.3	6.94	1.57	2.03	1.84	2.86	0.808	0.756	0.432	0.669	0.684	0.342	0.0206	0.0268
5.9	6.81	33.9	6.61	1.61	1.96	1.89	2.89	1.13	0.543	0.354	0.561	0.575	0.483	0.0249	0.0337
5.4	7.30	37.4	6.03	1.46	1.95	1.86	2.63	1.05	0.506	0.330	0.566	0.532	0.397	0.0196	0.0250
5	9.03	40.2	5.62	1.36	1.96	1.86	2.45	1.08	0.517	0.318	0.594	0.509	0.344	0.0145	0.0202
4.5	6.53	31.8	3.47	1.00	1.62	1.54	1.81	0.808	0.336	0.250	0.505	0.403	0.548	0.0156	0.0138
4	7.39	35.3	3.08	0.894	1.62	1.52	1.61	0.809	0.296	0.220	0.502	0.354	0.446	0.0112	0.00989
3.75	7.77	38.4	2.91	0.836	1.63	1.51	1.51	0.759	0.281	0.209	0.505	0.334	0.376	0.00932	0.00792
3.25	6.03	29.6	1.57	0.558	1.29	1.18	1.01	0.472	0.188	0.165	0.444	0.264	0.633	0.00917	0.00463
3.1	6.44	31.0	1.50	0.533	1.29	1.18	0.967	0.497	0.176	0.154	0.441	0.247	0.578	0.00778	0.00403
2.2	5.39	26.3	0.579	0.268	0.949	0.841	0.483	0.190	0.0897	0.0973	0.374	0.155	0.779	0.00494	0.00124
1.85	7.75	30.2	0.483	0.226	0.945	0.827	0.409	0.174	0.0863	0.0863	0.400	0.136	0.609	0.00265	0.000754
9.45	6.01	7.91	1.05	0.528	0.617	0.512	1.03	0.276	4.35	1.74	1.26	2.66	1.00	0.156	0.0732
3	11.9	14.6	0.208	0.133	0.493	0.341	0.241	0.112	0.732	0.385	0.926	0.588	1.00	0.00919	0.00193

B.Sc. Engg. (CEE)/ 7th Sem. March 2, 2020 (Morning)

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

Semester: Mid Semester Examination **Winter Semester: 2019-2020**
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.

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1 (a) IUT recently tested the wastewater quality parameters of an influent whose provider has put a confidentiality of its sources. The tested result shows in the table represents the characteristics of the wastewater. (18)

Parameters	pH	Grease	Suspended solids	Chloride	COD	BOD_5	Chromium
Unit	-	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
value	10	150	4500	15000	3500	3000	100

Now answer the followings-

i. Name the type of industry based on the observed characteristics of the wastewater. Justify your choice.
ii. What are the factors you would like to consider as a consultant before planning an effluent treatment plant (ETP)?
iii. Draw a systematic flow diagram required for the treatment of received influent.

(b) The authority wants to establish a small unit that will serially treat wastewater in a biological environment. Suggest an appropriate treatment facility with proper diagram. Briefly justify your choice. (07)

2 (a) Write short notes on (with diagram)- (10)
i. Underdrain and ventilation systems of a typical trickling filter
ii. Dissolved air floatation (DAF)
iii. Role of sludge types in activated sludge process

(b) Prove that, theoretical yield (Y_t) is greater that biomass yield (Y) by establishing stoichiometric relationship between organic matter, oxygen and microorganisms. (06)

(c) How many conditions are there in bacterial decompositions (based on oxygen availability)? Also, write down the basic equations responsible for the generation of the energy occurs in those decomposing conditions. (06)

(d) Draw a diagram of bacterial growth pattern in a batch culture. (03)

3(a) Specific growth rate, μ is a function of rate of substrate (S) utilization and is expressed by- $\mu = \mu_{max}\frac{S}{K_s+S}$. Answer the followings- (12)

i. Write down the famous Monod's equation.
ii. Draw a typical μ vs S graph showing limiting substrate (K_s)
iii. When does zero and first order reaction occurs in the kinetics? Briefly explain.

iv. Mention two examples of these two extreme conditions.

(b) Establish the Monod equation for a simple wastewater using following data- (13)

Substrate, S (mg/l)	9	12	20	25	40	60	90	120	150
Specific growth rate μ (d^{-1})	0.4	0.55	0.65	0.7	0.8	0.85	0.87	0.9	0.9

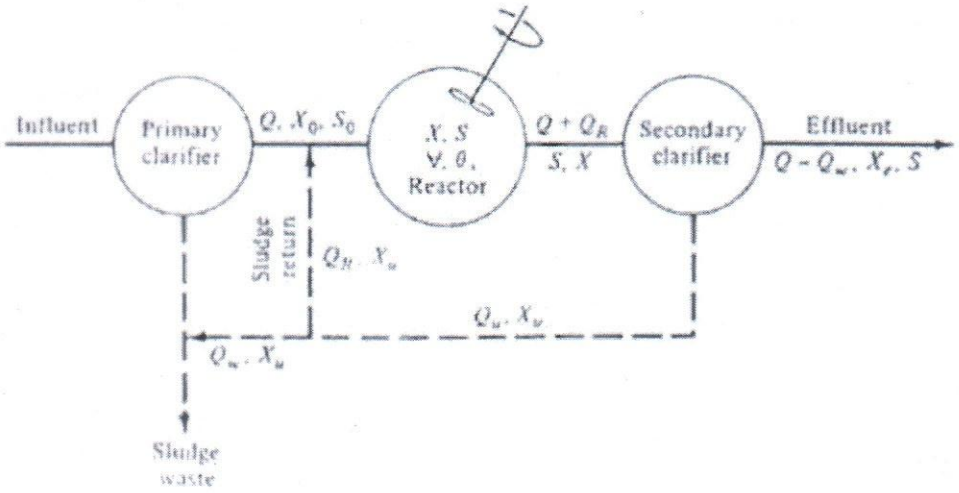
Estimate the value of limiting substrate from graph. Also calculate μ when S=30 and 115 mg/l using your established equation. Compare the results with the graphical results.

4 (a) Which type of aerator configuration provides better efficiency? Why? (03)

(b) Prove that, for a completely mixed activated sludge process with wasting from sludge return line- (07)
$\frac{1}{\theta_c} = Yk - K_d$

(c) A textile industry discharges its effluent to Balu River after treating through an activated-sludge process (completely mixed) that receives 150 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 kg/kg, K_d = 0.045 d^{-1}. Assuming an MLSS concentration of 4000 mg/L and an underflow concentration of 10,000 mg/L from the secondary clarifier, determine- (15)

i. Volume of the reactor (V)
ii. F/M ratio and Hydraulic retention time (HRT)
iii. Specific substrate utilization rate (k)
iv. the flow of solids that must be wasted each day (W_w)
v. Is the reactor efficient? Comments on the result



ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

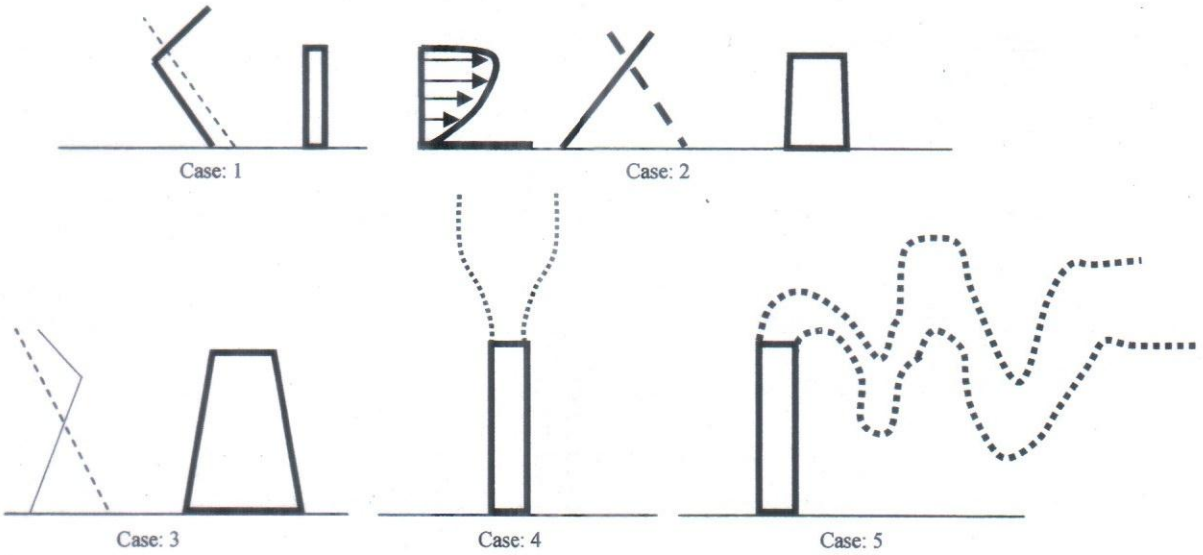
EXAM : MID SEMESTER EXAMINATION WINTER SEMESTER: 2019-2020
COURSE NO.: CEE 4735 TIME: 1.5 Hours
COURSE TITLE: Environmental Pollution and its Control FULL MARKS: 75

There are ~~6 (Six)~~ 4 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. Assume any reasonable value for missing data. The Symbols have their usual meaning.

1. (a) What is air quality management system? Explain the cycle of integrated air quality management system. **(07)**

   (b) Define lapse rate and adiabatic lapse rate. Derive the equation for adiabatic lapse rate for a dry air parcel. **(08)**

   (c) What are the design considerations of a stack? Draw the plume pattern for case 1, 2, 3 and temperature profile (comparing ambient and adiabatic lapse rate) for case 4, 5. Apply wind velocity where necessary. Name and Describe the effects of lapse rate on the plume pattern for all cases. **(10)**



2. (a) Comment on the following statements whether they are **True** or **False**. Justify your answer. **(04)**
   i. For a particle to be collected in the gravitational settling chamber the residence time must be equal to or greater than the collection time.
   ii. In order to avoid re-entrainment of collected dust within the gravitational settling chamber, the throughput velocity must exceed the pickup velocity.

   (b) Define particulate matter. How USEPA categorized particulate matter on the basis of **(06)**

size? Explain the modes of formation of particulates.

(c) Daily pollutant concentrations were calculated and averaged for the month of January 2020 from continuous air monitoring stations located at Gazipur, Chattogram and Khulna city summarized as below: **(15)**

Parameter	Unit	NAAQS	Gazipur	Chattogram	Khulna
SO_2 – 24 hr.	ppb	140	4.96	8.6	N/A
NO_2 – 24 hr.	ppb	53	63.7	41	51
CO	ppm	9	2.51	1.61	1.25
$PM_{2.5}$ – 24 hr.	$\mu g/m^3$	65	192	141	138
PM_{10} – 24 hr.	$\mu g/m^3$	150	315	104	153

Determine the AQI value for each station against each parameter and identify critical pollutant using the following breakpoint table. Also prepare an AQI report for the city having highest AQI.

These Breakpoints							equal these PSIs
O_3 (ppm) 8-hour	O_3 (ppm) 1-hour[1]	PM_{10} ($\mu g/m^3$)	$PM_{2.5}$ ($\mu g/m^3$)	CO (ppm)	SO_2 (ppm)	NO_2 (ppm)	PSI
0.000 - 0.069	-	0 - 54	0.0 - 15.4	0.0 - 4.4	0.000 - 0.034	(*)	0 - 50
0.070 - 0.084	-	55 - 154	15.5 - 65.4	4.5 - 9.4	0.035 - 0.144	(*)	51 - 100
0.085 - 0.104	0.125 - 0.164	155 - 254	65.5 - 100.4	9.5 - 12.4	0.145 - 0.224	(*)	101 - 150
0.105 - 0.124	0.165 - 0.204	255 - 354	100.5 - 150.4	12.5 - 15.4	0.225 - 0.304	(*)	151 - 200
0.125 - 0.374 (0.155 - 0.404)[1]	0.205 - 0.404	355 - 424	150.5 - 250.4	15.5 - 30.4	0.305 - 0.604	0.65 - 1.24	201 - 300
(*)	0.405 - 0.504	425 - 504	250.5 - 350.4	30.5 - 40.4	0.605 - 0.804	1.25 - 1.64	301 - 400
(*)	0.505 - 0.604	505 - 604	350.5 - 500.4	40.5 - 50.4	0.805 - 1.004	1.65 - 2.04	401 - 500

3. (a) List down the criteria pollutants under the clean air act 1970. Mention the pollutant specific health effects statements of any three pollutants for the pollutant standard index. **(08)**

(b) Define emission inventory and mention its importance. **(04)**

(c) It is desired to design a cyclone that will remove 15 micrometer particles with 50% efficiency from an airstream of 6.0 m^3/min. The temperature of the air is 75^0 C and specific gravity of the particles is 1.5. The cyclone is to have standard dimensions. **(08)**

(d) The air pollution control equipment on a municipal waste incinerator includes a fabric filter particle collector (known as a baghouse). The baghouse contains 424 cloth bags arranged in parallel, that is 1/424 of the flow goes through each bag. The gas flow rate into and out of the baghouse is 47 m^3/s, and the concentration of particles entering the baghouse is 15 g/m^3. In normal operation, the baghouse particulate discharge meets the regulatory limit of 24 mg/m^3. During preventive maintenance replacement of the bags, **(05)**

one bag is inadvertently not replaced, so only 423 bags are in place.
Calculate the fraction of particulate matter removed and the efficiency of particulate removal when all 424 bags are in place and the emissions comply with the regulatory requirements. Estimate the mass emission rate when one of the bags is missing and recalculate the efficiency of the baghouse. Assume the efficiency for each individual bag is the same as the overall efficiency for the baghouse.

4. (a) What are the advantages and disadvantages of wet collectors? Explain the pollutant capture mechanisms within wet collectors. **(06)**

(b) Explain the typical diurnal variation of NO, NO_2 and O_3 in the atmosphere with figure. **(04)**

(c) Design a settling chamber to collect particles with 50 μm in diameter and 111 lb/ft^3 in density from an air stream with a volumetric flow of 8 ft^3/s. The cross-sectional area of the square inlet cannot exceed 9 ft^2. (a) How long must the chamber be to give theoretical perfect collection efficiency? (b) Determine the collection efficiency for 10 μm particles with the same density. Assume the gas stream temperature is 70°F such that the gas density and viscosity are 0.075 lb/ft^3 and 51.23 10 lb/ft-s respectively. Use both the plug flow and mixed model and comment which one provides the realistic rate of efficiency? Assume any reasonable value for missing data. **(15)**

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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 number of flips until there is a run of three consecutive heads. Find 7+6
   i. $P(N \leq 8)$
   ii. $P(N = 8)$

   b) Suppose that, whether or not, it rains today depends on previous weather conditions through the last two days. If it has rained for the past two days, then it will rain tomorrow with probability 0.7; if it rained today but not yesterday, then it will rain tomorrow with probability 0.5; if it rained yesterday but not today, then it will rain tomorrow with probability 0.4; if it has not rained in the past two days, then it will rain tomorrow with probability 0.2. 6+3+3
   i. Given that it rained on Monday and Tuesday, what is the probability that it will rain on Thursday?
   ii. Given that it rained neither on Monday nor on Tuesday, what is the probability that it will rain on Thursday?
   iii. Given that it rained on Monday and Tuesday, what is the probability that it will not rain on Thursday?

2. a) Suppose for a Poisson process with arrival rate of λ=30 per hour. Answer the followings: 4×4
   i. The expected number of arrivals in the first 15 minutes of an hour.
   ii. The probability of exactly 5 arrivals in the first 10 minutes of an hour.
   iii. The probability of 3 or fewer arrivals in the first 20 minutes of an hour.
   iv. The probability of 35 or more arrivals in an hour given that there were 8 arrivals in the first 10 minutes of that hour.

   b) Suppose that the amount of time one spends in a bank is exponentially distributed with mean ten minutes, that is, $\lambda = 0.1$. 5+4
   i. What is the probability that a customer will spend more than fifteen minutes in the bank given that she is still in the bank after ten minutes?
   ii. Show the memoryless property of above question's exponential distribution.

3. a) Consider a gambler who at each play of the game has probability p of winning one unit and probability $q = 1 - p$ of losing one unit. Assuming that successive plays of the game are independent, what is the probability that, starting with i units, the gambler's fortune will reach N before reaching 0? 10

   b) Suppose Max and Patty decide to flip pennies, the one coming closest to the wall wins. Patty, being the better player, has a probability 0.6 of winning on each flip. 5
   If Patty starts with five pennies and Max with ten, what is the probability that Patty will wipe Max out?

c) On any given day Gary is either cheerful (C), so-so (S), or glum (G). If he is cheerful today, then he will be C, S, or G tomorrow with respective probabilities 0.5, 0.4, 0.1. If he is feeling so-so today, then he will be C, S, or G tomorrow with probabilities 0.3, 0.4, 0.3. If he is glum today, then he will be C, S, or G tomorrow with probabilities 0.2, 0.3, 0.5. In the long run, what proportion of time is the process in each of the three states? 10

4. a) Let $P^{(1)}$ and $P^{(2)}$ denote transition probability matrices for ergodic Markov chains having the same state space. Let π^1 and π^2 denote the stationary (limiting) probability vectors for the two chains. Consider a process defined as follows: 5+5+5

   i. $X_0 = 1$. A coin is then flipped and if it comes up heads, then the remaining states X1,.
   are obtained from the transition probability matrix $P^{(1)}$ and if tails from the matrix $P^{(2)}$. Is $\{X_n, n>= 0\}$ a Markov chain?

   ii. If p = P{coin comes up heads}, what is $\lim_{n\to\infty} P(X_n = i)$?

   iii. $X_0 = 1$. At each stage the coin is flipped and if it comes up heads, then the next state is chosen according to $P^{(1)}$ and if tails comes up, then it is chosen according to $P^{(2)}$. In this case do the successive states constitute a Markov chain? If so, determine the transition probabilities.

b) A professor continually gives exams to her students. She can give three possible types of exams, and her class is graded as either having done well or badly. Let *pi* denote the probability that the class does well on a type *i* exam, and suppose that $p1 = 0.3$, $p2 = 0.6$, and $p3 = 0.9$. If the class does well on an exam, then the next exam is equally likely to be any of the three types. If the class does badly, then the next exam is always type 1. What proportion of exams are type *i*, $i = 1, 2, 3$? 10

B.Sc. Engg. (CEE), 7th Sem. 03 March, 2020 (Morning)

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

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

MID-SEMESTER EXAMINATION
Course No. : HUM 4753
Course Title : Engineering Economics and Accounting

Winter Semester : 2019-2020
Time : 1.5 hours
Full Marks : 75

There are **4 (four)** questions. Answer **any 3 (three)** of them. 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) On May 1, Thomas Magnum started Skyline Flying School, a company that provides flying lessons, by investing $45,000 cash in the business. Following are the assets and liabilities of the company on May 31, 2019, and the revenues and expenses for the month of May. (16)

Cash	$5,600
Accounts Receivable	7,200
Equipment	64,000
Accounts Payable	800
Notes Payable	30,000
Lesson Revenue	7,500
Rent Expense	1,200
Repair Expense	400
Fuel Expense	2,500
Insurance Expense	400

Thomas made no additional investment in June, but withdrew $1,500 in cash for personal use during the month.

Required:

Prepare an **Income Statement** and **Owner's Equity Statement** for the month of May and a **Balance Sheet** at May 31, 2019.

b) Muaz Hasan is a licensed dentist. During the first month of the operation of his business, the following events and transactions occurred. (9)

April 1: Invested $40,000 cash.
April 1: Hired a secretary-receptionist at a salary of $600 per week payable monthly.
April 2: Paid office rent for the month $1,000.
April 3: Purchased dental supplies on account from Smile Company $4,000.
April 10: Provided dental services and billed insurance companies $5,100.
April 11: Received $1,000 cash advance from Trudy Borke for an implant.
April 20: Received $2,100 cash for services completed and delivered to John Stanley.
April 30: Paid secretary-receptionist for the month $2,400.

April 30: Paid $1,600 to Smile Company for accounts payable due.

Muaz uses the following chart of accounts: No. 101 Cash, No. 112 Accounts Receivable, No. 126 Supplies, No. 201 Accounts Payable, No. 205 Unearned Revenue, No. 301 Muaz Hasan, Capital; No. 400 Service Revenue, No. 726 Salaries Expense, and No. 729 Rent Expense.

Required:

Journalize the above transactions for the month March 2018.

2. a) Morris Glass Company has decided to invest funds for the next 5 years so that development of "smart" glass is well funded in the future. This type of new-technology glass uses electro chrome coating to allow rapid adjustment to sun and dark in building glass, as well as assisting with internal heating and cooling cost reduction. The financial plan is to invest first, allow appreciation to occur, and then use the available funds in the future. All cash flow estimates are in $1000 units, and the interest rate expectation is 8% per year. (12)
Years 1 through 5: Invest $7000 in year 1, decreasing by $1000 per year.
Years 6 through 10: No new investment and no withdrawals.
Years 11 through 15: Withdraw $20,000 in year 11, decreasing 20% per year.
Determine the equivalent present worth of the project with proper CFD.

b) Ten years ago, Jacobson Recovery purchased a wrecker for $285,000 to move disabled 18-wheelers. He anticipated a salvage value of $50,000 after 10 years. During this time his average annual revenue totaled $52,000. Did he recover his investment and a 12% per year return? (5)

c) PGM Consulting is under contract to Montgomery County for evaluating alternatives that use a robotic, liquid-propelled "pig" to periodically inspect the interior of buried potable water pipes for leakage, corrosion, weld strength, movement over time, and a variety of other parameters. Two equivalent robot instruments are available. Robot Joeboy will have a first cost of $85,000, annual M&O costs of $30,000, and a $40,000 salvage value after 3 years. Robot Watcheye will have a first cost of $125,000, annual M&O costs of $27,000, and a $33,000 salvage value after its 5-year life. Assume an interest rate of 8% per year. Which robot is the better economic option? (8)

3. a) The supervisor of a community swimming pool has developed two methods for chlorinating the pool. If gaseous chlorine is added, a chlorinator will be required that has an initial cost of $8000 and a useful life of 5 years. The chlorine will cost $650 per year, and the labor cost will be $800 per year. Alternatively, dry chlorine can be added manually at a cost of $1000 per year for chlorine and $1900 per year for labor. Which method should be used on the basis of a present worth analysis if the interest rate is 10% per year? (7)

b) An electric switch manufacturing company has to choose one of three different assembly methods. Method A will have a first cost of $40,000, an annual operating cost of $9000, and a service life of 2 years. Method B will cost $80,000 to buy and will have an annual operating cost of $6000 over its 4-year service life. Method C will cost $130,000 initially with an annual operating cost of $4000 over its 8-year life. Methods A and B will have no salvage value, but method C will have some equipment worth an estimated $12,000. Which method should be selected? Use present worth analysis at an interest rate of 10% per year. (8)

c) A wealthy businessman wants to start a permanent fund for supporting research directed toward sustainability. The donor plans to give equal amounts of money for each of the next 5 years, plus one now (i.e., six donations) so that $100,000 per year can be withdrawn each year forever, beginning in year 6. If the fund earns interest at a rate of 8% per year, how much money must be donated each time? (8)

d) What is the difference between mutually exclusive alternatives and independent projects? (2)

4. 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) Your friend Fuad is asking you the debit and credit procedure of three different types of accounts. Which chart will you show him? (8)

d) The total assets of Pereira Company are $57,000. Karen Perry's capital account is $25,000; drawings are $7,000; revenues, $50,000; and expenses, $35,000. What is the amount of the company's total liabilities? (5)

Compound Interest Factor Tables

Interest rate 6%

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	1.0600	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%

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	1.0800	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 12%

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	1.1200	0.8929	1.00000	1.0000	1.12000	0.8929		
2	1.2544	0.7972	0.47170	2.1200	0.59170	1.6901	0.7972	0.4717
3	1.4049	0.7118	0.29635	3.3744	0.41635	2.4018	2.2208	0.9246
4	1.5735	0.6355	0.20923	4.7793	0.32923	3.0373	4.1273	1.3589
5	1.7623	0.5674	0.15741	6.3528	0.27741	3.6048	6.3970	1.7746
6	1.9738	0.5066	0.12323	8.1152	0.24323	4.1114	8.9302	2.1720
7	2.2107	0.4523	0.09912	10.0890	0.21912	4.5638	11.6443	2.5512
8	2.4760	0.4039	0.08130	12.2997	0.20130	4.9676	14.4714	2.9131
9	2.7731	0.3606	0.06768	14.7757	0.18768	5.3282	17.3563	3.2574
10	3.1058	0.3220	0.05698	17.5487	0.17698	5.6502	20.2541	3.5847
11	3.4785	0.2875	0.04842	20.6546	0.16842	5.9377	23.1288	3.8953
12	3.8960	0.2567	0.04144	24.1331	0.16144	6.1944	25.9523	4.1897
13	4.3635	0.2292	0.03568	28.0291	0.15568	6.4235	28.7024	4.4683
14	4.8871	0.2046	0.03087	32.3926	0.15087	6.6282	31.3624	4.7317
15	5.4736	0.1827	0.02682	37.2797	0.14682	6.8109	33.9202	4.9803
16	6.1304	0.1631	0.02339	42.7533	0.14339	6.9740	36.3670	5.2147
17	6.8660	0.1456	0.02046	48.8837	0.14046	7.1196	38.6973	5.4353
18	7.6900	0.1300	0.01794	55.7497	0.13794	7.2497	40.9080	5.6427
19	8.6128	0.1161	0.01576	63.4397	0.13576	7.3658	42.9979	5.8375
20	9.6463	0.1037	0.01388	72.0524	0.13388	7.4694	44.9676	6.0202

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

TERM : **MID SEMESTER EXAMINATION** WINTER SEMESTER: **2019-2020**
COURSE NO. : **CEE 4769** TIME : 1.5 Hours
COURSE TITLE: **River Engineering and Flood Mitigation** FULL MARKS: 75

There are 4 (Four) questions. Answer 3 (three) of them while **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) Explain different types of river planform (with sketches) with two examples for each in Bangladesh. How longitudinal slope classify a planform as meandering or braided for a constant river flow? (10)

(b) The following parameters have been measured in a river:
Average discharge = 5000 m^3/s, Channel width = 1100 m, flow depth = 8 m, average sediment size in the bed = 0.12 mm. Evaluate whether river bed sediment will transport or not? Assume other parameters if required. (15)

2 (a) What are the differences of short-cut and chut-cut, generally observed in meandering rivers? Explain the developing processes with sketches for both. (10)

(b) A reach of a river has sinuosity of 1.20. The linear wavelength of the reach is 50 km, average velocity is 1.10 m/s and channel width is the one-tenth of the wavelength. Estimate super elevation at bend apex. Assume minimum radius of curvature at the bend is equal to 10 km. (15)

3(a) Rainfall intensity, topography tidal extents and anthropogenic developments are playing important role in generating different kind of floods. Explain the types of floods with particular reference Bangladesh. (15)

(b) Sediment transport is the pre-requisite for river bank erosion. Justify this statement. Explain different mode of sediment transport (with sketches) in rivers. (10)

4 (a) Explain the processes (with sketch) of bank erosion in alluvial rivers and explain the following modes of bank failure: Planer/Slab Failure, Rotational Failure, Beam failure. (15)

(b) "Flood warning is provided in terms of Danger Level". What is Danger level? What are differences in between the following terminologies: Flood hazard, Flood vulnerability and Flood Risk? (10)

M. Sc. Engg. (CEE) 28 February (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM : MID SEMESTER EXAMINATION SUMMER SEMESTER: 2019-2020
COURSE NO. : CEE 6109 TIME : 1.5 Hours
COURSE TITLE: Advance Concrete Technology FULL MARKS: 75

There are 3 (Three) 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. Assume reasonable data, if necessary.

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1 The specified FM of fine aggregate of a bridge project is 2.6. The sieve analysis data of a fine aggregate sample collected for the bridge project are summarized below: (25)

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	20
#8	70
#12	60
#16	30
#30	0
#40	0
#50	0
#100	110
#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 2.8 to obtain the required fineness modulus of 2.6?

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

2(a) Compare the consumption rate of construction materials in Bangladesh with respect to global rate of consumptions. (5)

(b) "Cement industries pollute our environment significantly" – Justify. Explain the countermeasures that can be taken to reduce this pollution. (5)

(c) Explain the influence of the following (related to coarse aggregate of concrete) on the compressive strength of concrete: (8)

(i) AIV
(ii) ACV
(iii) TPF
(iv) Abrasion
(v) FM
(vi) Angularity Number
(vii) Elongation Index
(viii) Flakiness Index

(d) Explain the significance of using gypsum in cement with chemical reactions. (7)

3 In an experiment in the Concrete Lab of IUT, a cement paste was prepared by adding 100 g of cement with 25 g of water. The paste was kept in a sealed environment, i.e., water was not allowed to enter into the paste or evaporate from the paste. Calculate the following: (25)

(i) Amount of cement hydrated,
(ii) Water chemically combined during hydration of cement,
(iii) Amount of gel water,
(iv) Capillary voids due to contraction during hydration process,
(v) Amount of un-hydrated cement, and
(vi) Gel/Space ratio.

If water is allowed to enter into the paste (due to curing under water), repeat the above calculations.

Make comments on the results (sealed and unsealed curing conditions).

Make a brief discussion on the results if W/C is gradually varied from 0.25 to 1.0 (calculations are not necessary).

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

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

CSE 6391: Advanced Human Computer Interaction

Programmable calculators are not allowed. Do not write anything on the question paper.

There are **3 (three)** questions. **Answer all of them**.

Figures in the right margin indicate marks.

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1. a) What are experiential and reflective cognitions? Explain with examples. 8

   b) Suppose you want to design a two-way communication tool between deaf/mute and normal people. Your goal is to design communication dialogues using noun-verb combinations for this communication aid. Nouns are the context information where the interaction takes place and verbs are the operations or actions the user wants/allowed to perform.

      i. Identify the technologies required to support this assistive communication aid and describe in brief. 9

      ii. Design the dialogue (containing nouns and verbs) for the conversations between deaf/mute and normal person. 8

2. a) Monocular cues allow people to see visual depth in the absence of binocular vision. List the monocular depth cues with one example of each cue. 8

   b) Consider the arrangement of image files in the 2D interface as given in Figure 1.

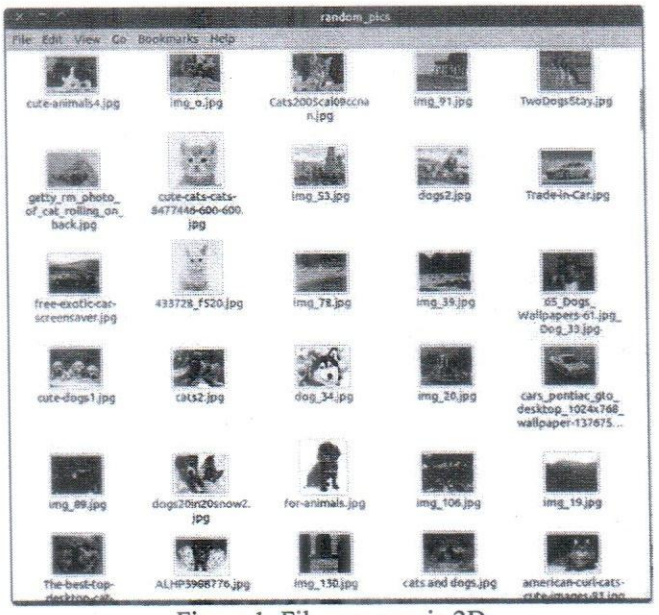

Figure 1: File manager in 2D

Answer the followings: 7

   i. Can visual depth affect the target detection task (selecting a particular image file) in the 2D interface? Explain. 10

   ii. Redesign the interface of Figure 1 by introducing monocular depth cues those are suitable to improve visual attention. You have to keep in mind the issues related to cognitive load while designing.

3. a) Interaction design can be considered as a translation problem between task language and system language. During these translations the gulfs that can be analyzed are Articulation, Performance, Presentation, and Observations. Categorize the following poor translations into these four type of gulfs with one sentence justification. 8

   i. Adjacent keys causing opposite state changes
   ii. To shutdown windows, the user must click on START
   iii. Applications performing the commands wrong
   iv. Lack of indentation, no visual change in the UI
   v. User cannot find important Windows OS commands
   vi. Pressing keys simultaneously
   vii. Cannot read fonts inside the image printed.
   viii. There is no indication that the file has been saved already by pressing `Ctrl+S` command.

   b) Suppose you are designing a Force Touch UI. Force Touch is a feature that was developed by Apple to sense the level of force exerted on a touchpad or trackpad and respond accordingly. People exert forces differently, based on gender, age, and physique.

      i. How would you develop a general scale to measure force touch input that could then be reliably used to trigger system responses? 7

      ii. Suggest some interactions that can be designed with this technology for a real-life scenario. 10