

**International Islamic University Chittagong**  
**Morality Development Program**  
**Semester End Examination, Autumn-2024**  
**3<sup>rd</sup> Semester (Other than Shari‘ah faculty)**

Course code: MDP-2303

**Course Title: Tajweedul Qur'an (Arts of Correct Recitation of the Qur'an)-III**

Full Marks: 50

Time: 2 hours & 30 minutes

Answer any five of the following questions; the column on the right side indicates the marks for each question

- |    |   |                   |
|----|---|-------------------|
| 1  | Write the meaning of the following Surah: (Any two):  | $5 \times 2 = 10$ |
| a) | <i>Surah At-Teen</i> (سورة التين)   |                   |
| b) | <i>Surah Al-Inshirah</i> (سورة الانشراح)  |                   |
| c) | <i>Surah Ad-Dhuha</i> (سورة الضحى)  |                   |
| 2  | Define Velarization (ترقيق) and Attenuation (ترقيق). When the letter of <i>Alif</i> (ا) of <i>Maad</i> and <i>Laam</i> (ل) of the word <i>Allah</i> (الله) will be recited with <i>Tafkheem</i> (ترقيق) and when will be recited with <i>Tarqeeq</i> (ترقيق)? | $2+3+5=10$        |
| 3  | Define <i>Waqf</i> (وقف), <i>Saktah</i> (سكتة) and <i>Ibtiah</i> (ابتداء). Explain different types of <i>Waqf</i> (وقف) with examples. Identify the valid and invalid types of <i>Waqf</i> .  | $3+6+1=10$        |
| 4  | Where and when do we perform <i>Salatul Eid</i> ? What are the essential works of the <i>Salah</i> of <i>Eid al-Fitr</i> and <i>Eid al-Adha</i> ? Explain the importance of <i>Salatul Eid</i> in Islamic <i>Shari‘ah</i> .                                   | $2+6+2$           |
| 5  | Explain briefly five types of voluntary prayers mentioning their importance in Islamic <i>Shari‘ah</i> .  | $5 \times 2 = 10$ |
| 6  | Summarize the biographies of five Muslim scientists who contributed especially to the history of Islam.   | $5 \times 2 = 10$ |
| 7  | Explain five verses of the holy Qur'an indicate the significant scientific indications of the holy Qur'an.  | $5 \times 2 = 10$ |

**International Islamic University Chittagong**  
**Center for General Education (CGED)**  
**Semester End Examination, Autumn- 24**

**Course Code: URED-2302 (URED- 2101 for LL.B)**  
**Course Title: Sciences of *Qur'an* and *Hadith***

**Time: 2:30 Hours**

**Full Marks: 50**

***Answer the following questions***  
*(All questions are of equal value)*

SL	Questions	Marks	CLOs	Bloom's taxonomy domain
1	Analyze the definitions of <i>Makkai</i> and <i>Madani</i> revelations along with their characteristics.	10	3	Analyze
2	Explain how the holy <i>Qur'an</i> was preserved during the time of Abu Bakr and Uthman (R). Summarize the main differences between them regarding the preservation systems of the holy <i>Qur'an</i> during their time.	10	3	Create
3	'The <i>Ijaz</i> of the holy <i>Qur'an</i> also includes the indications of modern sciences found in the holy <i>Qur'an</i> ' - establish	10	3	Apply
4	Explain the importance and position of <i>Hadith</i> in Islamic <i>Shariah</i> .	10	3	Create
5	a) Define <i>Hadith</i> literally and terminologically. Explain some types of <i>Hadith</i> according to the number of reporters involved in each stage of <i>Sanad</i> with some examples. Or, b) Explain with example: <ul style="list-style-type: none"> <li>• <i>Sanad &amp; Matan</i></li> <li>• <i>Al-Hadith Al-Qudsi</i></li> <li>• <i>Al-Hadith As-Sahih</i></li> <li>• <i>Al-Hadith Al-Mawdu'</i></li> <li>• <i>Al-Kutub As-sittah</i> (six books of Hadith)</li> </ul>	10	3	Remember & create  Create

# International Islamic University Chittagong

## Department of Computer Science & Engineering

*B. Sc. in CSE, Semester Final Examination, Autumn-2024*

**Course Code: CHEM- 2301, Course Title: Chemistry**

Total marks: 50 Time: 2 hours 30 minutes

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[Answer **all** the questions. Figures in the right hand margin indicate full marks.  
Separate answer script must be used for Group A and Group B]

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		<u><b>Group-A</b></u>	<b>Marks</b>
1.	a)	Define electrolytes. Differentiate between ionization and dissociation.	1+2=3
1.	b)	Discuss the Faraday's Laws of electrolysis with relevant equations.	2+2=4
1.	c)	A Solution of $\text{AgNO}_3$ Containing 12.14 g of Silver in 50 ml of Solution was electrolysed between platinum electrodes. After electrolysis, 50 ml of the anode solution was found to contain 11.55 g of silver, While 1.25 g metallic silver was deposited on the cathode. Calculate the transport number of $\text{Ag}^+$ and $\text{NO}_3^-$ ions.	3
2.	a)	Discuss Henry's law for the solubility of a gas in a solvent.	1+3=4
2.	b)	Distinguish between Ideal and Real solution.	3
2.	c)	What is colligative property. Explain Raoult's law for the relative lowering of vapour pressure with its mathematical expression.	1.5
2.	d)	Describe the relation between elevation of boiling point and lowering of vapour pressure and deduce a mathematical expression for the determination of molecular mass from elevation of boiling point.	1.5
		<b>OR</b>	
2.	a)	Define conductance and molar conductance.	2
2.	b)	Classify the following electrolytes as strong and weak electrolytes. $\text{HClO}_4$ , $\text{H}_2\text{SO}_3$ , $\text{NH}_4\text{OH}$ , $\text{HNO}_3$ .	2
2.	c)	What is transport number? Prove that, $t_- = 1 / 1+r$ , where, $t_-$ is the transport number of the anion and $r$ is the speed ratio of the ions.	1+2=3
2.	d)	The resistance of decinormal solution of a salt occupying a volume between two platinum electrodes 1.80 cm apart and $5.4 \text{ cm}^2$ in area was found to be 32 ohms. Calculate the equivalent conductance of the solution.	3
		<b>Group-B</b>	
3.	a)	Define Zero order reaction and Pseudo-unimolecular reaction & explain briefly with suitable examples.	2+2=4
3.	b)	Define first order reaction. Prove that $K = 2.303/t \log (a/a-x)$ Where symbols have usual meanings.	1+3=4
3.	c)	Differentiate between order of reaction and molecularity.	2

4.	a)	Chemical equilibrium is a dynamic equilibrium- explain it.	2
4.	b)	Discuss the law of mass action. Express the equilibrium constant for the following reaction:	3
		$A + B \rightleftharpoons C + D$	
4.	c)	Prove that $K_p = K_c \times (RT)^{\Delta n}$	5
5.	a)	What are colloids? Give some example of colloids.	2
5.	b)	What is an emulsion? Discuss the role of emulsifier in a solution.	2
5.	c)	Illustrate Freundlich adsorption isotherm with relevant log plot.	3.5
5.	d)	What is Langmuir adsorption isotherm? Write the important assumptions in Langmuir adsorption isotherm.	2.5
		OR	
5.	a)	Differentiate between homogeneous equilibrium and heterogeneous equilibrium.	2
5.	b)	Discuss the characteristics of chemical equilibrium.	3
5.	c)	Some nitrogen and hydrogen gases are pumped into an empty five-litre glass bulb at 500°C. When equilibrium is established, 3.00 moles of N <sub>2</sub> , 2.10 moles of H <sub>2</sub> , and 0.298 mole of NH <sub>3</sub> , are found to be present. Find the value of K <sub>c</sub> , for the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ at 500°C.	3
5.	d)	What are the conditions (temperature, pressure and catalyst) for maximum production of Ammonia by Haber process in industry.	2

# International Islamic University Chittagong

## Department of Computer Science and Engineering

*B. Sc. in CSE Semester Final Examination, Autumn 2024*

**Course Code: CSE 2321 Course Title: Data Structures**

**Time: 2 hours 30 minutes**

**Total marks: 50**

[Answer the following questions. Figures in the right hand margin indicate full marks.]

CO    D  
      L

### Group A

- 1.a) What is *stack*? Suppose STACK is allocated with  $N=8$  memory cells and initially STACK is empty (i.e. TOP=0). Find the output of the following module [show the elements of STACK and value of TOP in each step].

2 CO1 C  
      2

1. Set  $A := 15$  and  $B := 17$
2. Call **PUSH** (STACK, A)  
Call **PUSH** (STACK, 5)  
Call **PUSH** (STACK,  $B - 3$ )  
Call **PUSH** (STACK, 10)  
Call **PUSH** (STACK,  $A * B$ )  
Call **PUSH** (STACK, 9)
3. Repeat while  $TOP \neq 0$ :  
    Call **POP** (STACK, ITEM)  
    Write: ITEM  
    [End of loop]
4. Return

- b) Write an algorithm/code to *reverse* the elements of a stack.

2 CO3 C  
      2

- c) Given a postfix expression:

3 CO3 C  
      2

$$Q: 9, -4, +, 3, \uparrow, N, 4, -, 2, *, +, 5, -$$

For what value of  $N$ , the result of the expression Q would be XY.

[Here, XY is the last two digits of your ID. For example, if ID = C161026, then XY = 26. The result of any division operator must be taken 2 places after the decimal point. For example,  $26 / 5 = 5.20$ ]

- d) Consider the *infix* expression Q:  $((A + B) / D) ^ ((E - F) * G)$ . Translate Q into its equivalent *postfix* expression P using the algorithm you studied.

3 CO3 C  
      2

*Or,*

Write an algorithm that receives a bracket sequence and tells whether the sequence is correct or incorrect. For example, "()", "( )[]{}", "({})[]{}" are correct sequences while, "({})[ ])", "{ ]" are not. [You can safely assume that the required data structure and its operational algorithms are available to you to solve this problem. You don't need to re-implement them.]

- 2.a) Find the value of factorial five ( $5!$ ) using recursion. Show each step and also show the status of stack used in the recursion.

3 CO4 C  
      5

- b) Suppose a queue is maintained by a circular array QUEUE with  $N=15$  memory cells. Find the number of elements in QUEUE if

3 CO4 C  
      5

- i) FRONT = 5, REAR = 10
- ii) FRONT = 12, REAR = 3 and
- iii) FRONT = 6, REAR = 6

- c) Let  $N$  be an integer and suppose  $G(N)$  is recursively defined by

4 CO1 C  
      2

$$G(N) = 3 * X \quad \text{if } N < 5 \\ G(N) = 2 * G(N-3) + X \quad \text{otherwise}$$

- i) Find the base criteria of G.

- ii) Find  $G(2)$ ,  $G(8)$  and  $G(24)$ .

[Here X is the last digit of your ID. For example, if ID is C191085, X will be 5].

[Type here]

*Or,*

Define Fibonacci sequence. Find the value of  $F(12)$  using the definition of Fibonacci sequence.

**Group B**

- 3.a) Suppose the numbers are stored in an array A: {44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, 66}. Apply insertion sort algorithm to sort the array A and show each pass separately 5 CO3 C  
2

*Or,*

Suppose the characters are stored in an array A: {D, A, T, A, S, T, R, U, C, T, U, R, E, S}. Apply selection sort algorithm to sort the array A and show each pass separately.

- b) The following values are to be stored in a hash table: 3 CO1 C  
2

25, 42, 96, 101, 102, 162, 197, 205

Describe how the values are hashed by using *division method* of hashing with a *table size* of 11. Use linear probing as the method of *collision resolution*.

- c) Consider a situation where *swap* operation is very costly. Which of the following sorting algorithms should be preferred so that the number of swap operations are minimized in general? Why? 2 CO4 C  
4

i) Heap Sort ii) Selection Sort iii) Insertion Sort iv) Merge Sort

- 4.a) Analyze the differences between Binary tree and Complete binary tree with figure. 5 CO5 C  
2

Construct an *expression tree* T for the following arithmetic expression:

$$(A + B * C) + ((D / E - F) * G)$$

Traverse the tree T in preorder, postorder and inorder.

- b) What is a *binary search tree*? The *preorder* traversal sequence of a *binary search tree* is 30, 20, 10, 15, 25, 23, 39, 35, 1XX. Draw the tree. Show each step. 3 CO1 C  
2

[Here XX is the last two digits of your ID. For example, if ID is C191085, 1XX will be 185].

*Or,*

Explain the three cases of deletion operation from BST.

- c) Explain which data structure is most efficient to find the *top 10 largest items* out of 2 CO4 C  
4 *1 million items* stored in file? Why?

i) Min heap ii) Max heap iii) BST iv) Sorted array

- 5.a) Define each of the following about graph with figure. 2 CO3 C  
1

(i) Directed graph (ii) Strongly Connected Graph (iii) Weakly Connected Graph (iv) Self Loop

- b) Show how Depth First Search (DFS) works on the graph of Fig 1 and consider A as 4 CO4 C  
2 the source. Visit the nodes in lexicographic order (A, B, C ...).

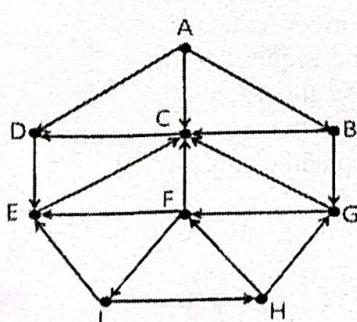


Fig1

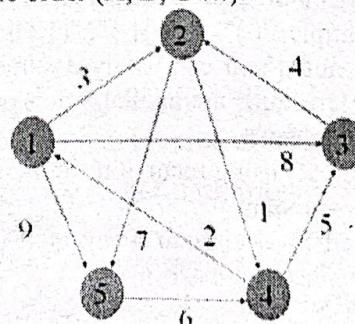


Fig2

- c) Consider the graph of Fig 2. Find the matrix  $Q(1)$  from the matrix  $Q(0)$  using the following equation. 4 CO4 C  
2

$$Q_k[i,j] = \min(Q_{k-1}[i,j], Q_{k-1}[i,k] + Q_{k-1}[k,j])$$

*Or,*

Find the path matrix of the graph G of Fig 2 using powers of the adjacency matrix..

[Type here]

International Islamic University Chittagong  
Department of Computer Science and Engineering  
B. Sc. in CSE  
Semester Final Exam, Autumn 2024

Course Code: STAT 2311  
Time: 2 hours 30 minutes

Course Title: Probability and Statistics  
Full Marks: 50

- (i) The figures in the right-hand margin indicate full marks  
(ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns

**Part A**

[Answer the questions from the followings]

- ✓ 1. a) What is a correlation coefficient? State any four properties of the Pearson correlation coefficient. CO2 R 4

Or,

- a) Explain the term regression equations. State some uses of regression in engineering statistics. CO2 R 4  
1. b) The following data represent the basic salary ('000) and M. Sc. Grade Point Average (GPA) of 8 professionals, randomly selected from an organization: CO2 E 6

Basic salary (y)	25	20	15	18	30	12	22
GPA (x)	3.75	3.50	3.00	3.25	3.80	2.80	3.60

- (i) Draw a scatter diagram.  
(ii) Calculate Karl Pearson's coefficient of correlation between basic salary and GPA

Or,

- b) You are evaluating the performance of a machine learning model. You have recorded the size of the training dataset ( $x$ , in thousands of samples) and the corresponding training time ( $y$ , in minutes): CO2 E 6  
 $x: [50, 100, 150, 200, 250]$   
 $y: [5, 18, 35, 45, 60]$ ,  
(i) Determine the best-fit regression line for this data.  
(ii) Predict the training time for a dataset size of 300,000 samples.
2. a) What are the different approaches to defining probability? Explain the concept of axiomatic probability. CO3 U 4  
2. b) Define conditional probability. It is observed that 40% of mails are spam. There is software that filters spam mail before reaching the inbox. Its accuracy for detecting a spam mail is 99% and chances of tagging a non-spam mail as spam mail is 5%. If a certain mail is tagged as spam find the probability that it is not a spam mail. CO3 AP 6

**Part B**

[Answer the questions from the followings]

3. a) Define the following terms with examples: CO3 U 4  
(i) Random variable  
(ii) Probability function and  
(iii) Probability density function

**Or,**

- a) Define the mathematical expectation of a random variable. How do you know whether a random variable is continuous or discrete? Provide at least two examples of each. CO3 U 4
3. b) A cloud storage service provides a data backup policy that ensures 100% data recovery for files lost due to system failures, up to a maximum of 10 TB per user annually. The total annual data loss, X, in terabytes, experienced by a user has a probability density function given by: CO3 E 6

$$f(X) = Cx(4 - x); 0 < x < 3$$

Compute (i) the value of 'C'; (ii) the probability that a user loses more than 2 TB of data in a year; (iii) the expected data loss;

**Or,**

- b) A continuous random variable X has the following probability density function: CO3 E 6
- $$f(x) = kx^3(1 - x) \quad 0 \leq x \leq 1$$
- Compute (i) the value of 'K'; (ii) the expected values of X,  $X^2$  and (iii) Standard deviation of X.
4. a) Write the probability density function (PDF) of the Normal distribution. Provide four real-life scenarios where a Poisson distribution is appropriate. CO3 U 4
4. b) In a data encryption algorithm, a random bit (0 or 1) is generated for key initialization. Suppose 8 bits are generated, and each has an equal probability of being 0 or 1. Find the probability of:  
(i) Exactly three 1s in the key.  
(ii) At most two 1s in the key.  
(iii) No 1s in the key.  
(iv) At least six 1s in the key.

*3/8*

5. a) What is a hypothesis in the context of statistical testing? Explain the concept of Type I and Type II errors. What does it mean if the p-value is less than the significance level? CO4 U 4
5. b) A company is testing two algorithms, **Algorithm A** and **Algorithm B**, to determine if the response time of the system is independent of the choice of algorithm. A simple random sample of 400 response events yields the following data: CO4 C 6

Response Time	Algorithm A	Algorithm B
Under 1 second	120	80
Over 1 second	140	60

At a significance level of  $\alpha = 0.05$ , is there enough evidence to conclude that the response time is independent of the choice of the algorithm?

**Note:** At a 5% level of significance, the tabulated value of Chi-square at 1 degree of freedom (df) = 3.84.

International Islamic University Chittagong  
 Department of Computer Science & Engineering  
 B.Sc. in CSE Final Examination, Autumn - 2024

Course Title: Mathematics-III Course Code: MATH-2307 (New)  
 Course Title: Mathematics-IV Course Code: MATH-2401 (Old)

**Time: 2 Hours 30 Minutes**

**Full Marks: 50**

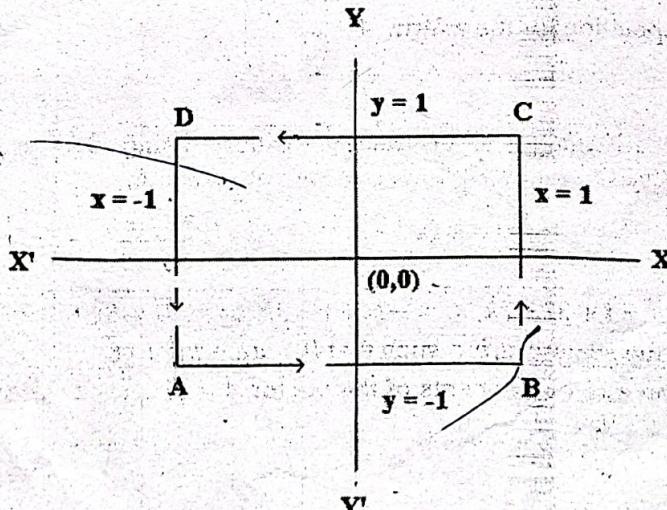
- 
- (i) The figures in the right-hand margin indicate full marks  
 (ii) Course Outcomes and Bloom's Levels are mentioned in additional Columns
- 

Course Outcomes (COs) of the Questions	
CO1	Understand the fundamentals of Matrix , Linear system of equations & Vector analysis
CO2	Implement the fundamental knowledge of Matrix, linear system of equations, vector functions, vector field, scalar field, gradient, divergence, curl, differentiation and integration of vector valued functions, partial derivatives in different problems
CO3	Solve line integrals, surface area, surface integrals, volume integrals, and the work done in different problems
CO4	Apply Green's theorem, Stoke's theorem, Gauss' theorem in solving mathematical problems

Bloom's Levels of the Questions						
Letter Symbols	R	U	App	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

		Part A Answer the following questions				
1.		Write the names of 4 methods of matrix decomposition. Examine the Eigen decomposition for the matrix $A = \begin{pmatrix} 1 & 2 \\ 2 & 1 \end{pmatrix}$		CLO1	An	2+8
		<b>Or</b>				
		Write down the advantage of LU decomposition. Using LU decomposition solve the following linear system of equation, $x_1 + 2x_2 + 3x_3 = 5, 2x_1 - 4x_2 + 6x_3 = 18, 3x_1 - 9x_2 - 3x_3 = 6$		CLO1	An	2+8
2.	a)	If $\vec{A} = 2\hat{i} - \hat{j} + \hat{k}$ , $\vec{B} = \hat{i} + 3\hat{j} - 2\hat{k}$ , $\vec{C} = -2\hat{i} + \hat{j} - 3\hat{k}$ and $\vec{D} = 3\hat{i} + 2\hat{j} + 5\hat{k}$ then find the scalars $a, b, c$ such that $\vec{D} = a\vec{A} + b\vec{B} + c\vec{C}$		CLO2	U	5
	b)	Find the projection and components of the vector $\vec{A} = 2\hat{i} - \hat{j} + \hat{k}$ on the vector $\vec{B} = \hat{i} + 3\hat{j} - 2\hat{k}$		CLO2	U	5

Part B Answer the following questions					
3.	a)	Find the directional derivative of the function $\phi = (x, y, z) = x^2 - y^2 + 2z^2$ at the point of (1, 2, 3) in the direction of the vector $\vec{A} = 4\hat{i} - 2\hat{j} + \hat{k}$ .	CLO2	U	4
	b)	Find the level surface of $F(x, y, z) = x^2 + y^2 + z^2$ passing through (1, 1, 1). Graph the gradient at the point.	CLO3	U	3
	c)	Show that $\nabla^2(\ln r) = \frac{1}{r^2}$	CLO3	U	3
4.	a)	Derive the total work done formula $\int_C \vec{F} \cdot d\vec{S} = \lim_{n \rightarrow \infty} \sum_{i=1}^n \vec{F}(\vec{S}_{i-1}) \cdot (\vec{S}_i - \vec{S}_{i-1})$ with necessary graph	CLO3	App	5
	b)	Evaluate the line integral $\int_C xy \, dx$ along the curve C that the portion of $x^2 + y^2 = 1$ in the first quadrant.	CLO3	App	5
5.		State Divergence's theorem. Verify the divergence theorem for the vector field $\vec{F} = xy\hat{i} + z\hat{j} - x^2\hat{k}$ taken over the region bounded by the planes, $x = 0, x = 2; y = 0, y = 3; z = 0, z = 4$	CLO4	App	10
	Or				
		Use Green's theorem to evaluate $\int_C (x^2 + xy)dx + (x^2 + y^2)dy$ where C is the square formed ABCD by the lines $y = \pm 1, x = \pm 1$	CLO4	App	10



# International Islamic University Chittagong

## Department of Computer Science & Engineering

Program: B.Sc. in CSE; Semester: 3<sup>rd</sup>

Semester End Examination, Autumn-2024

Course Code: CSE-2323

Time: 2 Hour 30 minutes

Course Title: Digital Logic Design

Total Marks: 50

[Answer all the Questions; Separate answer scripts must be used for Group A and Group B]

- i) The figures in the right-hand margin indicate full marks.
- ii) Course Outcomes and Bloom's Levels are mentioned in additional columns.

### Group A

1.a) Construct a 4-to16 decoder by joining 2-to-4 decoders with enable input.

CO2 5 A

Or

Design a multiplexer using the following Boolean Equation.

$$F(A, B, C) = \sum(1, 3, 4, 5, 6, 7, 8)$$

b) What is the carry propagation problem of parallel Adder? What could be the solution of carry propagation problem of parallel adder?

CO1 5 U

2. a) How does JK flip-flop remove the indeterminate states of S-R flip-flop? Design a JK flip-flop and show its characteristic equation, characteristic table, logic diagram and timing diagram.

CO3 5 A

Or

Describe the operation of master-slave D flip-flop with logic diagram and characteristic table.

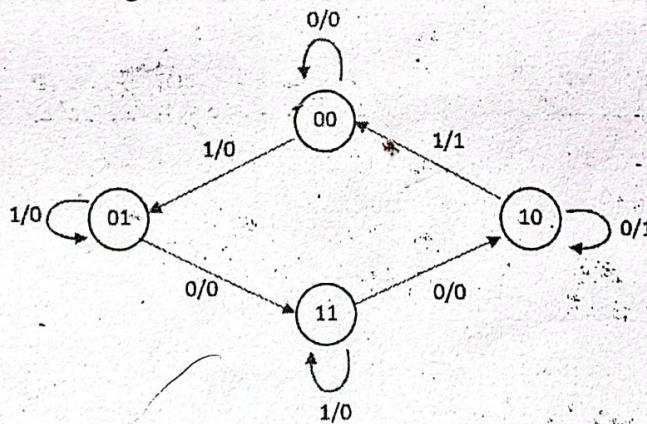
b) Design a full adder circuit with a decoder and two OR gates.

CO1 5 Ap

### Group B

3. a) Analyze the given state diagram of a clocked sequential circuit and find the

CO3 5 An



- (i) state table
- (ii) state equation and
- (iii) logic diagram.
- (iv) Consider J-K Flip Flop for the logic diagram of the clocked sequential circuit.

b) Differentiate between a synchronous counter and an asynchronous counter. Design a 3 bit synchronous counter using T Flip Flop with proper circuit diagram. CO2 5 R+ Ap

4 a) Design and simulate a 4-bit parallel adder circuit using full adders. CO2 5 A

1. Add the binary numbers  $A = 1010$  and  $B = 0111$  with an initial Carry-In = 0.
2. Show the intermediate steps, including the carry at each stage and the final output.

b) What is race round condition in JK flip flop? How JK Master Slave flip flop overcome the problem and discuss with timing diagram. CO2 5 U

Or

Design a sequential circuit with JK flip flop to satisfy the following state equation: CO2 5 Ap

$$A(t+1) = A'B'CD + A'B'C + ACD + AC'D'$$

$$B(t+1) = A'C + CD' + A'BC$$

$$C(t+1) = B$$

$$D(t+1) = D'$$

5 a) How PLA recover the limitation of ROM? A combinational circuit is defined by the functions: CO3 1 U

$$F1(A,B,C) = \sum(3,5,6,7)$$

$$F2(A,B,C) = \sum(0,2,4,7)$$

Implement the circuit with a PLA having Three inputs, four product terms and two outputs.

Or

A combinational circuit is defined by the following functions:

$$F1(A,B,C) = \sum(3,5,7)$$

$$F2(A,B,C) = \sum(4,5,7)$$

Implement the circuit with a PLA having 3 inputs, 3 product terms and two outputs.

b) Define Register. Design a Serial Input Serial Output(SISO) register and explain it with shift register. CO3 1 U