International Islamic University Chittagong
Center for General Education (CGED)
Semester End Examination   Spring-2025
Course Code: GEBL-2401
Course Title: Bangla Language and Literature
Full Marks: 50   Time: 2.5 Hours

ক-বিভাগ
ভাষা ও নির্মিতি: ৩০
(ডান পাশের সংখ্যা প্রশ্নের মান জ্ঞাপক)

প্রশ্ন নং	বর্ণনা	মান	CLO	Cognitive learning
০১.	প্রমিত বাংলা বানানের দশটি নিয়ম উদাহরণসহ লেখ।	১০	CLO1	Apply
০২.	সংবাদপত্রে প্রকাশের উপযোগী **"আন্তর্জাতিক ইসলামী বিশ্ববিদ্যালয় চট্টগ্রামের জন্য শাটল ট্রেন চাই"** - শিরোনামে একটি পত্র রচনা কর।	১০	CLO1	Create
	অথবা			
	স্বরচিত একটি খুদে গল্প উপস্থাপন কর।	১০	CLO1	Create
০৩.	সংক্ষেপে আলোচনা কর: ক. মানবতা ও নৈতিকতা খ. মুক্তিযুদ্ধ	৫×২=১০	CLO1	Create

খ-বিভাগ
সাহিত্য: ২০

প্রশ্ন নং	বর্ণনা	মান	CLO	Cognitive learning
০৪.	'আজ সৃষ্টি সুখের উল্লাসে' কবিতার আলোকে কাজী নজরুল ইসলামের জীবনদৃষ্টির পরিচয় দাও।	১০	CLO3	Evaluate
	অথবা			
	'যৌবনে দাও রাজটিকা' প্রবন্ধের মূলবক্তব্য বিশ্লেষণ কর।	১০	CLO3	Analyze
০৫.	" 'কবর' নাটক শুধু ভাষা আন্দোলনের নয়, জুলাই গণ-অভ্যুত্থানেরও প্রতিবাদী শিল্পভাষ্য" -উক্তিটির যৌক্তিকতা বিচার কর।	১০	CLO3	Evaluate

Course Code: ACC 2401   Course Title: Financial & Managerial Accounting
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

Part A
[Answer the questions from the followings]

1.   CO2   C1   10

Ford painting service
Trial Balance
Month ended April 30, 2025

a/c no.	Account's Name	DEBIT $	CREDIT$
1	Cash	1,010	
2	Accounts Receivable	6,200	
3	Supplies	3,400	
4	Prepaid Rent	1,890	
5	Painting Equipment	37,300	
6	Accumulated Depreciation		14,360
7	Accounts Payable		6,410
8	Salary Payable		
9	Unearned Service Revenue		3,110
10	Ford, Capital		14,310
11	Ford, Withdrawal	40,100	
12	Service Revenue		91,060
13	Salary Expense	32,150	
14	Depreciation Expense		
15	Supplies Expense		
16	Rent Expense	6,000	
17	Utilities Expense	1,200	
	Total	129,250	129,250

Following additional data as follows:

Adjustment entries:

i. At April 30 the business has earned $10,200 of service revenue, that has not been yet recorded.

ii. Supplies used during the month $3,000

iii. Prepaid rent is still in force $550

iv. Depreciation for the year based on painting equipment costing $40,300 and an estimated useful life 10 years.

v. The business owes its employees accrues salaries for two-thirds of weekly payment. The weekly payroll is $3,000

Requirements:

a. Journalize the adjusting entries

b. Prepare adjusted trial balance for the Ford painting service, month ended April 30, 2025

OR

1.

a/c no.	Account's Name	DEBIT $	CREDIT$
1	Cash	1,010	
2	Accounts Receivable	6,200	
3	Supplies	3,400	
4	Prepaid Rent	1,890	
5	Painting Equipment	37,300	
6	Accumulated Depreciation		14,360
7	Accounts Payable		6,410
8	Salary Payable		450
9	Unearned Service Revenue		3,110
10	Ford, Capital		14,310
11	Ford, Withdrawal	40,100	
12	Service Revenue		91,060
13	Salary Expense	32,150	
14	Depreciation Expense	250	
15	Supplies Expense	200	
16	Rent Expense	6,000	
17	Utilities Expense	1,200	
	Total	129,250	129,250

Requirements: prepare financial statements of Ford painting service for the year ended 30 April, 2025

2. The trial balance of State Service Company pertains to December 31, 2024, which is the end of its yearlong accounting period.   CO2   C2   10

State Service Company
Trial Balance
December 31, 2024

	Amount ($)	Amount ($)
Cash	198,000	
Accounts Receivable	370,000	
Supplies	6,000	
Furniture & Fixtures	100,000	
Accumulated Depreciation- Furniture & Fixtures		40,000
Building	250,000	
Accumulated Depreciation-Building		130,000
Accounts Payable		380,000
Salary Payable		-
Unearned Service Revenue		45,000
Capital		293,000
Owner's Withdrawal	65,000	
Service Revenue		286,000
Salary Expense	172,000	
Supplies Expense	-	
Depreciation Expense-Furniture & Fixtures	-	
Depreciation Expense- Building	-	
Miscellaneous Expense	13,000	
	1,174,000	1,174,000

Data needed for the adjusting entries include:
a) Supplies on hand at year end, $2,000.

b) Depreciation on furniture and fixtures, $20,000
c) Depreciation on building, $10,000
d) Salaries owed but not yet paid $5,000
e) Accrued service revenue, $12,000
f) Of the $45,000 balance of unearned service revenue, $32,000 was earned during the year.
Required: Prepare a ten-column worksheet.

Part B
[Answer the questions from the followings]

3. The following data are provided by the controller of Arrow Fashion Pvt. Ltd.:

CO1   C4   10

Cash	Tk. 240,000
Accounts Receivable	348,000

Inventories	January-1, 2024	December-31, 2024
Finished Goods	Tk. 44,200	Tk. 66,000
Work-in-Process	29,800	38,800
Materials	88,000	64,000

Material Purchased	Tk. 366,000
Sales Discount	8,000
Factory Overhead (Excluding Depreciation)	468,400
Marketing and Administrative Expenses (Excluding Depreciation)	344,200
Depreciation (90% Manufacturing, 10% Marketing and Administrative Expenses)	116,000
Sales	1,844,000
Direct Labor	523,600
Freight on Material Purchased	6,600
Rental Income	64,000
Interest on Bond Payable	16,000

Required: Prepare a Cost of Goods Sold Statement.

4. Glow Gadget Co. manufactures a desk lamp that sells for $100 per unit. The variable cost per unit is $65, and the company incurs fixed costs of $250,000 annually.

CO2   C4   10

Required:
1. What is the contribution margin per unit and CM ratio?
2. Using the equation method:
   a. Compute the break-even point in units and in dollars.
   b. How many lamps must be sold to earn a $50,000 profit?
   c. If fixed expenses increase to $300,000, what is the new break-even point?
3. Assume, a through intense effort company's sales increase by 10% next year. By what percent operating income to increase (use degree of operating leverage to obtain your answer). Verify the answer by preparing a new income statement showing as 10% increase in sales.

5. Peak sales for Midwest Products, Inc. occur in August. The company's sales budget for the third quarter showing these peak sales is given below:

CO3   C4   10

	July	August	September	Total
Budgeted sales	$600,000	$900,000	$500,000	$2,000,000

From past experience, the company has learned that 20% of a month's sales are collected in the

month of sale, that another 70% is collected in the month of following sale, and that the remaining 10% is collected in the second month following sale. Bad debts are negligible and can be ignored. May sales totaled $430,000, and June sales totaled $540,000.

Required:

a. Prepare a schedule of expected cash collections from sales by month and in total, for the third quarter.

b. Assume that the company will prepare a budgeted balance sheet as of September 30. Compute the accounts receivable as of that date.

OR

5. Nano Devices Ltd. manufactures a smart wearable device. The device requires a special sensor that costs $4 each unit and is purchased from a local supplier. Nano Devices has prepared a production budget for the device by quarters for Year 2 and for the first quarter of Year 3, as shown below:

	Year 2				Year 3
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter
Budgeted Production (Units)	70,000	1,00,000	1,30,000	1,20,000	90,000

The sensor used in the wearable is occasionally subject to supply delays, so the company maintains a buffer inventory. The ending inventory of sensors each quarter must equal 25% of the next quarter's production. At the beginning of Q1 of year 2, 18,000 sensors are in inventory.

Required:

1. Prepare a materials purchases budget for the sensors by quarter and for the year in total. At the bottom of your budget, show the dollar amount of purchases for each quarter and the total for the year.

2. Purchase of raw materials are paid in following patterns: 70% paid in the quarter the purchase is made, and the remaining 30% in the following quarter. On January 1, year 2, the company's balance sheet shows 95,500 in accounts payable for raw materials purchase, all of which will be paid on the first quarter of the year.

Prepare a schedule of expected cash payments for material purchase.

4

Time: 2 Hours an...
(Answer all the follow
answer script for C

No.
Q1. a)

International Islamic University Chittagong (IIUC)
Department of Computer Science and Engineering (CSE)
Semester End Examination

Program: B. Sc. in CSE	Semester: Spring-2025
Course Code: MATH-2407	Course Title: Mathematics-IV
Time: 2:30 hours	Total Marks: 50

(i)	Answer all the questions. The figures in the right-hand margin indicate full marks.
(ii)	Separate answer script must be used for separate group.
(iii)	Course Learning Outcomes (CLOs) and Bloom's Levels are mentioned in additional Columns.

Course Learning Outcomes (CLOs) of the Questions

CLO1	Demonstrate the understanding of the basic principles and operations set theory, complex numbers, geometrical interpretation complex functions and the concept of transformation in a complex plane. different types of functions and signals
CLO2	Apply the concept of transformation of an object into complex space and operation of complex functions
CLO3	Use Fourier series, Laplace's Transforms, Fourier Transform in different scenario.
CLO4	Analyze the harmonics & spectrum of different types of waves.
CLO5	Demonstrate the harmonic analysis using MATLAB.

Bloom's Taxonomy Domain Levels of the Questions

Letter Symbols	R	U	App	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Group-A

			Mark	CLO	DL

1.
   i.   Sketch 3 cycles for the function represented by   **2+8**   **CLO3**   **App**

$$y = f(t) = \begin{cases} 0; & -3 \le t < 0 \\ 3; & 0 \le t < 3 \end{cases} \qquad T = 2L = 6 \qquad \therefore L = 3$$

   ii.   Find the Fourier series for the above function.

Or

Derive the complex form of Fourier series.   **10**   **CLO3**   **App**

2.   **a)**   Evaluate the convolution sums of $y[n] = x[n] * h[n]$ **6**   **CLO4**   **U**
     Where,

$$x[n] = \begin{cases} 1, & n = 0 \\ 1, & n = 1 \end{cases} \quad and \quad h[n] = \begin{cases} 2, & n = 0 \\ 1, & n = 1 \end{cases}$$

     Where, n represents the time index.

  b)   How would you explain the functioning of the cochlea inside the ear as a   **2**   **CLO4**   **U**
     practical example of a Fourier series?

  c)   Plot the line (**at least 3**) spectrum for the following complex wave   **2**   **CLO4**   **An**

$$f(t) = 2\pi + \sum_{n=1}^{500} \frac{6}{n} \sin n\pi t$$

Page 1 of 2

Group-B

			Mark	CLO	DL

3. a) Find the Fourier transform of the function,

$$f(t) = e^{-t} \qquad ; t > 0$$
$$= e^{t} \qquad ; t < 0$$

Mark	CLO	DL
5	CLO3	App

Or

Find the inverse Laplace transform of $\dfrac{s+8}{s(s-2)(s-4)}$.

b) Why is the line spectrum continuous in the Fourier transform?

c) What type of signals do Fourier series, Fourier transform, and Laplace transform analyze?

d) Give an example of an unstable signal (function)

Mark	CLO	DL
5	CLO3	App
2	CLO4	U
2	CLO3	U
1	CLO3	U

4. a) Solve the following Initial Value Problem (IVP) by Laplace Transform

$$Y'' - 3Y' + 2Y = 4e^{2t} \quad Y(0) = -3 \qquad Y'(0) = 5$$

Mark	CLO	DL
5	CLO3	App

Or

Evaluate $\mathcal{L}\{t^2 \cos 3t\}$ using Multiplication theorem.

b) Draw the impulse function $2 * \delta(t - 2)$

c) Draw the graph of the following function : $f(t-a) * u(t-a) :$; where

$$f(t) = \sin t \text{ and } a = \frac{\pi}{2}$$

Mark	CLO	DL
5	CLO3	App
1	CLO1	U
4	CLO1	U

5. a) Write down a user defined function in MATLAB to reconstruct $f(t)$ in the time interval of [-4, 20] for the following complex wave and also draw line Spectrum for the following wave in one window

$$f(t) = \frac{\pi^2}{3} + \sum_{n=1}^{500} \frac{(-1)^n}{n^2} \sin n\pi t$$

Mark	CLO	DL
8	CLO5	An

b) If

$$x[n] = 2 \quad ; \ n = 0$$
$$= 3 \quad ; \ n = 1 \qquad \text{and} \qquad h[n] = \quad 2 \ ; \quad n = 0$$
$$= 5 \ ; \quad n = 1$$

Write MATLAB code to find the convolution sum of the above signals.

Mark	CLO	DL
2	CLO5	An

Bismillahir Rahmanir Rahim

International Islamic University Chittagong
Department of Computer Science and Engineering
BSc in CSE, Final Examination, Spring-2025
Course Code: **CSE-2423**   Course Title: **Database Management System**

Time: **2 Hours and 30 minutes**   Marks: **50**

[Answer all the following questions from Group A and B. Some questions may have an option. Use separate answer script for Group A & B. Figures at right margin illustrate the marks (M), course learning objectives (CLOs), and bloom's taxonomy (DL)].

No.	Group A [2 X 10] = 20 marks	M	CLOs	DL
Q1. a)	Consider the following relational database:	6	2	3

Q1. a) Consider the following relational database:

Student (sid, sname, email, dept_id, dob)
Course (cid, cname, credits)
Enrollment (sid, cid, enroll_date)
Instructor (iid, iname, designation, salary)
Teaches (iid, cid, semester)

Write the SQL DDL for this schema, incorporating the following constraints: sname, cname, and iname must not be NULL; email must be unique and properly formatted; credits and salary must be greater than 0; dept_id must exist in a referenced Department table (you may assume its schema)

OR Why is normalization very important in DBMS?

Consider the following set FD of functional dependencies for relation schema X = (A, B, C, D).

FD: $\{A \rightarrow B, B \rightarrow C\}$

Transform schema X into 2NF showing that the decomposition is a functional dependency preserving and lossless join decomposition.

b) Instructor(iid, iname, designation, salary), Teaches(iid, cid, semester) | 4 | 2 | 2 |

Write an assertion for the above schema to ensure that an instructor cannot teach more than two courses in the same semester.

OR What is the difference between authorization and authentication? Discuss how assertions differ from triggers.

Q2. a) Consider a relation schema S(WXYZTU) with the following functional dependencies: | 6 | 2 | 2 |

$W \rightarrow X$
$X \rightarrow Y$
$WY \rightarrow Z$
$Z \rightarrow T$
$TU \rightarrow W$

i. Can WY and ZT be candidate keys? Show closure and justification.

ii. Is this relation in BCNF? If not, decompose it into BCNF with explanation.

b) Let R(P, Q, R, S, T) be a relation with the following functional dependencies: | 4 | 2 | 2 |

$P \rightarrow Q$
$QR \rightarrow S$
$ST \rightarrow P$

List all the non-trivial functional dependencies that can be derived from the given set using Armstrong's axioms.

Group B [3 X 10] = 30 marks

Q3. a) When is it preferable to use a dense index rather than a sparse index?   4   2   2
Suppose we are building a static hash index on a file that contains records with the
following search-key values:

2, 3, 5, 7, 11, 17, 19, 23, 29, 31

Assume that:

- The hash function is $h(x) = x \bmod 5$
- The hash index uses buckets to store pointers to actual data records
- Each bucket can hold up to three pointers (one per search key)
- Separate chaining is not used; if a bucket overflows, an overflow bucket is created and linked to the original

Show the resulting static hash index structure for this data using the above constraints.

OR Explain the concept of multilevel indexing. How does it reduce the number of disk accesses compared to single-level indexing? In what scenario would multilevel indexing be necessary?

b) An EMPLOYEE file with ID# as the key field includes records with the following   6   2   3
ID# values: 8, 5, 1, 7, 3, 12, 9, 6. Suppose that the search field values are inserted in
the given order in a B+ tree of order n=3; show how the tree will expand and what
the final tree will look like.

Suppose that the following search field values are deleted, in the given order, from
the above B+-tree; show the final tree. The deleted values are 5, 12, 7, 6.

Q4. a) Explain how atomicity and durability are maintained in transactions. Give example.   5   1   2
b) Draw a state diagram and discuss the typical states that a transaction goes through   3   2   2
during execution.
c)   4   2   2

Transaction T_1	Transaction T_2	Transaction T_3
	read_item(Z); read_item(Y); write_item(Y);	
read_item(X); write_item(X);		read_item(Y); read_item(Z);
		write_item(Y); write_item(Z);
read_item(Y); write_item(Y);	read_item(X);	
	write_item(X);	

Time (indicated on the left axis)

Schedule E

Identify whether the Schedule E is conflict serializable or not by drawing a precedence graph. Find the order of execution of transactions for the equivalent serial schedule.

Q5. a) Describe the Two-Phase Locking (2PL) protocol. How does it ensure serializability?   4   2   2
b) Explain the wait-die and wound-wait schemes used in deadlock prevention.   3   2   2

OR Explain the dirty read problem with an example of a non-serial schedule. Discuss
the problems of deadlock and starvation.

c) Describe the purpose of log-based recovery. When should a system perform a   3   2   2
checkpoint to minimize recovery time?

OR What is a timestamp? How does the system generate timestamps? Discuss the
timestamp ordering protocol for concurrency control.

International Islamic University Chittagong
Department of Computer Science and Engineering
B. Sc. in CSE Final Examination, Spring 2025
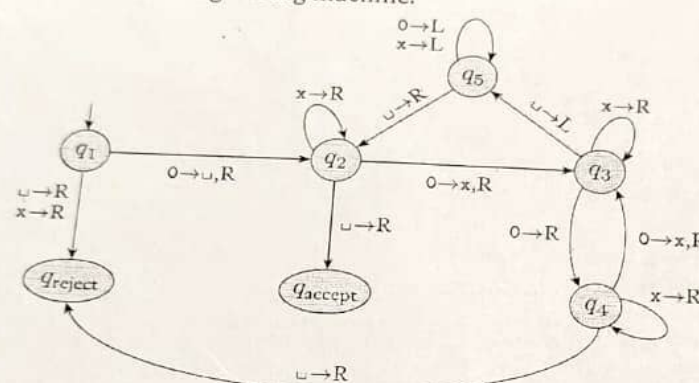Course Code: CSE-2427   Theory of Computing
Total marks: 50
Time: 2 hours 30 minutes
[Figures in the right-hand margin indicate full marks
Course Outcomes and Bloom's taxonomy levels are mentioned in additional columns]

Letter Symbols	Bloom's Taxonomy Levels (Cognitive Domain)					
Meaning	R	U	A	N	E	C
	Remember	Understand	Apply	Analyze	Evaluate	Create

Group-A

			CO	DL
1.a)	Formally describe the components of context-free grammar. **OR** Define parse tree and derivation.	2	CO1	U
b)	What is ambiguity? Determine whether this grammar is ambiguous or not. $A \to xBy \mid xByAz \mid c$ $B \to d$	4	CO2	N
c)	Consider the following grammar $P \to xPy \mid yR \mid Rx$ $R \to yR \mid xR \mid \varepsilon$ Show how to derive the string **xyyxy** using this grammar following a *left-most* derivation. Draw the corresponding parse tree. **OR** Show how to derive the string **xyyxy** using this grammar using a *right-most* derivation. Draw the corresponding parse tree.	4	CO2	A
2.a)	Convert any one of the following CFG into an equivalent CFG in Chomsky normal form. $S \to aSc \mid cZ \mid Za$ $Z \to cZ \mid aZ \mid d \mid \varepsilon$ **OR** $S \to aXbX$ $X \to aY \mid bY \mid \varepsilon$ $Y \to X \mid c$	4	CO2	A
b)	Can you give a context-free grammar (CFG) for the following language over the alphabet $\Sigma = \{a,b\}$? $$L = \{a^n b^{2n} c^{3n} \mid n \geq 0\}$$ If it is not possible, present a formal argument to establish that.	3	CO2	E
c)	Give a context-free grammar (CFG) for each of the following languages over the alphabet $\Sigma = \{a,b\}$. i) $L = \{a^n b^{2n} \mid n \geq 0\}$ ii) All nonempty strings that read the same from left or right.	3	CO2	C

3.a)	What are ε-rule and unit rules?	2	CO2	U
b)	Construct a pushdown automaton that recognizes the following language $L = \{a^n b^{2n} \mid n \geq 0\}$	4	CO3	C
	OR			
	Construct a pushdown automaton that recognizes all nonempty palindromes of even length.			
c)	Convert any one of the following context-free grammar (CFG) to an equivalent pushdown automaton	4	CO1	N

$$S \rightarrow aSb \mid bY \mid Ya$$
$$Y \rightarrow bY \mid aY \mid c \mid \varepsilon$$

OR

$$S \rightarrow aXbX$$
$$X \rightarrow aY \mid bY \mid \varepsilon$$
$$Y \rightarrow X \mid c$$

4.a) Consider the following Turing machine. | 4 | CO3 | A

Give the sequence of configurations that the machine enters when started with the following strings.

  i.   0000
  ii.   000000

b)	Give the implementation-level description of a Turing machine that decides the following two languages over the alphabet $\Sigma = \{a,b\}$: i. $L_1 = \{a^n b^{2n} c^{4n} \mid n \geq 0\}$ ii. $L_2 = \{w \mid w$ is a non-empty palindrome of odd length$\}$	6	CO3	C

5.a)	State the key technical ideas to formally settle decidability of the following:
	
	     Whether an integer n is prime or not.
	            OR
	   Whether a given graph G is connected or not.
		2	CO4	E

b)	Show that *the set of infinitely long binary sequences is uncountable.*	4	CO5	U
c)	Define the complexity classes **P, NP, NP-Hard** and **NP-Complete**. How can you show that a problem is **NP-Complete**?	4	CO5	U

International Islamic University Chittagong
Department of Computer Science and Engineering
B. Sc. in CSE Final Examination, Spring 2025
Course Code: CSE 2421   Course Title: Computer Algorithms
Total marks: 50   Time: 2 hours 30 minutes
[The figures in the right hand margin indicate full marks. Course Outcomes and
Bloom's Taxonomy Levels are mentioned in additional columns]

Group A

			CO	DL
1a)	Show that activity selection problem has greedy choice property. OR Show that activity selection problem has optimal substructure property.	4	CO4	
1b)	You are a space explorer preparing your cargo for an interplanetary mission. Your spaceship cargo hold can carry at most 60 kg of supplies. You find various resource packs on the planet, each with a specific weight and energy value.	3	CO4	

Resource Pack	1	2	3	4	5	6
Weight (kg)	20	30	40	25	35	15
Energy Value	70	110	130	85	100	60

You are allowed to take **fractions of resource packs** to maximize the total energy value loaded onto your spaceship. Determine the maximum energy value you can carry within the 60 kg weight limit. Explain which resource packs (and fractions) you would take.

1c)	A data compression engineer needs to design an efficient encoding scheme for the following symbols with their occurrence frequencies in a large text file:	3	CO4

Symbol	X	Y	Z	W	V	U
Frequency	15	2	19	11	6	5

Construct the optimal Huffman codes for these symbols based on their frequencies. Show steps of the construction of the Huffman tree.

2a)	You are managing a network of delivery hubs in a city, represented by the following undirected graph. Each node is a hub, and edges represent direct roads connecting the hubs:	3	CO3

P, Q, R, S, T, U, V, W, X

Roads: (P, Q), (F, U), (Q, R), (R, S), (R, T), (S, T), (S, W), (U, T), (V, U), (V, X), (W, U), (W, V), (X, U)

You want to deliver a package starting from hub P and want to explore the hubs using Breadth-First Search (BFS) or Depth First Search (DFS). If there is more than one hub available to visit next, always choose the hub with the alphabetically smaller name.

Give an adjacency list representation of the graph.

List the order in which the hubs will be visited by the delivery route starting from hub **P** (i) using BFS and (ii) DFS. You are not required to show the intermediate steps.

2b)	A company is designing a network of fiber optic cables to connect 7 offices located in different cities. The cities and the possible cable connections between them are represented by the graph specified below, with edge weights indicating the cost (in thousands of dollars) to lay cable: **Cities:** M, N, O, P, Q, R, S **Edges/Connections and Costs:** (M, N): 4, (M, O): 3, (N, O): 2 , (N, P): 5, (O, Q): 7, (P, Q): 6, (P, R): 8, (Q, R): 9, (Q, S): 4, (R, S): 3 Find the minimum spanning tree (MST) of the network using Kruskal's algorithm, starting from the city M (show each step). **OR** Find the minimum spanning tree (MST) of the network using Prim's algorithm, starting from the city M (show each step).	6	CO3	
2c)	Mention the running time of BFS if the graph is represented by (i) adjacency list and (ii) adjacency matrix.	1	CO3	

Group B

3a)	A delivery robot operates inside a smart warehouse with **5 stations: S, A, B, C, and D.** The robot moves along direct paths between stations, with the following travel times (in minutes).	5	CO3	

From	To	Time (minutes)
S	A	45
S	C	10
C	A	8
C	D	7
C	B	14
A	C	7
A	B	6
B	D	9
D	S	13
D	B	11

Using **Dijkstra's algorithm**, find the shortest travel times from station S to all other stations. Show the **distance table and parent table** after each iteration.

OR

Using **Bellman-Ford algorithm**, find the shortest travel times from station S to all other stations. Show the **distance table and parent table** after each iteration.

3b)	Given a weighted graph and the distance matrix D[4] after the fourth iteration of the Floyd-Warshall's All-Pair shortest path algorithm (i.e., after considering vertices A through D as intermediate nodes). Compute and show the distance matrix D[5] by including vertex E as an intermediate node.	5 CO3
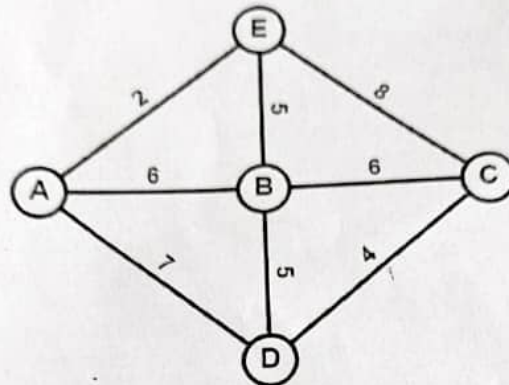
	A	B	C	D	E
A	0	6	10	7	2
B	6	0	6	5	5
C	10	6	0	4	8
D	7	5	4	0	7
E	2	5	8	7	0

4a)	Find the greatest common divisor of 414 and 662 using the Euclidean Algorithm.	1 CO4
4b)	Let a bee was travelling from point A to point B in a straight line, then it changed its direction at point B and flew towards point C in a straight line. How will you determine if the bee turned left or right at point B? **OR** A drone flies through four waypoints in the following sequence: • **Waypoint M (3, 4) to Waypoint N (6, 7)** • **Waypoint N (6, 7) to Waypoint O (9, 10)** Determine whether the drone makes a **left turn or right turn at Waypoint N.** [Use the cross-product technique to determine the direction of the turn at each location.]	4 CO1
4c)	Perform Graham's Scan on the following set of points to determine their convex hull. The points are given by their x and y coordinates in the format (x, y): $Q_0(7,2)$, $Q_1(8,3)$, $Q_2(8,4)$, $Q_3(5,7)$, $Q_4(6,3)$, $Q_5(4,5)$, $Q_6(2,3)$ Show the calculations of determining the sign of the cross product at each step. You don't need to plot the points. Note that the points are already sorted by polar angle in counterclockwise order around Q_0.	5 CO1

5a)	What is the implication of having a polynomial time algorithm for a problem in the NP-complete class? **OR** . Define the complexity classes P and NP.	1	CO2
5b)	What is a Backtracking Algorithm? In a futuristic alien base, you are tasked with deploying **4 security drones** on a **4×4 surveillance grid**. Each drone must be placed such that **no two drones can detect each other** meaning no two are in the same **row**, **column**, or **diagonal**. Explain how the **Backtracking algorithm** would solve the **4-drones placement problem**, and outline how it searches the grid to find valid arrangements.	4	CO4
5c)	Define the Branch-and-Bound algorithm and explain its key properties: branching, bounding, and pruning. You are a space probe AI on a mission to collect samples from 3 planets in a distant star system: Zebes, SR388, and Aether. You must start and return to your mothership, orbiting above Zebes, after visiting each planet exactly once. Travel between planets consumes fuel, and your goal is to minimize total fuel consumption. Fuel Cost Matrix (in units):	5	CO4

From / To	Zebes	SR388	Aether
Zebes	∞	20	25
SR388	30	∞	35
Aether	40	45	∞