CBCS SCHEME

USN | | | | | | | | | | |

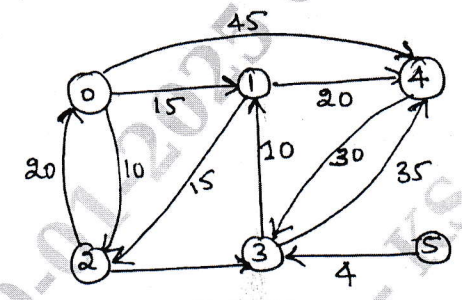
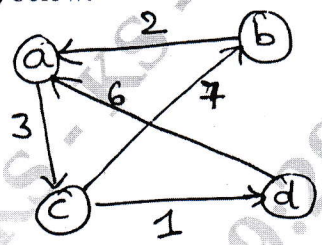
BCO402

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Analysis and Design of Algorithm

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Describe the Asymptotic Notations and Basic efficiency classes.	10	L2	CO1
	b.	Apply application of brute – force approach to design a selection sort, Bubble sort algorithm and explain its time complexity.	10	L3	CO1
		OR			
Q.2	a.	Describe the mathematical analysis of recursive algorithms, Also describe the tower of Honoi problem and obtain its time complexity.	10	L2	CO1
	b.	Develop an algorithm to multiply two matrices and obtain its time complexity.	10	L3	CO1
		Module – 2			
Q.3	a.	Apply Brute – force approach to explain the exhaustive search (Travelling sales man and knapsack problem).	10	L3	CO2
	b.	Solve using divide and conquer method, multiply the following two matrices with the help of Stassen's matrix multiplication $\begin{bmatrix}1 & 2\\5 & 6\end{bmatrix}$ $\begin{bmatrix}8 & 7\\1 & 2\end{bmatrix}$.	10	L3	CO2
		OR			
Q.4	a.	Apply Decrease and conquer to explain the insertion sort with an example.	10	L3	CO2
	b.	Develop merge sort algorithm using divide and conquer method and trace 60, 50, 25, 10, 35, 25, 75, 30.	10	L3	CO2
		Module – 3			
Q.5	a.	Develop a bottom – up heap algorithm with an example and explain its time complexity.	10	L3	CO3
	b.	Develop an algorithm of sorting by comparison counting and sort these 62, 31, 84, 96, 19, 47 using comparison counting.	10	L3	CO3
		OR			
Q.6	a.	Develop a Horspool's string matching algorithm along with its shift table algorithm and give example.	10	L3	CO3
	b.	Apply different types of rotation to construct an AVL tree for the list 5, 6, 8, 3, 2, 4, 7 and explain its time complexity.	10	L3	CO3

		Module – 4			
Q.7	**a.**	Develop C/C ++ program to find minimum cost spanning tree of a given connected graph using prims algorithm.	**10**	**L3**	**CO4**
	b.	Develop a coin-Row problem algorithm and solve the problem by Dynamic programming for the coin-Row 5, 1, 2, 10, 6, 2.	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	Apply the Dijkstra's algorithm to find the shortest distance and shortest path from vertex 5 (five) to vertex 0 (zero). Using Dijkstra algorithm.  Fig Q8(a)	**10**	**L3**	**CO4**
	b.	Solve the all pair of shortest path problem using Floyd's algorithm for the digraph shown Fig Q8(b) below.  Fig Q8(b)	**10**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Build the Decision trees for searching a sorting array (Binary search tree)	**10**	**L3**	**CO5**
	b.	Apply backtracking to solve the following instance of the subset sum problem. A = {3, 5, 6, 7} and d = 15	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	Develop C/C++ program to solve the discrete and continuous knapsack problem using greedy approximation method.	**10**	**L3**	**CO5**
	b.	Solve the following instance of the knapsack problem by the branch and bound algorithm and construct state space tree. The knapsack capacity w is 10.	**10**	**L3**	**CO5**

Item	Weight	Value
1	4	$40
2	7	$42
3	5	$25
4	3	$12

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CBCS SCHEME

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BCS403

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Database Management System

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the following terms: (i) Database (ii) Schema (iii) Entity (iv) DDL (v) Degree of a relationship	05	L1	CO1
	b.	Briefly explain characteristics of database approach.	05	L2	CO1
	c.	List and explain advantages of using DBMS approach.	10	L2	CO1
		OR			
Q.2	a.	Define the following terms: (i) Cardinality (ii) Weak entity (iii) Program data independence (iv) DML (v) Value sets	05	L1	CO1
	b.	Describe three-schema architecture. Why do we need mappings between schema levels?	05	L2	CO1
	c.	Explain different types of attributes in ER model with suitable example for each.	10	L2	CO1
		Module – 2			
Q.3	a.	With suitable example, explain the entity integrity and referential integrity constraints. Why each is considered important?	05	L2	CO2
	b.	Discuss equijoin and natural join with suitable example using relational algebra notation.	05	L2	CO2
	c.	Given the relational tables: Employee: EID | Name | DepID | Salary 1 | Alice | 10 | 5000 2 | Bob | 20 | 6000 3 | Eve | 20 | 6500 Department: DeptID | DeptName 10 | HR 20 | IT 30 | Sales Project PID | Project Name | DeptID 101 | Project Alpha | 10 102 | Project Beta | 20 103 | Project Gamma | 30 Write relational algebra expression for the following: (i) Find the names and salaries of all employees in the 'IT' department. (ii) Find the ID's and names of employees who are in the 'IT' department and have a salary greater than 6000. (iii) Find the ID's and names of employees who are either in the 'HR' department or have a salary greater than 6000. (iv) Find the names of employees who are not in the 'IT' department (v) Find the names of employees along with their department names.	10	L3	CO2

OR

Q.4	**a.**	Explain any two operations that change the state of relation in a database. Provide suitable examples.	**05**	**L2**	**CO2**
	b.	Discuss the aggregation functions and grouping in relational algebra with suitable examples.	**05**	**L2**	**CO2**
	c.	Given the relational tables: Student: SID | Name a | Alice b | Bob c | Carol Project: PID | Project Name p | Alpha q | Beta r | Gamma Language: LID | Language Name x | Python y | Java z | C++ Enrollment: SID | PID a | p a | q b | q c | r Write relational algebra expression for the following: (i) Rename the student table to Learner and display it. (ii) Find the students (learners) who are not enrolled in any project. (iii) Find the students who are enrolled in all projects. (iv) Find the students who are not enrolled in any project. (v) Find the students who are enrolled in both the 'Alpha' and 'Beta' projects.	**10**	**L3**	**CO2**

Module – 3

Q.5	**a.**	Explain Armstrong inference rules.	**05**	**L2**	**CO4**
	b.	What is the need for normalization? Explain 1NF, 2NF and 3NF with examples.	**05**	**L2**	**CO4**
	c.	What is functional dependency? Write an algorithm to find minimal cover for set of functional dependencies. Construct minimal cover M for set of functional dependencies which are: E = {B → A, D → A, AB → D}	**10**	**L3**	**CO4**

OR

Q.6	**a.**	Explain the types of update anomalies in SQL with an example.	**05**	**L2**	**CO4**
	b.	Explain types of JBBC drivers.	**05**	**L2**	**CO5**
	c.	Consider the schema R = ABCD, subjected to FDs F = {A →B, B →C}, and the non-binary partition D1 = {ACD, AB, BC}. State whether D1 is a lossless decomposition? [give all steps in detail].	**10**	**L3**	**CO4**

Module – 4

Q.7	**a.**	Define transaction. Discuss ACID properties.	**05**	**L2**	**CO5**
	b.	With a neat diagram, explain transition diagram of a transaction.	**05**	**L2**	**CO5**
	c.	Demonstrate working of assertion and triggers in SQL with example.	**10**	**L3**	**CO5**

OR

Q.8	**a.**	Explain cursor and its properties in embedded SQL with suitable example.	**05**	**L2**	**CO5**
	b.	Determine if the following schedule is serializable and explain your reasoning: i) T1 : R(X)W(X) T2 : R(X)W(X) T1 : COMMIT T2 : COMMIT ii) T1 : W(X)R(Y) T2 : R(X)W(Y) T1 : COMMIT T2 : COMMIT	**05**	**L2**	**CO5**

	c.	Consider the tables below: Sailors (<u>sid : integer</u>, sname : string, rating : integer, age : real) Boats (<u>bid : integer</u>, bname : string, color : string); Reserves (<u>sid : integer</u>, <u>bid : integer</u>, day : date) Write SQL queries for the following: (i) Write create table statement for reserves. (ii) Find all information of sailors who have reserved boat number 101. (iii) Find the names of sailors who have reserved at least one boat. (iv) Find the names of sailors who have reserved a red boat. (v) Find the average age of sailors for each rating level.	10	L3	CO5
		Module – 5			
Q.9	a.	Explain the CAP theorem.	05	L2	CO6
	b.	What is NOSQL graph database? Explain Neo4j.	05	L2	CO6
	c.	Why concurrency control and recovery are needed in DBMS? Demonstrate with suitable examples types of problems that may occur when two simple transactions run concurrently.	10	L3	CO5
		OR			
Q.10	a.	Explain basic operations CRUD in MongoDB.	05	L2	CO6
	b.	Explain deadlock prevention protocols.	05	L2	CO5
	c.	Briefly discuss the two-phase looking techniques f_0 concurrency control.	10	L3	CO5

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CBCS SCHEME

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BCS405A

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define a tautology. Prove that for any propositions p, q, r the compound propositions $\{(p \rightarrow q) \wedge (q \rightarrow r)\} \rightarrow (p \rightarrow r)$ is tautology.	06	L2	CO1
	b.	Establish the validity of the following argument using the rules of inference: $\{p \wedge (p \rightarrow q) \wedge (s \vee r) \wedge (r \rightarrow \sim q)\} \rightarrow (s \vee t)$	07	L2	CO1
	c.	For any two odd integers m and n, show that: (i) m + n is even (ii) mn is odd	07	L2	CO1
		OR			
Q.2	a.	Show that the compound proposition $[(p \vee q) \rightarrow r] \Leftrightarrow [(p \rightarrow r) \wedge (q \rightarrow r)]$ for primitive statements p, q, r is logically equivalent.	06	L2	CO1
	b.	Prove the following using law of logic: $p \rightarrow (q \rightarrow r) \Leftrightarrow (p \wedge q) \rightarrow r$	07	L2	CO1
	c.	Determine the truth value of each of the following quantified statements, the universe being the set of all non-zero integers: (i) $\exists x, \exists y, [xy = 1]$ (ii) $\exists x, \forall y, [xy = 1]$ (iii) $\forall x, \exists y, [xy = 1]$ (iv) $\exists x, \exists y, [(2x + y = 5) \wedge (x - 3y = -8)]$ (v) $\exists x, \exists y, [(3x - y = 17) \wedge (2x + 4y = 3)]$	07	L3	CO1
		Module – 2			
Q.3	a.	Prove that for each $n \in z^+$, $1^2 + 2^2 + 3^2 + \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$.	06	L2	CO2
	b.	Let $a_0 = 1$, $a_1 = 2$, $a_2 = 3$ and $a_n = a_{n-1} + a_{n-2} + a_{n-3}$ for $n \geq 3$, prove that $a_n \leq 3^n \ \forall \ n \in z^+$.	07	L2	CO2
	c.	How many positive integers n can be we form using the digits 3, 4, 4, 5, 5, 6, 7 if we want n to exceed 5,000,000?	07	L3	CO2
		OR			
Q.4	a.	By mathematical induction prove that $1.3 + 2.4 + \ldots + n(n+2) = \frac{n(n+1)(2n+7)}{6}$	06	L2	CO2
	b.	Find the number of permutations of the letters of the word ENGINEERING such that: (i) All the E's are together (ii) Arrangement begin with N (iii) All the vowels are adjacent.	07	L3	CO2
	c.	Find the coefficient of $a^2b^3c^2d^5$ in the expansion of $(a + 2b - 3c + 2d + 5)^{16}$.	07	L3	CO2
		Module – 3			
Q.5	a.	State pigeon hole principle. Prove that if 30 dictionaries in a library contain a total of 61,327 pages then atleast one of the dictionaries must have atleast 2045 pages.	06	L3	CO3
	b.	Let $f : R \rightarrow R$ be defined by $f(x) = \begin{cases} 3x - 5 & \text{if } x > 0 \\ 1 - 3x & \text{if } x \leq 0 \end{cases}$. Find $f^{-1}(0)$, $f^{-1}(1)$, $f^{-1}(-1)$, $f^{-1}(3)$, $f^{-1}(-6)$, $f^{-1}([-6, 5])$ and $f^{-1}([-5, 5])$	07	L2	CO3
	c.	Draw the Hasse diagram representing the positive divisor of 36.	07	L3	CO3

OR

Q.6	a.	Let A = {1, 2, 3, 4} and B = {1, 2, 3, 4, 5, 6}, (i) How many functions are there from A to B? (ii) How many of these are one to one? (iii) How many functions are there from B to A? (iv) How many of these are onto?	06	L2	CO3
	b.	Let f and g be functions from R to R defined by f(x) = ax + b and $g(x) = 1 - x + x^2$. If $(g \circ f)(x) = 9x^2 - 9x + 3$, determine a and b.	07	L2	CO3
	c.	Let A = {1, 2, 3, 4, 6} and R be a relation on A defined by aRb if and only if "a is multiple of b". Write down the relation R, relation matrix M(R) and draw the digraph. List out in degree and out degree.	07	L3	CO3

Module – 4

Q.7	a.	In how many ways 5 number of a's, 4 number of b's and 3 number of c's can be arranged so that all the identical letters are not in a single block?	06	L3	CO4
	b.	Determine the number of positive integers n such that $1 \le n \le 100$ and n is not divisible by 2, 3, or 5.	07	L3	CO4
	c.	Solve the recurrence relation $a_{n+2} - 3a_{n+1} + 2a_n = 0$, $a_0 = 1$, $a_1 = 6$.	07	L2	CO4

OR

Q.8	a.	In how many ways can the 26 letters of the English alphabet be permuted so that none of the patterns CAR, DOG, PUN or BYTE occurs?	06	L3	CO4
	b.	Five teachers T_1, T_2, T_3, T_4 are to be made class teachers for five classes, C_1, C_2, C_3, C_4, C_5, one teacher for each class. T_1 and T_2 do not wish to become the class teachers for C_1 or C_2, T_3 and T_4 for C_4 or C_5, and T_5 for C_3 or C_4 or C_5. In how many ways can the teachers be assigned the work? (Without displeasing any teacher)	07	L3	CO4
	c.	Solve the recurrence relation $F_{n+2} = F_{n+1} + F_n$ where $n \ge 0$ and $F_0 = 0$, $F_1 = 1$.	07	L2	CO4

Module – 5

Q.9	a.	If G be a set of all non zero real numbers and let $a * b = \frac{ab}{2}$ then show that (G, *) is an abelian group.	06	L2	CO5
	b.	Define Klein group and if A = {e, a, b, c} then show that this is a Klein-4 group.	07	L2	CO5
	c.	State and prove Lagrange's theorem.	07	L2	CO5

OR

Q.10	a.	If H and K are subgroups of group G, prove that $H \cap K$ is also a subgroup of G. Is $H \cup K$ a subgroup of G?	06	L2	CO5
	b.	Define cyclic group and show that (G, *) whose multiplication table is as given below is cyclic.	07	L2	CO5

*	a	b	c	d	e	f
a	a	b	c	d	e	f
b	b	c	d	e	f	a
c	c	d	e	f	a	b
d	d	e	f	a	b	c
e	e	f	a	b	c	d
f	f	a	b	c	d	e

	c.	Let G = S_4, for $\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 1 \end{pmatrix}$, find the subgroup H = $<\alpha>$. Determine the left cosets of H in G.	07	L3	CO5

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CBCS SCHEME

USN 1KS22AI011

BBOC407

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Biology for Engineers (CSE)

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	What is stem cell? Explain its types and list its applications.	7	L2	CO1
	b.	Explain in detail the properties and functions of nucleic acids.	6	L2	CO1
	c.	Explain the importance of special biomolecules.	7	L2	CO1
		OR			
Q.2	a.	What is a biomolecule? Explain the classifications of biomolecule.	7	L2	CO1
	b.	Explain the properties and functions of carbohydrates.	6	L2	CO1
	c.	Describe the structure and functions of a cell with a neat diagram.	7	L3	CO1
		Module – 2			
Q.3	a.	What is the role of lipids? Outline the process of obtaining biodiesel from lipids.	7	L3	CO2
	b.	Differentiate between PHA and PLA as a bioplastic materials.	6	L4	CO1
	c.	Explain the role of DNA vaccine for rabies and RNA vaccine for COVID-19.	7	L2	CO1
		OR			
Q.4	a.	What are the key properties, advantages and limitations of cellulose based water filters.	7	L3	CO2
	b.	How can DNA finger printing be applied to evaluate its effectiveness and reliability in forensic applications.	6	L4	CO1
	c.	Describe the use of meat analogue and plant protein as food.	7	L2	CO2
		Module – 3			
Q.5	a.	Deliberate the functioning of brain as CPU system.	7	L3	CO2
	b.	Write a short note on spirometry and ventilator.	6	L2	CO2
	c.	Explain heart as pump system.	7	L3	CO2

		OR			
Q.6	**a.**	Explain eye as a camera system.	**7**	**L3**	**CO2**
	b.	Write a short note on cardiac pacemaker.	**6**	**L2**	**CO2**
	c.	Explain kidney as purification system.	**7**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	Describe the materials used and engineering applications of Velcro technology.	**7**	**L3**	**CO3**
	b.	Compare the process of photosynthesis to the functioning of photovoltaic cells.	**6**	**L4**	**CO3**
	c.	Explain the HBOCs and PFCs as human blood substituents.	**7**	**L3**	**CO3**
		OR			
Q.8	**a.**	Explain the terms lotus leaf effect and bird flying.	**7**	**L3**	**CO3**
	b.	Compare biological echolocation and technological echolocation highlighting their applications in navigation and detection.	**6**	**L4**	**CO3**
	c.	Explain the terms shark skin, swim suits and bullet train using biological concepts.	**7**	**L3**	**CO3**
		Module – 5			
Q.9	**a.**	Compare the functioning of electrical tongue and human tongue.	**7**	**L4**	**CO4**
	b.	Explain muscle cells as scaffold for tissue growth.	**6**	**L2**	**CO4**
	c.	Explain bioremediation and biomining via microbial surface adsorption.	**7**	**L2**	**CO4**
		OR			
Q.10	**a.**	Illustrate the basic steps of bioprinting process and list the various types of bioprinting techniques.	**7**	**L4**	**CO4**
	b.	Write a short note on: i) Importance of DNA origami ii) Self healing bioconcrete.	**6**	**L2**	**CO4**
	c.	Discuss the applications of artificial intelligence in the diagnosis of disease.	**7**	**L2**	**CO4**

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