CBCS SCHEME

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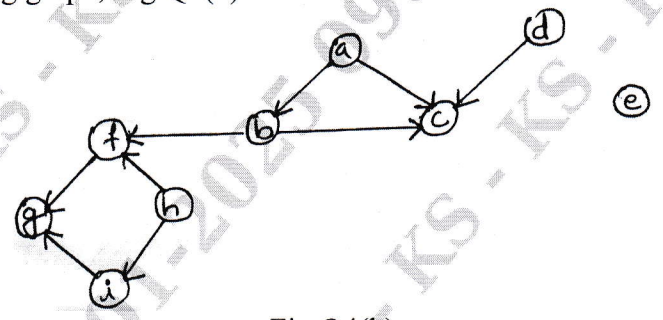
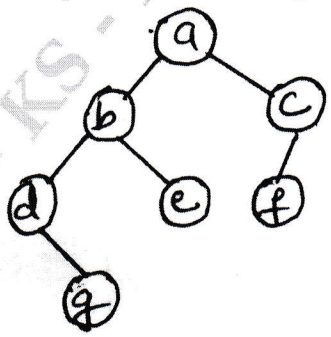
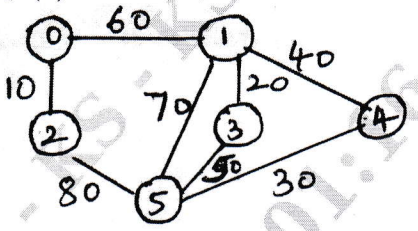
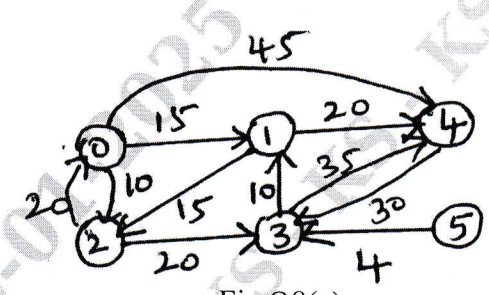
BCS401

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

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.	Explain the various steps in algorithm design and analysis process with the flow diagram.	08	L1	CO1
	b.	Give formal and informal definitions of asymptotic notations.	06	L1	CO1
	c.	Explain the general plan of mathematical analysis of recursive algorithm with an example.	06	L1	CO1
		OR			
Q.2	a.	Design algorithm for tower of Hanoi problem and obtain time complexity.	10	L1	CO1
	b.	Write an algorithm to search an element in an array using sequential search. Discuss the best case, worst case and average case efficiency of this algorithm.	10	L1	CO1
		Module – 2			
Q.3	a.	Write an algorithm to sort the numbers using insertion sort. Discuss its efficiency.	10	L2	CO2
	b.	Design quick sort algorithm and obtain its best, average and worst case efficiency.	10	L2	CO2
		OR			
Q.4	a.	Write merge sort algorithm and sort the list E X A M P L E.	08	L2	CO2
	b.	Apply the DFS based algorithm to solve the topological sorting problem for the following graph, Fig.Q4(b)  Fig.Q4(b)	06	L3	CO2
	c.	Write algorithm for pre-order, post order and in order traversals of a tree. Write pre-order, in-order and post order for the given tree.  Fig.Q4(c)	06	L2	CO2

		Module – 3			
Q.5	**a.**	Define AVL tree. Construct AVL tree for the list 5, 6, 8, 3, 2, 4, 7.	**10**	**L3**	**CO3**
	b.	Define heap. Sort the following lists by heapsort: H E A P S O R T (in alphabetical order)	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	Write the algorithm for comparison counting sort. Discuss its efficiency.	**10**	**L2**	**CO4**
	b.	Design Horspools algorithm for string matching. Apply Horspools algorithm to find the pattern BARBER on the text JIM_SAW_ME_IN_BARBERSHOP	**10**	**L3**	**CO4**
		Module – 4			
Q.7	**a.**	Write Warshall's algorithm and apply the same to compute transitive closure of a directed graph. a b c d e a 1 0 0 1 0 b 0 1 0 0 0 c 0 0 0 1 1 d 1 0 0 0 0 e 0 1 0 0 1	**10**	**L3**	**CO3**
	b.	Construct minimum cost spanning tree using Kruskal's algorithm for the following graph, Fig.Q7(b).  Fig.Q7(b)	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	Solve the following single source shortest path problem assuming vertex '5' as the source.  Fig.Q8(a)	**10**	**L3**	**CO4**
	b.	Write Huffman's algorithm. Construct Huffman tree and resulting code word for the following: Character | A | B | C | D | E | - Probability | 0.5 | 0.35 | 0.5 | 0.1 | 0.4 | 0.2 Encode the text DAD_CBE.	**10**	**L4**	**CO4**
		Module – 5			
Q.9	**a.**	Explain the following with example: (i) P problem (ii) NP problem	**06**	**L1**	**CO5**
	b.	What is decision tree? Construct decision tree for the three element insertion sort.	**08**	**L2**	**CO5**
	c.	Construct state space tree to solve 4 queens problem.	**06**	**L3**	**CO5**

OR

Q.10	**a.**	What is backtracking? Apply back tracking to solve the below instance of sum of subset problem: s = {3, 5, 6, 7}, d = 15	**10**	**L3**	**CO6**
	b.	Solve the following instance of knapsack problem using branch and bound technique knapsack capacity = 10.	**10**	**L4**	**CO6**

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

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BCS402

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

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.	Explain the purpose of various fields of current program status register with a neat diagram.	05	L2	CO1
	b.	Explain the ARM design philosophy.	06	L2	CO1
	c.	Explain the core extensions of ARM processor with neat block diagram.	09	L2	CO1
		OR			
Q.2	a.	Explain Embedded systems hardware with a neat block diagram.	06	L2	CO1
	b.	What is pipelines in ARM? Illustrate with an example the pipeline stage of ARM 9 and ARM 10.	09	L2	CO1
	c.	Describe the RISC design philosophy with 4 design rules.	05	L2	CO1
		Module – 2			
Q.3	a.	Explain the following with examples : (i) RSC (ii) MLA (iii) STRH (iv) SWP	10	L2	CO2
	b.	Explain the different data processing instruction in ARM.	10	L2	CO2
		OR			
Q.4	a.	Explain Barrel shifter instruction in ARM with suitable examples.	10	L2	CO2
	b.	Explain the different branch instruction of ARM processor.	05	L2	CO2
	c.	Explain co-processor instruction of ARM processor.	05	L2	CO2
		Module – 3			
Q.5	a.	Explain the different basic data types in C. Provide examples of how each data type can be used in a C program.	08	L2	CO3
	b.	Discuss the concept of register allocation in compiler optimization. Illustrate its significance with an example.	07	L2	CO3
	c.	Describe the process of a function call in C.	05	L2	CO3
		OR			
Q.6	a.	Discuss the common portability issues faced when writing C programs. How can these issues be mitigated.	07	L2	CO3
	b.	Explain the concept of pointer aliasing with example.	07	L2	CO3
	c.	How are function calls handled efficiently in calling function in C?	06	L2	CO3
		Module – 4			
Q.7	a.	What are interrupts? Discuss interrupt vector table with diagram for ARM processor.	06	L2	CO4
	b.	Describe the sequence of operations that occurs when an ARM processor handles an IRQ exceptions.	06	L2	CO4
	c.	Discuss the priority system for exception in ARM processor.	08	L2	CO4
		OR			
Q.8	a.	Explain the role of the link register in ARM exception handling.	08	L2	CO4
	b.	Explain the design and implementation of an interrupt stack in a ARM-based system. Explain the steps involved.	08	L2	CO4
	c.	What are the key differences between a boot loader and firmware?	04	L2	CO4

		Module – 5			
Q.9	a.	Explain the basic operation of a cache controller.	06	L2	CO5
	b.	With a neat diagram, explain the basic architecture of a cache memory.	10	L2	CO5
	c.	Mention any 4 relationship between cache and main memory.	04	L2	CO5
		OR			
Q.10	a.	Write a note on cache write policy both write back or write through.	10	L2	CO5
	b.	Describe the allocation policy on a cache miss.	04	L2	CO5
	c.	Write a note on following : (i) Write buffers (ii) Cache efficiency	06	L2	CO5

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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:	10	L3	CO2

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.

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 (sid : integer, sname : string, rating : integer, age : real) Boats (bid : integer, bname : string, color : string); Reserves (sid : integer, bid : integer, 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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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**
	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**

*	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

CBCS SCHEME

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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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