UNITED INSTITUTE OF TECHNOLOGY

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Periyanaickenpalayam, Coimbatore – 641020

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)

QUESTION BANK

II YEAR

ODD SEMESTER

ACADEMIC YEAR 2025 - 2026

INDEX

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24MABS301
DISCRETE MATHEMATICS

UNIT – I

LOGIC AND PROOFS

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs.

Q. NO	QUESTION	CO	BTL	Marks
	PART–A			
1.	State the truth table of "If tigers have wings then the earth travels roUN the sun".	1	UN	2
2.	Give the converse and contra positive of the implication "If it is raining, then I get wet".	1	UN	2
3.	Show that P→Q and ¬P∨Q are equivalent.	1	UN	2
4.	Construct the truth table for the compoUN proposition (p →q)→(q→p).	1	UN	2
5.	Symbolize the statement "Good food is not cheap".	1	UN	2
6.	Write the following sentence in a symbolic form "Every one who is healthy can do all kinds of work".	1	UN	2
7.	Verify (R→S) ∨¬(R→S) is a tautology.	1	UN	2
8.	Verify P∨Q→P is a tautology.	1	UN	2
9.	Show that ¬ (P→Q) and P∧¬Q are equivalent.	1	UN	2
10.	What are the negations of the statements $\forall x(x^2 > x)$ *and* $\exists x(x^2 = 2)$?	1	RE	2
11.	Construct the truth table for the compoUN proposition $(p \to q) \to (q \to p)$.	1	UN	2
12.	State Demorgan's laws of logic.	1	RE	2
13.	Express the following statement using predicators and quantifiers, "All men are mortal"	1	UN	2
14.	When a set of formulae is consistent and inconsistent?	1	RE	2
15.	Determine whether the conclusion C follows logically from the pREises H_1 and H_2 or not. H_1 : P→Q, H_2 : P, C : Q	1	UN	2

PART-B

1.	(i) Construct the truth table for the following statement $\neg(p \vee (q \wedge r)) \leftrightarrow ((p \vee q) \wedge (p \vee r))$.	1	UN	8
	(ii) Show that $\big(\neg P \wedge (\neg Q \wedge R)\big) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$.	1	UN	8
2.	(i) Show that $p \vee (q \wedge r)$ *and* $(p \vee q) \wedge (p \vee r)$ are logically equivalent.	1	AP	8
	(ii) Without constructing the truth table find the PDNF and PCNF of $(\neg P \rightarrow R) \wedge (Q \leftrightarrow P)$.	1	AP	8
3.	(i) Without constructing the truth table find the PDNF and PCNF of $P \rightarrow (Q \wedge R) \wedge (\neg P \rightarrow (\neg Q \wedge \neg R))$	1	AP	8
	(ii) Find the PDNF of the statement, $(q \vee (p \wedge r)) \wedge \neg((p \vee r) \wedge q)$.	1	AP	8
4	(i) Using indirect method of proof, derive $P \rightarrow \neg S$ from $P \rightarrow (Q \vee R)$, $Q \rightarrow \neg P$, $S \rightarrow \neg R$, P.	1	AP	8
	(ii) Use the indirect method to prove that the conclusion $\exists z Q(z)$ follows from the pREises $\forall x(P(x) \rightarrow Q(x))$ *and* $\exists y P(y)$.	1	AP	8
5	(i) Find the disjunctive normal form of $p \rightarrow ((p \rightarrow q) \wedge \neg (\neg q \vee \neg p))$.	1	UN	8
	(ii) Use indirect method of proof, $(\forall x)(P(x) \vee Q(x)) \Rightarrow (\forall x)P(x) \vee (\exists x)Q(x)$.	1	AP	8
6	(i)Show that $R \rightarrow S$ can be derived from the pREises $P \rightarrow (Q \rightarrow S)$, $\neg R \vee P$ and Q.	1	AP	8
	(ii)Show that $R \vee S$ follows logically from the pREises $C \vee D$, $(C \vee D) \rightarrow \neg H$, $\neg H \rightarrow (A \wedge \neg B)$ and $(A \wedge \neg B) \rightarrow (R \vee S)$.	1	AP	8
7	(i)Without using truth tables, show that $Q \vee (P \wedge \neg Q) \vee (\neg P \wedge \neg Q)$ is a tautology.	1	AP	8
	(ii)Show that S is valid inference from the pREises $P \rightarrow \neg Q, Q \vee R, \neg S \rightarrow P$ and $\neg R$.	1	AP	8
8	(i)Show that the pREises $R \rightarrow \neg Q, R \vee S, S \rightarrow \neg Q, P \rightarrow Q, P$ are inconsistent.	1	AP	8
	(ii)Show that d can be derived from the pREises $(a \rightarrow b) \wedge (a \rightarrow c), \neg(b \wedge c), d \vee a$	1	AP	8

UNIT – II

COMBINATORICS

Mathematical induction – Strong induction and well ordering – The basics of counting – Thepigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Inclusion and exclusion principle and its APlications.

Q. NO	QUESTION	CO	BTL	Marks
	PART–A			
1.	State the principle of Mathematical induction.	2	RE	2
2.	State the principle of Strong induction.	2	RE	2
3.	How many ways are there to select five players from a 10 member tennis team to make a trip to a match at another school?	2	UN	2
4.	What is the number of arrangements of all the six letters in the word PEPPER ?	2	UN	2
5.	In how many ways can the letters of the word MISSISSIPPI be arranged?	2	UN	2
6.	Find the number of permutations of the letters of the word MATHEMATICS.	2	UN	2
7.	State the Pigeonhole principle.	2	RE	2
8.	If 9 colours are used to paint 100 houses, show that at least 12 houses will be of the same colour.	2	UN	2
9.	If we select any group of 1000 students on campus . show that atleast 3 of them must have same birthday .	2	UN	2
10.	Define recurrence relation .	2	RE	2
11.	Find the recurrence relation for the Fibonacci sequence	2	UN	2
12.	Find the first four terms of the sequence defined by the recurrence relation and initial condition$a_n = a_{n-1}^2$, $a_1 = 2$.	2	UN	2
13.	Find the recurrence relation satisfying the equation $y_n = A(3)^n + B(-4)^n$	2	UN	2
14.	Write an explicit formula for a_n if $a_n = 3a_{n-1}$ and $a_1 = 2$.	2	UN	2
15.	Write the Principle of Inclusion and Exclusion.	2	RE	2

PART-B

1.	(i) Using mathematical induction to show that $1^2 + 2^2 + 3^2 + \cdots \ldots . + n^2 = \frac{n(n+1)(2n+1)}{6}$ whenever n is a positive integer.	2	AP	8
	(ii) Using mathematical induction prove that $1^2 + 3^2 + 5^2 \ldots \ldots . + (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3}$ for all $n \geq 1$.	2	AP	8
2.	(i) Use mathematical induction to show that $1 + 2 + 3 + \ldots . + n = \frac{n(n+1)}{2}$.	2	AP	8
	(ii) Solve the recurrence relation $a_n = 8a_{n-1} - 16a_{n-2}$ for $n \geq 2$, $a_0 = 16,\ a_1 = 80.$	2	AP	8
3.	(i) Solve the recurrence relation $a_n = 6a_{n-1} - 9a_{n-2}, n \geq 2, a_0 = 2, \quad a_1 = 3.$	2	AP	8
	(ii) Show that the sequence $\{a_n\}$ is a solution of the recurrence relation $a_n = a_{n-1} + 2\,a_{n-2} + 2n - 9$ if $a_n = 3(-1)^n + 2^n - n + 2.$	2	AP	8
4	(i)Solve the recurrence relation $a_{n+2} = 4a_{n+1} - 4a_n \ , n \geq 0, a_{0=}1\ , a_1 = 3.$	2	AP	8
	(ii) In a survey of 100 students, it was foUN that 40 studied Mathematics, 64 studied Physics, 35 studied Chemistry, 1 studied all the three subjects, 25 studied Mathematics and Physics, 3 studied Mathematics and Chemistry, 20 studied Physics and Chemistry. Use the principle of inclusion and exclusion, find the number of students who studied Chemistry only and the number who studied none of these subjects?	2	AP	8
5.	(i) In how many arrangements of the letters of the word PHOTOGRAPH are there with exactly 5 letters between the two H^s?	2	UN	8
	(ii) A survey of 100 students with respect to their choice of the ice cream flavours Vanilla, Chocolate and Straberry shows that 50 students like Venilla, 43 like Chocolate, 28 like Strawberry, 13 like Venilla and Strawberry, 11 like Chocolate and Strawberry, 12 like Strawberry and Venilla, and 5 like all of them. Find the number of students who like (i) Venilla only (ii) Chocolate only (iii) Strawberry only (iv) number of students who do not like any of these.	2	AP	8
6.	(i) Prove by mathematical induction that $6^{n+2} + 7^{2n+1}$ is divisible by 43 for each positive integer 'n'.	2	AP	8
	(ii) Use mathematical induction to prove the inequality $n < 2^n$ for all positive integer n.	2	AP	8

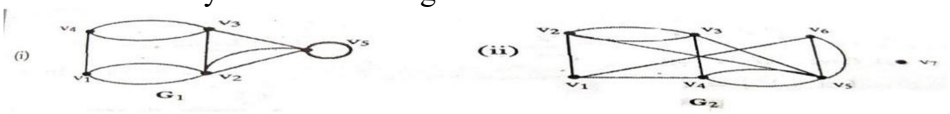
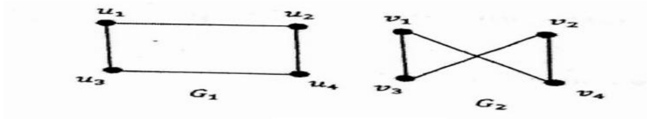
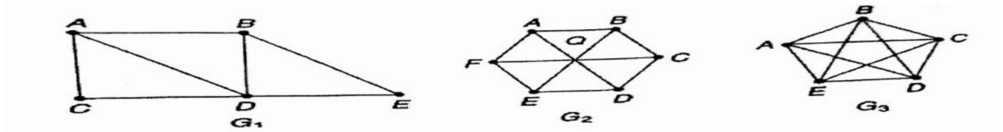
UNIT –III

GRAPHS

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

Q. NO	QUESTION	CO	BTL	Marks
	PART–A			
1.	Define a complete graph with example.	3	RE	2
2	What is meant by simple graph? Give an example.	3	RE	2
3.	Define a regular graph.	3	RE	2
4.	State the handshaking theoRE.	3	RE	2
5.	Define Pseudo graph.	3	RE	2
6.	Draw the graph represented by the given adjacency matrix $\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \end{bmatrix}$	3	UN	2
7.	Show that the simple graphs with the following adjacency matrices are isomorphic. $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$, $\begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{bmatrix}$.	3	UN	2
8.	Define path.	3	RE	2
9.	Define degree of a vertex in a graph.	3	RE	2
10.	State the necessary and sufficient conditions for the existence of an Eulerian path in connected graph.	3	RE	2
11.	Draw a complete bipartite graph of $K_{2,3}$ and $K_{3,3}$	3	RE	2
12.	Give an example of an Euler graph.	3	RE	2
13.	Give an example of a non-Eulerian graph which is Hamiltonian.	3	RE	2
14.	Define isomorphism between graphs.	3	RE	2
15.	Give an example of a graph which is Eulerian but not Hamiltonian.	3	RE	2

PART-B

1.	(i) In any graph G, prove that the total number of odd-degree vertices is even.	3	AP	8
	(ii) Show that the maximum number of edges in a simple graph with n vertices is $\frac{n(n-1)}{2}$.	3	AP	8
2.	(i) Find the number of vertices, number of edges and the degree of each vertex. Verify the handshaking theoRE. 	3	AP	8
	(ii) Prove that maximum number of edges in a simple disconnected graph G with 'n' vertices and 'k' Components is $\frac{(n-k)(n-k+1)}{2}$.	3	AP	8
3.	(i) Determine whether the following graphs G1 and G2 are isomorphic. 	3	AP	8
	(ii) Find an Euler path or an Euler circuit, if it exists in each of the three graphs below. If it does not exist, explain why? 	3	AP	8
	(ii)Draw the directed graph corresponding to the adjacency matrix and also find the indegree and outdegree for each of the vertices. $\begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$	3	UN	8
5.	(i) Prove that a connected graph 'G' is an Euler graph if only if all the vertices of ' G ' are of even Degree.	3	AP	8
	((ii) Draw the graph with 5 vertices A,B,C,D,E such that deg(A) = 3 , B is an odd vertex , deg(C) = 2 and D and E are adjacent.	3	UN	8
6.	(i) State and prove Hand shaking theoRE .	3	AP	8
	(ii)If G is a simple graph with n vertices with minimum degree $(G) \geq \frac{n}{2}$, show that G is connected.	3	AP	8

UNIT –IV

ALGEBRAIC STRUCTURES

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism's – Normal subgroup and cosets – Lagrange's theoRE.

Q. NO	QUESTION	CO	BTL	Marks
	PART–A			
1.	State any two properties of a group.	4	RE	2
2.	Define monoid.	4	RE	2
3.	Define a semi-group.	4	RE	2
4.	Prove that identity element is unique in a group.	4	RE	2
5.	Find the idempotent elements of G={1, -1, i, -i}UNer the binary operation multiplication.	4	UN	2
6.	Show that if every element in a group is its own inverse, then the group must be abelian.	4	UN	2
7.	Prove that if G is abelian group then for all $a,b \in G$ $(a*b)^2 = a^2 * b^2$.	4	UN	2
8.	Show that every cyclic group is abelian.	4	UN	2
9.	When is a group (G,*) called abelian?	4	RE	2
10.	Given $G = \{1, -1, i, -i\}$ is a group UNer usual multiplication and $H = \{1, -1\}$ is a subset of G. Find the index of H in G.	4	UN	2
11.	Find the left cosets of {[0], [3]} in the group $(Z_6, +_6)$	4	UN	2
12.	If 'a' is a generator of a cyclic group G then show that a^{-1} is also a generator of G.	4	UN	2
13.	Prove that every subgroup of an abelian group is a normal subgroup.	4	UN	2
14.	Show that $(Z_5, +_5)$ is a cyclic group.	4	UN	2
15.	Find all the cosets of the sub group $H = \{1, -1\}$ in $G = \{1, -1, i, -i\}$ with the operation multiplication.	4	UN	2

PART-B

1.	(i) If H_1 and H_2 are subgroups of a group (G,*) prove that $H_1 \cap H_2$ is a subgroup of (G,*).	4	AP	8
	(ii) Let (G, *) be a group, then prove that (i) For each $a \in G, (a^{-1})^{-1} = a$ (ii) For all, $a, b \in G, (a * b)^{-1} = b^{-1} * a^{-1}$ for all $a, b \in G$	4	AP	8
2.	(i) Let $Z_5^* = \{[1], [2], [3], [4]\}$ be the non-zero elements of Z_5. Prove that $(Z_5^*, \ _{\cdot 5})$ is an abelian group.	4	AP	8
	(ii) Show that the set of all non-zero real numbers is an abelian group UNer the operation * defined by $a * b = \frac{ab}{2}$.	4	AP	8
3.	(i) Show that $(Z_m, +_m)$ is an abelian group.	4	AP	8
	(ii) Show that the intersection of two normal subgroup of a group (G,*) is a normal subgroup of (G,*).	4	AP	8
4.	(i) State and prove Lagrange's theoRE.	4	AP	8
	(ii) Show that Kernal of a group homomorphism is a normal subgroup of the group.	4	AP	8
5.	(i) If * is a binary operation on the set R of real numbers defined by a*b = a+b+2ab , a) Find (R, *) is a semigroup b) Find the identity element if it exist . c) Which element has inverse and what are they?	4	AP	8
	(ii) Prove that the necessary and sufficient condition for non-empty subset H of a group {G , *} to be subgroup is $a, b \in H \Rightarrow a * b^{-1} \in H$.	4	AP	8
6.	(i)Show that every subgroup of a cyclic group is cyclic.	4	AP	8
	(ii)If H and K are subgroup of G, prove that $H \cup K$ is a subgroup of G if and only if either $H \subseteq K$ *or* $K \subseteq H$	4	AP	8
7.	(i) If $(G,*)$ *and* (H,Δ) are two groups and $g : (G,*) \to (H,\Delta)$ is a group homomorphism then prove that kernel of g is normal subgroup of (G,*).	4	AP	8
	(ii) If <H,* > is a subgroup of <G,* > then show that <H,* > is a normal subgroup iff $a * h * a^{-1} = H, \forall a \in G$.	4	AP	8
8.	State and prove the fUNamental theoRE on homomorphism of groups.	4	AP	16

UNIT – V

LATTICES AND BOOLEAN ALGEBRA

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems– Sub lattices – Some special lattices – Boolean algebra – Sub Boolean Algebra – Boolean Homomorphism.

Q. NO	QUESTION	CO	BTL	Marks
	PART–A			
1.	Define a partially ordered set.	5	RE	2
2	Draw a Hasse diagram of $D_{20} = \{1,2,4,5,10,20\}$.	5	UN	2
3.	Draw a Hasse diagram of $D_{12} = \{1,2,3,4,6,12\}$.	5	UN	2
4.	Define Lattice.	5	RE	2
5.	State the distributive inequalities in Lattice.	5	RE	2
6.	In a distributive lattice prove that complement of an element, if it exists, is unique.	5	RE	2
7.	Define Boolean algebra.	5	RE	2
8.	Prove that $(a')' = a$ for all $a \in B$ where B is a Boolean Algebra.	5	UN	2
9.	If B is a Boolean algebra then prove that for $a \in B$, $a + 1 = 1$and $a.0 = 0$.	5	UN	2
10.	State De Morgan's law in Boolean Algebra.	5	RE	2
11.	Draw the Hasse – diagram of the set of partitions of 5.	5	UN	2
12.	Give an example of a lattice which is a modular but not a distributive.	5	RE	2
13.	If A = {2,3} $\subseteq$ X = {2,3,6,12,24,36} and the relation $\leq$ is such that x $\leq$ y is x divides y, find the least element and greatest element for A.	5	UN	2
14.	Obtain the partial ordering represented by the Hasse diagram.	5	UN	2
15.	In any Boolean algebra, show that a = b if and only if $a\bar{b} + \bar{a}b = 0$.	5	UN	2

PART-B

1.	(i) Let D_{24} be the set of divisors of 24 and the relation $\leq$ is $a \leq b$ if $a \mid b$. Draw the Hasse diagram for the poset $(D_{24}, \mid)$.	5	AP	8
	(ii) Let $(L, \leq)$ be a lattice. For any $a, b, c \in L$ the following properties called isotonicity hold. If $b \leq c$ then (i) $a * b \leq a * c$ (ii) $a \oplus b \leq a \oplus c$.	5	AP	8
2.	(i) Let $(L, \leq)$ be a lattice. For any $a, b, c \in L$ the following inequalities hold. (i) $a \oplus (b * c) \leq (a \oplus b) * (a \oplus c)$ (ii) $a * (b \oplus c) \geq (a * b) \oplus (a * c)$.	5	AP	8
	(ii) State and Prove De Morgan's law in Lattice.	5	AP	8
3.	(i) Prove that every chain is a distributive lattice.	5	AP	8
	(ii) In a distributive lattice (L, *, $\oplus$) if for any $a, b, c \in L$, $a * b = a * c$ and $a \oplus b = a \oplus c$ then $b = c$.	5	AP	8
4.	(i) In a Boolean Algebra show that $ab' + a'b = 0$ if and only if $a = b$.	5	AP	8
	(ii) In a Boolean Algebra, prove that the following statements are equivalent (i) $a + b = b$ (ii) $a.b = a$ (iii) $a' + b = 1$ (iv) $a.b' = 0$.	5	AP	8
5.	(i) State and Prove De Morgan's law in Boolean Algebra.	5	AP	8
	(ii)Prove that every distributive lattice is modular. Is the converse true? Justify your claim.	5	AN	8
6.	(i) In a distributive lattice prove that $a * b = a * c$ and $a \oplus b = a \oplus c$ imply $b = c$.	5	AP	8
	(ii)In Boolean algebra, prove that $(a \wedge b)' = a' \vee b'$ for all a,b∈L.	5	AP	8
7.	(i)In a lattice show that $a \leq b \Rightarrow a * b = a$.	5	AP	8
	(ii) Draw the Hasse – diagram of the Lattice L of all subsets of {a, b, c} UNer intersection and union.	5	AP	8
8.	(i)Show that if L is a distributive lattice then for all $a, b, c \in L$, $(a * b) \oplus (b * c) \oplus (c * a) = (a \oplus b) * (b \oplus c) * (c \oplus a)$	5	AP	8
	(ii) Show that in a distributive and complemented lattice $a \leq b \Leftrightarrow a * b' = 0 \Leftrightarrow a' \oplus b = 1 \Leftrightarrow b' \leq a'$	5	AP	8

24CBPC301
JAVA PROGRAMMING

UNIT I
INTRODUCTION TO OOP AND JAVA

Overview of OOP – Object oriented programming paradigms – Features of Object Orient Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators –Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments - Strings: Basic String class, methods and String Buffer Class.

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	Define Object-Oriented Programming (OOP).	1	RE	2
2.	Mention any two OOP paradigms.	1	RE	2
3.	List any four features of OOP.	1	RE	2
4.	What are Java buzzwords? Give any two.	1	RE	2
5.	List the access specifiers in Java.	1	RE	2
6.	Write the syntax for defining a class in Java.	1	RE	2
7.	Write any two operators in Java.	1	RE	2
8.	What is the purpose of a constructor in Java?	1	UN	2
9.	What is method overloading?	1	UN	2
10.	What is the use of arrays in Java?	1	UN	2
11.	What is the role of control statements?	1	UN	2
12.	What is the use of `static` keyword in Java?	1	UN	2
13.	Write a note on JavaDoc comments.	1	UN	2
14.	Differentiate between `String` and `StringBuffer`.	1	AN	2
15.	Give an example where a control structure is used in a Java ffprogram.	1	AP	2
	PART-B			
1.	Explain in detail the principles and features of OOP with suitable examples.	1	UN	16
2.	Discuss Java buzzwords and their role in Java's platform independence and security.	1	UN	16
3.	Compare OOP paradigms with procedural programming with examples.	1	AN	16
4.	Explain the different types of access specifiers with code examples.	1	AN	16
5.	ANyze the differences between String and StringBuffer with relEVnt code.	1	AN	16
6.	Write a Java program using arrays, loops, and conditional statements. Explain the logic.	1	AP	16
7.	Write a Java program to demonstrate the use of static members and constructors.	1	AP	16
8.	Design a class `Employee` with fields, constructors, methods, static members, and access control. Write a main class to test the functionality.	1	AP	16

UNIT II
INHERITANCE, PACKAGES AND INTERFACES

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes.Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	What is method overloading in Java?	2	RE	2
2.	Differentiate between static and non-static methods	2	UN	2
3.	What is the purpose of returning objects from a method?	2	UN	2
4.	Define inner class with an example	2	RE	2
5.	Mention the types of inheritance supported in java	2	RE	2
6.	What is dynamic method dispatch?	2	UN	2
7.	Explain the use of the super keyword	2	UN	2
8.	Why is method overriding needed?	2	UN	2
9.	Write the syntax for declaring an abstract class	2	RE	2
10.	How does the final keyword affect inheritance?	2	UN	2
11.	What are the types of packages in java?	2	RE	2
12.	Explain the use of import keyword	2	UN	2
13.	How do you define an interface in java?	2	RE	2
14.	Differentiate between interface and abstract class	2	AP	2
15.	Can a class implement multiple interfaces?Justify your answer.	2	AP	2
	PART-B			
1.	Describe method overloading with suitable java examples.	2	UN	16
2.	Write a java program to demonstrate objects as method parameters and returning objects.	2	AP	16
3.	Explain static,nested and inner classes with examples.	2	UN	16
4.	Discuss various types of inheritance in java with examples.	2	UN	16
5.	Illustrate method overriding and dynamic method dispatch with code.	2	AP	16
6.	Explain abstract classes and final keyword in the context of inheritance.	2	UN	16
7.	Explain the concept of packages and importing packages with suitable examples.	2	UN	16
8.	Define an interface in Java and demonstrate how to implement multiple interfaces	2	AP	16

UNIT III
EXCEPTION HANDLING AND MULTITHREADING

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication-Suspending –Resuming, and Stopping Threads –Multithreading. WrAPers – Auto boxing.

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	What is an exception in java?	3	RE	2
2.	Write the syntax for try-catch block.	3	RE	2
3.	What is the use of multiple catch clauses?	3	UN	2
4.	Explain nested try statements	3	UN	2
5.	Name any four built-in exceptions in Java.	3	RE	2
6.	How do you create a user-defined exception?	3	UN	2
7.	What is the Java thread model?	3	UN	2
8.	How can we create a thread in Java?	3	RE	2
9.	What is thread priority?	3	UN	2
10.	Define synchronization.Why is it needed?	3	UN	2
11.	What is inter-thread communication?	3	UN	2
12.	How can you suspend and resume a thread?	3	AP	2
13.	What is the difference between sleep() and suspend() methods?	3	AP	2
14.	Define autoboxing with an example.	3	UN	2
15.	What are wrAPer classes?Why are they needed?	3	UN	2
	PART-B			
1.	Explain the basics of exception handling in Java.Illustrate with suitable examples.	3	UN	16
2.	Write a Java program demonstrating multiple catch clauses and nested try statements	3	AP	16
3.	Discuss Java's built-in exceptions and explain how to create user-defined exceptions with an example.	3	UN	16
4.	Explain how threads are created and mANged in Java.Give examples for multiple threads	3	UN	16
5.	Write a java program to demonstrate thread priorities and synchronization.	3	AP	16
6.	Explain inter-thread communication. Illustrate suspending, resuming, and stopping threads with example.	3	AP	16
7.	Discuss Java's multithreading features and compare them with traditional programming models.	3	AN	16
8.	Explain wrAPer classes and demonstrate auto boxing and unboxing with code.	3	AP	16

UNIT IV
I/O, GENERICS, STRING HANDLING

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – BoUNed Types – Restrictions and Limitations.

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	What is stream in Java I/O?	4	RE	2
2.	Distinguish between byte stream and character stream.	4	UN	2
3.	What is the the purpose of System.in and System.out?	4	RE	2
4.	Write code to read a line from console in Java.	4	AP	2
5.	What are the classes used to write to a file in Java.	4	RE	2
6.	How can we read from a file in Java	4	UN	2
7.	What is generic programming?	4	RE	2
8.	Define generic classes with a simple example.	4	UN	2
9.	What is a generic method in Java?	4	RE	2
10.	Explain the concept of boUNed types in generics.	4	UN	2
11.	What are the restrictions on generics in Java?	4	UN	2
12.	List two advantages of using generics.	4	UN	2
13.	Can we create an array of generic type?Why or why not?	4	AP	2
14.	How do generics improve type safety?	4	UN	2
15.	Differentiate between generic classes and generic method.	4	AP	2
	PART-B			
1.	Explain the basics of Java I/O with examples.Describe how to read and write to console.	4	UN	16
2.	Write a java program to read and write text files using FileReader and FileWriter.	4	AP	16
3.	Compare and contrast byte streams and character streams with examples.	4	AN	16
4.	Explain generic classes and methods in Java with syntax and suitable examples.	4	UN	16
5.	Write a Java program using a generic class to store and display different types of data.	4	AP	16
6.	Describe boUNed types in Java generics.Give a sample program to demonstrate its use.	4	AP	16
7.	Discuss the restrictions and limitations of Java generics.Why do they exist?	4	AN	16
8.	Explain the concept of generic programming.How does it provide compile-time type safety in Java?	4	UN	16

UNIT V
JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – List View – Combo Box – Choice Box – Text Controls – Scroll Pane. Layouts –Flow Pane – H Box and V Box – Border Pane – Stack Pane – Grid Pane. Menus – Basics – Menu – Menubars – Menu Item.

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	What is an event in JavaFX?	5	RE	2
2.	Name any two types of events in JavaFX.	5	RE	2
3.	How do you handle a key event in JavaFX?	5	UN	2
4.	What is a mouse event?Give an example.	5	UN	2
5.	What is the use of a checkbox in JavaFX?	5	RE	2
6.	Differentiate between a toggle button and a radio button.	5	UN	2
7.	What is the function of a ListView in JavaFX?	5	UN	2
8.	Mention one difference between ComboBox and ChoiceBox.	5	UN	2
9.	Name any two text controls used in JavaFX.	5	RE	2
10.	What is a ScrollPane used for?	5	UN	2
11.	What is the difference between HBox and VBox layouts?	5	UN	2
12.	Write the purpose of a GridPane.	5	RE	2
13.	What is a BorderPane layout in JavaFX?	5	UN	2
14.	Define MeuBar and MenuItem in JavaFX.	5	RE	2
15.	How do you add a menu to a stage in JavaFX?	5	UN	2
	PART-B			
1.	Explain the event handling model in JavaFX.Demonstrate key and mouse event handling with examples.	5	UN	16
2.	Write a JavaFX program using checkbox,toggle button, and radio buttons.	5	AP	16
3.	Develop a JavaFX APlication using ListView,ComboBox, and ChoiceBox to select user input.	5	AP	16
4.	Explain text controls and ScrollPane in JavaFX with examples.	5	UN	16
5.	Compare various layout panes in JavaFX such as FlowPane, HBox,VBox,BorderPane, and GridPane.	5	AN	16
6.	Write a JavaFX APlication using GridPane to design a simple login form with labels and text fields.	5	AP	16
7.	Describe how menus are created and used in JavaFX.Write a program using MenuBar and MenuItems.	5	AP	16
8.	ANyze and design a GUI form using multiple controls and layout mANgers for a registration form.	5	AN	16

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DATA STRUCTURES AND ALGORITHMS

UNIT – I

LINEAR DATA STRUCTURES – LIST

Abstract data types(ADT) – List ADT – Array based Implementation - Linked list implementation – linked list singly linked list – circularly linked list – doubly linked list – Applications of lists-

Polynomial Manipulation – All operation(Insertion, Deletion, Merge, Traversal)

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	Define Abstract Data Type (ADT).	1	RE	2
2.	What is a singly linked list?	1	RE	2
3.	List any two operations of a linked list	1	RE	2
4.	What is the difference between singly and doubly linked lists?	1	UN	2
5.	Define circular linked list.	1	RE	2
6.	What is polynomial manipulation in linked lists?	1	UN	2
7.	Write any two Applications of linked lists.	1	RE	2
8.	What is the purpose of a dummy node in linked lists?	1	UN	2
9.	List two advantages of linked lists over arrays.	1	UN	2
10.	Define doubly linked list.	1	RE	2
11.	What is traversal in a list?	1	RE	2
12.	State any two disadvantages of linked lists.	1	UN	2
13.	What is the time complexity of insertion in a linked list?	1	UN	2
14.	What is the use of the head pointer in a linked list?	1	UN	2
15.	Differentiate between static and dynamic memory allocation.	1	UN	2

PART-B

1.	Explain the concept of Abstract Data Types (ADT) with examples.	1	UN	16
2.	Describe the array-based and linked list implementations of List ADT. Compare their merits and demerits.	1	AN	16
3.	Explain the creation and traversal operations in singly linked lists with examples and code.	1	AP	16
4.	Describe the insertion and deletion operations in doubly linked lists with diagrams and code.	1	AP	16
5.	Discuss circular linked lists. Write algorithms for insertion and deletion in circular lists.	1	AP	16
6.	Write an algorithm to add two polynomials using linked lists. Explain with example.	1	AN	16
7.	Illustrate all list operations (insert, delete, merge, traverse) for singly and doubly linked lists.	1	EV	16
8.	Compare and contrast the different types of linked lists (singly, doubly, circular) with diagrams.	1	AN	16

UNIT – II

LINEAR DATA STRUCTURES – STACK,QUEUES

Stack ADT – Operations – Applications - EVluating arithmetic expressions - Conversion of Infix to Postfix expression -EVluation of Postfix expression- Queue ADT – Operations – Circular Queue – Dequeue – Applications of queues

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	Define a stack.	2	RE	2
2.	List two Applications of stack.	2	RE	2
3.	What is postfix expression? Give an example.	2	UN	2
4.	Convert (A + B) * C into postfix.	2	UN	2
5.	What is the difference between stack and queue?	2	UN	2
6.	What is meant by stack overflow?	2	RE	2
7.	Define queue.	2	RE	2
8.	List any two operations performed on queues.	2	RE	2
9.	What is a circular queue?	2	RE	2
10.	Differentiate between linear queue and circular queue.	2	UN	2
11.	Define dequeue with an example.	2	RE	2
12.	Mention any one use of stack in arithmetic expression EVluation.	2	UN	2
13.	What is UNerflow condition in queue?	2	RE	2
14.	Write a real-life Application of queue.	2	UN	2
15.	How is recursion related to stack?	2	UN	2

PART-B

1.	Explain the Stack ADT with its operations and implementation.	2	UN	16
2.	Describe in detail the conversion of infix to postfix using stack.	2	AN	16
3.	Write an algorithm to EVluate postfix expression using stack.	2	AP	16
4.	Explain Applications of stacks in function calls and expression parsing.	2	AP	16
5.	Implement queue ADT using arrays. Explain enqueue and dequeue operations.	2	AP	16
6.	Describe circular queue operations with algorithm and advantages.	2	AN	16
7.	Compare and contrast stack and queue ADTs with real-world Applications.	2	EV	16
8.	Write the algorithms and explain all operations in double-ended queue.	2	AN	16

UNIT – III

NON LINEAR DATA STRUCTURES – TREES

Tree ADT – Operations – Applications - EVluating arithmetic expressions - Conversion of Infix to Postfix expression -EVluation of Postfix expression- Queue ADT – Operations – Circular Queue – Dequeue – Applications of queues

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	Define Tree ADT and explain its basic operations	3	UN	2
2.	What is a binary tree? Provide an example.	3	RE	2
3.	Explain the concept of a binary search tree (BST).	3	UN	2
4.	What are AVL Trees? How are they different from binary trees?	3	UN	2
5.	List the types of tree traversals and briefly describe each.	3	RE	2
6.	What is an expression tree? Give an example.	3	UN	2
7.	What is the significance of binary tree traversals?	3	UN	2
8.	Define a heap. What are the two types of heaps?	3	RE	2
9.	Explain the difference between a min-heap and a max-heap.	3	UN	2
10.	How does a binary search tree differ from a general binary tree?	3	UN	2
11.	Describe the insertion operation in a binary search tree.	3	UN	2
12.	What is the deletion operation in a binary search tree?	3	RE	2
13.	What are the Applications of binary trees in real-world scenarios?	3	RE	2
14.	What is the purpose of an AVL tree? Explain how it balances itself.	3	RE	2
15.	Explain the importance of heap data structures in algorithms like heap sort.	3	UN	2

PART-B

1.	Explain the operations on Binary Search Trees (BST) with examples of insertion, deletion, and searching.	3	UN	16
2.	Describe the structure and properties of AVL Trees. Explain the insertion and deletion operations with necessary rotations.	3	AN	16
3.	Discuss different tree traversal methods and their Applications. Provide examples.	3	AP	16
4.	Explain the concept of a heap. Discuss the difference between a Min-Heap and a Max-Heap. How are heaps used in heap sort?	3	AP	16
5.	Define expression trees. How are they constructed and EVluated? Give examples of arithmetic expressions.	3	AP	16
6.	Describe the different types of binary trees . Discuss their Applications.	3	AN	16
7.	Discuss the working of Prims and Kruskal's algorithms for Minimum Spanning Tree (MST) in the context of trees. Provide a comparative Analysis.	3	EV	16
8.	Explain the various types of tree-based data structures. Compare their properties and usage in real-world Applications.	3	AN	16

UNIT – IV

NON LINEAR DATA STRUCTURES – GRAPHS

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sorting – Shortest-Path algorithm - Dijkstra's algorithm - Minimum spanning tree – Prim's and Kruskal's Algorithms –Bi-connectivity – Cut Vertex – Applications of graphs.

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	Define a graph.	4	UN	2
2.	What is the difference between a directed and Undirected graph?	4	RE	2
3.	What is a weighted graph?	4	UN	2
4.	Define adjacency matrix and adjacency list.	4	UN	2
5.	What is a Breadth-First Traversal (BFS)?	4	RE	2
6.	What is a Depth-First Traversal (DFS)?	4	UN	2
7.	What is a spanning tree?	4	UN	2
8.	Define bi-connectivity in graphs.	4	UN	2
9.	What is a cut vertex in a graph?	4	RE	2
10.	State two Applications of graphs.	4	UN	2
11.	What is topological sorting?	4	UN	2
12.	What is the difference between BFS and DFS?	4	UN	2
13.	What is the time complexity of Dijkstra’s algorithm?	4	RE	2
14.	What is the purpose of Prim’s algorithm?	4	UN	2
15.	What is the difference between Prim’s and Kruskal’s algorithms?	4	UN	2

PART-B

1.	Explain Breadth-First Search (BFS) and Depth-First Search (DFS) with algorithms and example graphs.	4	UN	16
2.	Describe Prim's algorithm for minimum spanning tree with a suitable example and time complexity Analysis.	4	AN	16
3.	Explain Kruskal's algorithm with an example. Compare it with Prim's algorithm.	4	AP	16
4.	Discuss Dijkstra's algorithm for finding the shortest path in a weighted graph. Illustrate with a step-by-step example.	4	AP	16
5.	Explain the concept of Topological Sorting. Write the algorithm and explain it with a directed acyclic graph (DAG).	4	AP	16
6.	Compare Adjacency Matrix and Adjacency List with respect to space and time complexity. Provide an example for each.	4	AN	16
7.	What are Cut Vertices and Bi-connectivity in a graph? Explain with suitable examples.	4	EV	16
8.	Explain different types of graphs with diagrams and Applications.	4	AN	16

UNIT – V

SORTING, SEARCHING AND HASHING ALGORITHMS

Searching- Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Quick Sort. Hashing- Hash Functions – Collision Resolution - Open Addressing– Chaining – Extendible Hashing.

Q.No	Question	CO	BTL	Marks
	PART-A			
1.	Define linear search.	5	UN	2
2.	What is binary search?	5	RE	2
3.	Differentiate between linear and binary search.	5	UN	2
4.	What is the time complexity of binary search?	5	UN	2
5.	Define bubble sort.	5	RE	2
6.	What is selection sort?	5	UN	2
7.	Write the worst-case time complexity of insertion sort.	5	UN	2
8.	What is the basic idea of quick sort?	5	UN	2
9.	What is a stable sorting algorithm?	5	RE	2
10.	Define a hash function.	5	UN	2
11.	What is collision in hashing?	5	UN	2
12.	What is open addressing in hashing?	5	RE	2
13.	Define chaining in hashing.	5	UN	2
14.	What is extendible hashing?	5	UN	2
15.	Differentiate between open addressing and chaining.	5	UN	2

PART-B

1.	Write and explain the linear search and binary search algorithms. Compare their time complexities and give examples.	5	UN	16
2.	Explain any four sorting algorithms along with algorithm, example, and time complexity.	5	AN	16
3.	Explain the quick sort algorithm with step-by-step execution on a sample input. ANyze its time and space complexity.	5	AP	16
4.	Describe binary search in detail with iterative and recursive versions. Provide dry run and complexity Analysis.	5	AP	16
5.	Write and explain the insertion sort and selection sort algorithms with suitable examples and performance Analysis.	5	AP	16
6.	What is hashing? Explain different collision resolution techniques like open addressing and chaining with examples.	5	AN	16
7.	Explain extendible hashing with a diagrammatic example. Compare it with static hashing.	5	EV	16
8.	Compare all major sorting algorithms (bubble, selection, insertion, quick, merge) based on time, space, and stability criteria.	5	AN	16

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FUNAMENTALS OF COMPUTER NETWORKS

UNIT- I
FUNAMENDALS AND PHYSICAL LAYER

Networks – Network Types – Internet Architecture - Protocol Layering – TCP/IP Protocol suite – OSI Model - Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching

Q NO	QUESTIONS	CO	BTL	MARKS
	PART – A			
1.	Define a computer network.	1	RE	2
2.	What is the OSI model?	1	RE	2
3.	List any two transmission media.	1	RE	2
4.	What is the function of the Physical Layer?	1	RE	2
5.	State any two layers of the TCP/IP model.	1	RE	2
6.	Differentiate between LAN and WAN.	1	UN	2
7.	What is protocol layering?	1	UN	2
8.	What is switching in a network?	1	UN	2
9.	Explain the term “latency”	1	UN	2
10.	What is the role of the Application Layer?	1	UN	2
11.	What is the suitable transmission medium used for high-speed internet?	1	RE	2
12.	What are the seven layers of the OSI model?	1	RE	2
13.	Explain the differences between packet switching and circuit switching with suitable examples.	1	UN	2
14.	Explain the differences between the OSI model and the TCP/IP model with suitable examples.	1	UN	2
15.	Explain the advantages of packet switching in modern networks with suitable reasons.	1	UN	2
	PART - B			
1.	Describe the seven layers of the OSI model with their functions.	1	RE	16
2.	Explain the architecture of the Internet and the role of routers and ISPs.	1	UN	16
3.	Discuss the types of transmission media with examples, advantages, and limitations.	1	UN	16
4.	Apply the concept of switching to describe how data flows in a packet-switched network.	1	AP	16
5.	Compare the OSI and TCP/IP models with respect to structure, usage, and protocol functions.	1	AN	16
6.	Analyze circuit switching vs. packet switching in terms of performance, reliability, and real-time usage.	1	AN	16
7.	EVluate the performance of the physical layer in terms of bandwidth, throughput, and error rate.	1	EV	16
8.	Design a simple network architecture for a small college including media types, switching method, and layered protocols.	1	CR	16

UNIT - II
DATA-LINK LAYER & MEDIA ACCESS

Link layer Addressing - Services – Framing – Error Detection – Flow control – HDLC - Media access control –Ethernet (802.3) – Wireless LANs – IEEE 802.11 – Bluetooth.

Q NO	QUESTIONS	CO	BTL	MARKS
	PART – A			
1.	Define MAC address with an example.	2	RE	2
2.	What is framing in the Data Link Layer?	2	RE	2
3.	List any two framing methods used in data communication.	2	RE	2
4.	Expand HDLC and write its basic frame format.	2	RE	2
5.	What is a piconet in Bluetooth communication?	2	RE	2
6	What is the purpose of the Data Link Layer in the OSI model?	2	UN	2
7.	What are the different frame types in HDLC?	2	UN	2
8.	Define CRC. Where is it used?	2	UN	2
9.	What is flow control? Why is it needed?	2	UN	2
10.	What is the function of the MAC sublayer?	2	UN	2
11.	What are two functions of the Link Layer?.	2	RE	2
12.	Explain the purpose of the preamble in an Ethernet frame with an example.	2	UN	2
13.	Explain error detection and error correction with suitable examples.	2	UN	2
14	Explain IEEE 802.3 and IEEE 802.11 standards with suitable examples.	2	UN	2
15.	What is CSMA/CD and where is it used?	2	RE	2
	PART - B			
1.	Compare and EVluate Media Access Control protocols.	2	EV	16
2.	Differentiate and justify the choice between Bluetooth and Wi-Fi.	2	EV	16
3.	Design and explain the architecture of IEEE 802.11 wireless LAN.	2	CR	16
4.	Formulate the detailed working of HDLC with diagram and explain its relEVnce.	2	CR	16
5.	Analyze the differences between CSMA/CD and CSMA/CA and explain how each works in different network environments	2	AN	16
6.	Demonstrate how the Ethernet (IEEE 802.3) frame format is Applied in data transmission with an example.	2	AP	16
7.	Illustrate how different framing techniques are Applied in data communication with suitable examples	2	AP	16
8.	Construct a detailed explanation of error detection techniques used in the Data Link Layer.	2	CR	16

UNIT- III
NETWORK LAYER

Network Layer Services – Switch basics – Basic Inter networking (IP, CIDR, ARP, DHCP and ICMP) - IPV4 Addressing – IPV6 Protocol - Routing (RIP, OSPF, metrics) – Global Internet (Areas, BGP, IPv6), Multicast –addresses – multicast routing (DVMRP, PIM).

Q.No	Question	CO	BTL	Marks
	PART – A			
1.	Define the services provided by the network layer.	3	RE	2
2.	Differentiate between a switch and a router.	3	UN	2
3.	What is an IP address?	3	RE	2
4.	What is CIDR? Why is it important?	3	UN	2
5.	Define ARP and state its purpose.	3	RE	2
6.	What is the role of DHCP in networking?	3	UN	2
7.	Mention any two uses of ICMP.	3	RE	2
8.	What are the classes of IPv4 addresses?	3	UN	2
9.	State two differences between IPv4 and IPv6.	3	UN	2
10.	What is a subnet mask? Give an example.	3	RE	2
11.	What is the main function of RIP?	3	RE	2
12.	What metric is used in OSPF?	3	UN	2
13.	What is BGP and where is it used?	3	UN	2
14.	What is a multicast address?	3	RE	2
15.	What is one difference between DVMRP and PIM?	3	RE	2
	PART - B			
1.	Explain in detail the services of the network layer with suitable examples.	3	UN	16
2.	Describe the working of switches. Compare it with routers	3	UN	16
3.	Explain IP addressing, CIDR, ARP, DHCP, and ICMP with examples.	3	AP	16
4.	Design an IPv4 addressing scheme for a network by incorporating address classes, subnetting, and CIDR, and present it with examples.	3	CR	16
5.	Explain the structure, features of IPv6 and comparison with IPv4	3	AN	16
6.	EVluate the efficiency of RIP and OSPF protocols by comparing their metrics and working, and justify which protocol is more suitable for modern networks	3	EV	16
7.	What is BGP? Explain how global Internet routing is handled using BGP and AS areas	3	AN	16
8.	Discuss multicast routing and explain the working of DVMRP and PIM protocols.	3	AN	16

UNIT- IV
TRANSPORT LAYER

Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements.

Q.No	Question	CO	BTL	Marks
	PART – A			
1.	What is the main function of the transport layer?	4	RE	2
2.	What is UDP and what is its key characteristic?	4	RE	2
3.	Why is TCP considered a reliable protocol?	4	UN	2
4.	What is connection management in TCP?	4	UN	2
5.	Define flow control in TCP.	4	UN	2
6.	What is retransmission in TCP?	4	UN	2
7.	What is the purpose of TCP congestion control?	4	UN	2
8.	What is DECbit used for in congestion control?	4	UN	2
9.	What does RED stand for in congestion avoidance?	4	UN	2
10.	What is QoS in networking?	4	RE	2
11.	Mention any two transport layer Application requirements.	4	RE	2
12.	List any two differences between TCP and UDP.	4	UN	2
13.	What is a 3-way handshake in TCP?	4	UN	2
14.	What is the role of ACK and timeout in TCP?	4	UN	2
15.	What makes TCP a reliable transport protocol?	4	UN	2
	PART - B			
1.	Explain in detail the functions and services of the transport layer.	4	UN	16
2.	Compare UDP and TCP in detail with examples.	4	AN	16
3.	Explain the process of connection establishment and termination in TCP.	4	UN	16
4.	Describe flow control and retransmission techniques used in TCP.	4	UN	16
5.	EVluate the effectiveness of different TCP congestion control mechanisms and justify which is most suitable for modern networks.	4	EV	16
6.	Discuss congestion avoidance methods – DECbit and RED.	4	AN	16
7.	Design a QoS implementation plan for a network by selecting suitable parameters and techniques, and present it with a practical example.	4	CR	16
8.	Explain the transport layer Application requirements with examples.	4	UN	16

UNIT - V
APLICATION LAYER

WWW and HTTP – FTP – Electronic Mail (SMTP, POP3, IMAP, MIME) – Telnet – SSH – DNS – SNMP.

Q.No	Question	CO	BTL	Marks
	PART – A			
1.	What is WWW?	5	RE	2
2.	What is HTTP and its default port number?	5	RE	2
3.	Define FTP.	5	RE	2
4.	Mention any two uses of FTP.	5	RE	2
5.	What is the role of SMTP in email communication?	5	UN	2
6.	How does POP3 retrieve emails?	5	UN	2
7.	Explain POP3 and IMAP protocols with suitable examples	5	UN	2
8.	What is MIME in email systems?	5	UN	2
9.	What is Telnet used for?	5	RE	2
10.	Explain Telnet and SSH protocols with an example, highlighting how they differ in usage.	5	UN	2
11.	What is the purpose of DNS?	5	RE	2
12.	Mention any two types of DNS records.	5	UN	2
13.	Define SNMP.	5	RE	2
14.	What is the main function of the Application layer?	5	RE	2
15.	Name any two Application layer protocols.	5	RE	2
	PART - B			
1.	Explain the architecture and working of WWW and HTTP in detail.	5	UN	16
2.	Describe FTP architecture, modes, and commands with examples.	5	AN	16
3.	Explain email architecture and working using SMTP, POP3, IMAP, and MIME.	5	UN	16
4.	Demonstrate how SSH can be Applied for secure Remote login in place of Telnet, with a suitable example.	5	AP	16
5.	Design a DNS hierarchy for an organization and demonstrate how name resolution would work within it using examples.	5	CR	16
6.	EVluate the effectiveness of SNMP architecture and its message formats in managing modern networks, and justify their advantages or limitations with examples.	5	EV	16
7.	Explain in detail the functions of the Application layer with suitable protocols.	5	UN	16
8.	Discuss in detail the working of SMTP, POP3, IMAP, and MIME in email systems.	5	AN	16

24ECPC306

DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION

UNIT- I

COMBINATIONAL LOGIC

combination Circuits – Karnaugh map -5 variable Karnaugh map, don't care conditions - Analysis and Design Procedures – Binary Adder-Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - De-multiplexers.

Q.No	Question	CO	BTL	Marks
	PARTA			
1.	List the four possible elementary operations simple binary addition consists of.	1	RE	2
2.	Which combinational circuit is otherwise known as data selector ?why?	1	RE	2
3.	outline a full adder by using two half adders and OR gate.	1	UN	2
4.	Compare the function of decoder and encoder .	1	UN	2
5.	Give disadvantage of half adder and full adder.	1	RE	2
6.	Draw the logic diagram of a 2 –bit multiplier?	1	RE	2
7.	The output Y of a 2-bit comparator is logic1whenever the 2-bit input A is greater than the 2-bit input B. What is the number of combinations for which the output is logic 1?	1	RE	2
8.	Draw the logic circuit of a 2-bitcomparator.	1	RE	2
9.	List out the Applications of multiplexer.	1	RE	2
10.	In what way encoder differs from decoder?	1	RE	2
11	Write down the Borrow and Subtract or equation of full subtract or.	1	RE	2
12	Compare Sequential circuit and Combinational circuit	1	UN	2
13.	Outline the combinational circuit with three inputs and one output. The output is 1 when the binary value of the inputs is less than three. The output is zero otherwise	1	UN	2
14.	Recall how many selection inputs, data inputs and outputs for 1*32 Demultiplexer ?	1	RE	2
15.	Outline the following function using suitable multiplexer F= Σm (0,2,5,7).	1	RE	2

PARTB

1.	Simplify below boolean function expression considering don't care conditions using 4 variable K map F(A,B,C,D) =∑(1,2,4,5,8,9,10,12)+d(3,6,7,13,14).	1	AN	16
2.	Develop a combinational circuit with three inputs, x, y and z and three outputs, A, B and C. When the binary input is 0, 1, 2 or 3 the binary output is one greater than the input. When the binary input is 4,5,6 or 7, The binary output is one less than the input.	1	AP	16
3.	Develop a 4 bit adder and subtractor circuit and explain.(8 mark each)	1	AP	16
4.	Construct 2-bit magnitude comparator with three outputs: A>B, A<B and A=B.	1	AP	16
5	Build BCD adder and explain how it differ from 4 bit binary adder	1	AP	16
6	Build three to eight line decoder circuit using inverters and AND gates. Also, present the truth table for the same	1	AP	16
7	a)Develop the Boolean expression F (A, B, C) = Σm (0, 2, 5, 6) using 4:1 multiplexer. b)Develop the Boolean expression F(A,B,C,D) = ∑m(0,1,3,4,8,9,15) using suitable multiplexer.	1 1	AP	8 8
8	What is a K-Map? Simplify the Boolean function F (A,B,C,D,E) = $\sum_m$ (1, 2, 4, 5, 6, 8, 9, 12, 13, 14,16,17,20,23,28,30,32) using K-Map.	1	AN	16

UNIT- II

SYNCHRONOUS SEQUENTIAL LOGIC

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF,ANysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

Q.No	Question	CO	BTL	Marks
	PARTA			
1.	Outline the difference between asynchronous sequential circuit and synchronous sequential circuit.	2	UN	2
2.	How does ripple counter differ from synchronous counter?	2	RE	2
3.	How do you eliminate the race aroUN condition in a JK flip-flop?	2	RE	2
4.	Compare latches and flip-flops.	2	UN	2
5.	Explain about D-Latch with truth table.	2	UN	2
6.	List the different types of shift registers.	2	RE	2
7.	Define the terms :state table and state assignment.	2	RE	2
8.	Differentiate Mealy and Moore state machines.	2	UN	2
9.	Compare edge triggering and level triggering in sequential circuits	2	UN	2
10	Find minimum number of flip-flops needed to design a counter of Modulus 60.	2	RE	2
11	Construct a NAND based logic diagram of Master Slave JK FF.	2	AP	2
12	Illustrate the logic diagram of a clocked SR Flipflop.	2	UN	2
13	Show the operation of T FF.	2	RE	2
14	Define Counters and its types.	2	RE	2
15	Develop a Mealy machine to detect the sequence **"10"** and output **1** when detected. Otherwise, output **0**.	2	AP	2

PART B

1.	Explain SR FF using NOR gate.	2	EV	16
2.	Explain in detail about 4 bit Johnson counter.	2	EV	16
3.	Which flip flop is called as data flip flop? explain the operation of same with its circuit diagram, characteristic table and excitation table.	2	EV	16
4.	Outline the design of a BCD Ripple counter using JK Flip flops with state diagram and logic diagram	2	UN	16
5	Develop a Mod-5 synchronous counter using JK flip flop.	2	AP	16
6	Summarize the design procedure for asynchronous sequential circuit.	2	UN	16
7	What are registers? Construct a 4 bit register using D FF and explain the operation of register.	2	AP	16
8	Explain Mealy and Moore Models with the help of block diagram	2	UN	16

UNIT - III

COMPUTER FUNAMENTALS

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture(ISA):Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

Q.No	Question	CO	BTL	Marks
	PARTA			
1	What is the role of control unit in the operation of digital computer.	3	RE	2
2	Define computer architecture.	3	RE	2
3	Name the functional units of computer.	3	RE	2
4	What is Von Neumann bottleneck?	3	RE	2
5	Outline instruction cycle with diagram..	3	UN	2
6	What is the role of PC?	3	RE	2
7	What is operation code?	3	UN	2
8	Interpret instruction set architecture (ISA)	3	UN	2
9	What are the data transfer instructions?	3	RE	2
10	Compare direct and indirect addressing modes.	3	UN	2
11	List the types of addressing modes.	3	RE	2
12	What is meant by an addressing mode? Mention most important of them.	3	RE	2
13	Distinguish between auto incREent and auto decREent addressing mode.	3	UN	2
14	Define compiler.	3	RE	2
15	Compare machine level, assembly level and high level languages.	3	UN	2

PARTB

1.	a) Explain about fundamentals units in digital computer.	3	UN	8
	b) Explain about instruction cycle.		UN	8
2.	Explain Von Neumann architecture with neat sketch and features.	3	UN	16
3	Explain in detail about the various operands of the computer hardware.	3	UN	16
4.	Illustrate Byte addressability (4) Big endian assignment (6) Little endian assignment (6)	3	UN	16
5.	Mention four types of operations required to be performed by instruction in a computer. classify types of instruction formats? Give an example for each.	3	UN	16
6.	Define addressing mode. Explain the basic addressing mode with an example for each.	3	UN	16
7.	a) Explain about encoding in assembly language and types of instructions.(8) b) Discuss the interconnection between assembly language and high level language.(8)	3	UN	16
8.	Explain the data transfer operations between memory and the processor.	3	UN	16

UNIT- IV
PROCESSOR

Instruction Execution–Building a Data Path–Designing a Control Unit–Hard wired control Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

Q.No	Question	CO	BTL	Marks
	Part A			
1.	List the operations involved in instruction cycle.	4	RE	2
2.	Outline the data path segment for arithmetic-logic instructions.	4	UN	2
3.	What is the ideal speed-up expected in a pipelined Architecture with 'n' stages? Justify your answer.	4	RE	2
4.	What do you mean by pipelining? List its types.	4	RE	2
5.	Compare static and dynamic techniques.	4	UN	2
6.	What is branch hazard?	4	RE	2
7.	What is meant by speculative execution?	4	RE	2
8.	Compare data hazards and control hazards.	4	UN	2
9.	Differentiate: Hardwired control and micro programmed control	4	UN	2
10.	What is program counter?	4	RE	2
11.	When do data hazard occur in pipelining?	4	RE	2
12.	What is a data path?	4	RE	2
13.	What is exception?	4	RE	2
14.	What is a branch prediction buffer?	4	RE	2
15.	What is the need for speculation?	4	RE	2

Part B

1.	Outline the difference between hardwired control and micro programmed control.	4	UN	16
2.	What is hazard? ANyze hazard free realization for the following Boolean functions F(A, B, C, D) = ∑m (1, 5, 6, 7) using AND-OR gate network.	4	AN	16
3.	Explain why branch prediction algorithm needed? Differentiate between the static and dynamic techniques.	4	UN	16
4.	Illustrate pipeline hazards. Outline the types of pipeline hazards.	4	UN	16
5.	Construct a simple MIPS data path with control unit and explain the execution of ALU instruction.	4	AP	16
6.	Outline the methods for avoiding the control hazards.	4	UN	16
7.	Illustrate about data hazards. Explain with suitable techniques, how these hazards can be mitigated?	4	UN	16
8.	Explain how instruction is being fetched and executed through the data path in the processor?	4	UN	16

UNIT- V

MEMORY AND I/O

Memory Concepts and Hierarchy – Memory MANgement – Cache Memories: MAPing and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

Q.No	Question	CO	BTL	Marks
	Part A			
1.	What is a direct-mAPed cache?	5	RE	2
2.	What is hit time?	5	RE	2
3.	Which signal is used to notify the processor that the transfer is completed? Define.	5	RE	2
4.	Mention the modes of DMA transfer.	5	RE	2
5.	Outline of interrupt driven I/O.	5	UN	2
6.	What is memory mAPed I/O?	5	RE	2
7.	Define supervisor / kernel / executive state.	5	RE	2
8.	List the advantages of virtual memory?	5	RE	2
9.	Explain the concept of memory hierarchy in a computer system.	4	UN	2
10.	Compare main memory and cache memory based on access time and cost.	4	UN	2
11.	Illustrate the role of virtual memory with the help of a block diagram.	4	UN	2
12.	Summarize the need for Direct Memory Access (DMA) in data transfer.	4	UN	2
13.	Outline the differences between parallel and serial I/O interfaces.	4	UN	2
14.	Classify different cache mAPing techniques.	4	UN	2
15.	Infer the importance of interconnection standards like USB and SATA.	4	UN	2

Part B

1.	Present an outline of virtual address, physical address, address translation, segmentation, page table, swap space and page fault.	5	UN	16
2.	Explain interconnection standards.	5	UN	16
3.	Construct a direct memory access with a diagram and mention its advantage.	5	AP	16
4.	Describe the various mechanisms for accessing I/O devices.	5	AN	16
5.	Explain how memory mapping techniques are useful for finding the memory blocks in cache?	5	UN	16
6.	How virtual addresses are translated into physical addresses? Explain it with the help of virtual memory organization and page translation.	5	UN	16
7.	Examine the role of I/O interfaces in system bottlenecks.	5	AN	16
8.	Analyze how cache memory improves performance with respect to memory hierarchy.	5	AN	16

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