Course Plan

A. Course Handout (Version 1.0)

Institute/School Name	Chitkara University Institute of Engineering and Technology
Department Name	Department of Computer Science & Engineering
Programme Name	Bachelor of Engineering (B.E.), Computer Science & Engineering
Course Name	Advanced Programming Concepts using Java	Session	2024-2025
Course Code	22CS027	Semester/Batch	5th /2022
L-T-P (Per Week)	2-0-4	Course Credits	04
Course Coordinator	Dr. Deepak Ahlawat		

CLO01	Understand the features of Java such as operators, classes, objects, inheritance, packages and exception handling
CLO02	Get exposure to advance concepts of Database connectivity like JDBC
CLO03	Understand and apply the concept of algorithm complexity. Implement the advanced sorting algorithms and apply appropriate algorithm for a particular problem.
CLO04	Design the problems by understanding and utilizing graph algorithms.

1. Objectives of the Course

The scope of the course is to provides the foundation for understanding the key aspects of java programming and implementation obtaining a theoretical understanding of advance programming concepts. The objectives of the course are:

- to provide a comprehensive understanding of Java's syntax, structure, and fundamental programming concepts and build an understanding of analysing and evaluating real-world problems.
- to equip students with the knowledge and skills necessary to create efficient, robust, and scalable software solutions using Java
- to develop and apply advanced sorting and searching algorithms.
- to solve complex problems using greedy algorithms, backtracking, and dynamic programming.

2. Course Learning Outcomes

After completion of the course, student should be able to:

	Course Learning Outcome	*POs	**CL	***KC	Sessions
CLO01	Understand the features of Java such as operators, classes, objects, inheritance, packages and exception handling	PO1, PO2, PO4, PO3, PO5, PO6, PO11	K1	Conceptual Procedural	34
CLO02	Get exposure to advance concepts of Database connectivity like JDBC	PO3, PO4, PO5, PO9, PO10, PO11	K4	Procedural	26

CLO03	Implement the advanced sorting algorithms and apply appropriate algorithm for a particular problem.	PO1, PO2, PO3, PO4, PO5, PO7, PO11	K4	Conceptual Procedural	**30**
CLO04	Design the problems by understanding and utilizing graph algorithms.	PO4, PO5	K5	Conceptual Procedural	**30**
Total Contact Hours					**120**

Revised Bloom's Taxonomy Terminology
* PO's available at (shorturl.at/cryzF)
**Cognitive Level =CL
***Knowledge Categories = KC

Course Learning Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CLO01	H	H	H	H	H	M					H	
CLO02			H	H	H				H	H	M	
CLO03	H	H	H	H	H		M				H	
CLO04				H	H							

H=High, M=Medium, L=Low

3. ERISE Grid Mapping

Feature Enablement	Level (1-5, 5 being highest)
Entrepreneurship	1
Research	3
Innovation	4
Skills	5
Employability	5

4. Recommended Books:

Textbooks:
    B01: "Head First Java" by Kathy Sierra and Bert Bates, Shroff, 2nd Edition, 2009.
    B02: "Thinking in Java" by Bruce Eckel President, MindView, Inc., Fourth Edition, 2006.
    B03: "Java: A Beginner's Guide" by Herbert Schildt, McGraw-Hill Education, 9th Edition, 2022.
    B04: "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

B05: "Design and Analysis of Algorithms" by S. Sridhar, Oxford University Press, 2014.

Reference Books:
   B03: "Java: A Beginner's Guide" by Herbert Schildt, McGraw-Hill Education, 9th Edition, 2022.
E-Resources:
   ● https://library.chitkara.edu.in/subscribed-books.php

5. Other readings and relevant websites:

Serial No	Link of Journals, Magazines, websites and Research Papers
1.	https://www.javatpoint.com/method-overloading-vs-method-overriding-in-java
2.	https://www.javatpoint.com/wrapper-class-in-java
3.	https://www.geeksforgeeks.org/java-exercises/#pattern-programs-in-java
4.	https://www.geeksforgeeks.org/distributing-m-items-circle-size-n-starting-k-th-position/
5.	https://www.geeksforgeeks.org/priority-queue-using-linked-list/
6.	https://www.youtube.com/watch?v=HqPJF2L5h9U

6. Recommended Tools and Platforms

Code Quotient

7. Course Plan:

Lecture Number	Topics	Textbook
1-3	Introduction to JAVA: Java Introduction, History and goals of Java, Fundamentals of OOPs; Overview of JDK, JVM, Garbage Collection; Java Basics: Identifiers, Keywords, Java Data Types & Operators	B03
4-6	Practice Problem: Aggregate and Percentage Marks of a student, Gross salary of an employee, Add one to each digit of a 4 digit, Add one to each digit of a 4 digit	B03
7-9	Control Statements: Decision Constructs, Using Loop Constructs Command Line Arguments Practice Problems: The Number is Kaprekar or not, Generate first n Prime numbers, Next Closest Fibonacci	B03
10-12	Working with Arrays: Creating and Using Arrays (1D, 2D, Multidimensional); Jagged Arrays; Practice Problems: Matrix Multiplication, spirally traversing a matrix, Rotate a 2-D array by 90 degrees	B03
13-15	Classes & Objects: Classes, objects and methods: defining a class Access Control, Method overloading Practice Problems: Convert given number of seconds to	B01

	days, hours, minutes and second, Class- TimeSpan, class – BankFee	
16-18	Constructors, constructor overloading, use of this and static. Practice Problems: Class – TollBooth, methods of class: Display of Strings	B01
19-21	Inheritance: Working with Inheritance: Inheritance Basics & Types, Using super, Method Overriding Dynamic method dispatch, final keyword	B03
22-24	Practice Problems: class – Box, BookCD, Marketer Abstract Methods & Classes, Packages & Interfaces: Built-In Packages and User Defined Packages	B02
25-27	Interfaces: Declaration, Implementation, Extending Classes and Interfaces Practice Problem: Class - Customer and BankAccount, Class - MovablePoint and MovableCircle, Class: Circle and ResizableCircle	B02
28-30	Strings, StringBuffer, StringBuilder & StringTokenizer: Introduction, Immutable String Methods of String class, String Buffer class & StringBuilder class, toString method, StringTokenizer class	B02
31-33	Practice Problem: Capitalize the first letter of each word, Swap first and last character of each word in a string, Find occurrences of palindrome words in a string	B02
34-36	Exception Handling: Exception handling fundamentals, Exception types, try and catch Multiple catch clauses, nested try, throw, throws and finally, Creating custom Exception.	B03
37-39	Practice Problems: Password too short Exception, Valid email address, Valid index of array	B03
40-42	Multithreading: Java thread model, main thread, creating thread by implementing Runnable and extending thread class. Creating multiple threads, using isAlive() and join(), thread priorities Synchronization	B01
43-45	Practice Problems: Multithreading Java: Greetings in reverse, Transcations in Account with and without Synchronization	B01
46-48	Generics: Introduction, Generic Example, Generic Class,Generic Method	B03
49-51	Generic Constructor and Generic Interfaces Collections Framework: Introduction, Collection Interfaces-List, Queue. Practice Problems: Duplicate the Queue elements, Number is a Happy number or not	B03
52-54	Collections Interfaces- Set (Overview), Collection Classes: ArrayList, LinkedList; Collections Interfaces- Iterator, Working with Maps (Overview), Comparable & Comparator	B01

55-57	Practice Problems: Remove duplicates from a vector, Implement Own ArrayList in Java; Collections Interfaces- Arrays, Vector, Stack. Practice Problems: Cut the chocolate smartly for maximum pieces, find all pairs with sum K, Product Array - Ignoring the next IO Streams: Stream Classes: Byte Streams, Character Streams, StreamTokenizer. Practice Problems: Capitalize First Letter of every Word in a File, Strip HTML tags from a file	B01
58-60	JDBC Connectivity: Introduction, Architecture of JDBC Database Connection. JDBC Connectivity: Establishing JDBC Database Connection.	B03
61-63	Mathematical coding problems (Prime Factorization, GCD of two numbers, Distribute in circle)	B04
64-66	Basic Sorting Algorithms – Bubble sort, Insertion sort, Selection sort, Divide and Conquer algorithms - Quick Sort and Merge Sort	B04
67-69	Searching (Linear and Binary)	B04
70-72	String Algorithms - String Algorithms (KMP, Manacher, Z-value Algorithm)	B04
73-75	Hash Table: Introduction to Hash Table, Collision, Open Addressing, Linear Probing, Separate Chaining	B04
76-78	Heap and Priority Queues : Heap Sort, Priority Queues, Implement Priority Queue using Linked List, Find max/min in the continuous stream of data	B04
79-81	Greedy Algorithms: Greedy Algorithms, Fractional Knapsack problem, Interval scheduling , Job Scheduling with deadlines	B04
82-84	Dynamic Programming: Why Dynamic Programming, Memorization, Tabulation, Count number of ways to cover a distance	B04
85-87	Minimum Cost Path to last element of matrix, Longest Common Subsequence (LCS)	B04
88-90	Binary Trees	B05
91-93	Binary Trees	B05
94-96	Binary Search Trees: Introduction to Binary Search Trees, Traversals (recursive& non recursive), Delete a Node, Find Height of a tree, Path in a tree, Level Order Traversal, Top View and Bottom View of a tree, Lowest Common Ancestor	B05
97-99	Binary Search Trees: Introduction to Binary Search Trees, Traversals (recursive& non recursive), Delete a Node, Find Height of a tree, Path in a tree, Level Order Traversal, Top View and Bottom View of a tree, Lowest Common Ancestor	B05
100-102	AVL Trees: Balanced Trees, Introduction to the AVL trees, Implementation of AVL Trees	B05

103-105	AVL Trees: Balanced Trees, Introduction to the AVL trees, Implementation of AVL Trees	B05
106-108	Advance recursion problems and Optimization	B04
109-111	Red Black Trees: Balanced Trees - Red Black Trees, Graphs: Graphs, Edge List, Adjacency Matrix, Adjacency List, Depth first traversal, Breadth first traversal, Shortest Path algorithms	B05
112-114	Red Black Trees: Balanced Trees - Red Black Trees, Graphs: Graphs, Edge List, Adjacency Matrix, Adjacency List, Depth first traversal, Breadth first traversal, Shortest Path algorithms	B05
115-117	Tries: Implementing tries, Suffix Arrays: Suffix Arrays, Longest Repeated string - Overlapping and Non overlapping	B05
118-120	Tries: Implementing tries, Suffix Arrays: Suffix Arrays, Longest Repeated string - Overlapping and Non overlapping	B05

8. Delivery/Instructional Resources

Lecture No.	Topics	Web References	Audio-Video
1-3	Introduction to JAVA: Java Introduction, History and goals of Java, Fundamentals of OOPs; Overview of JDK, JVM, Garbage Collection; Java Basics: Identifiers, Keywords, Java Data Types & Operators	https://www.geeksforgeeks.org/introduction-to-java/	https://www.youtube.com/watch?v=AEo4KgwKYoU&list=PLqleLpAMfxGCbdaJ6SoExDfHrTfRDeWeG
4-6	Practice Problem: Aggregate and Percentage Marks of a student, Gross salary of an employee, Add one to each digit of a 4 digit, Add one to each digit of a 4 digit	https://www.geeksforgeeks.org/java-program-to-illustrate-total-marks-and-percentage-calculation/	https://www.youtube.com/watch?v=r4cFT9_kZIc
7-9	Control Statements: Decision Constructs, Using Loop Constructs Command Line Arguments Practice Problems: The Number is Kaprekar or not, Generate first n Prime numbers, Next Closest Fibonacci	https://www.geeksforgeeks.org/decision-making-javaif-else-switch-break-continue-jump/?ref=lbp	https://www.youtube.com/watch?v=OUZkdKFeuK0&list=PLlhM4lkb2sEgQmNKO43i7v60no4bdc3lI
10-12	Working with Arrays: Creating and Using Arrays (1D, 2D, Multidimensional); Jagged Arrays; Practice Problems: Matrix Multiplication, spirally traversing a	https://www.geeksforgeeks.org/arrays-in-java/?ref=lbp	https://www.youtube.com/watch?v=kWJHzambtNo

	matrix, Rotate a 2-D array by 90 degrees		
13-15	Classes & Objects: Classes, objects and methods: defining a class Access Control, Method overloading Practice Problems: Convert given number of seconds to days, hours, minutes and second, Class-TimeSpan, class – BankFee	https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in-java/?ref=lbp	https://www.youtube.com/watch?v=W-D71ZeMixQ&list=PLBlnK6fEyqRiwWLbSXKFtdGV8OVqr9dZr
16-18	Constructors, constructor overloading, use of this and static. Practice Problems: Class – TollBooth, methods of class: Display of Strings	https://www.geeksforgeeks.org/method-overloading-in-java/	https://www.youtube.com/watch?v=KpwBVAYbPDA
19-21	Inheritance: Working with Inheritance: Inheritance Basics & Types, Using super, Method Overriding Dynamic method dispatch, final keyword	https://www.geeksforgeeks.org/inheritance-and-constructors-in-java/?ref=lbp	https://www.youtube.com/watch?v=XSuybcFfLx4
22-24	Practice Problems: class – Box, BookCD, Marketer Abstract Methods & Classes, Packages & Interfaces: Built-In Packages and User Defined Packages	https://www.geeksforgeeks.org/differences-between-interface-and-class-in-java/?ref=lbp	https://www.youtube.com/watch?v=sC2DMPzIPFo
25-27	Interfaces: Declaration, Implementation, Extending Classes and Interfaces Practice Problem: Class - Customer and BankAccount, Class - MovablePoint and MovableCircle, Class: Circle and ResizableCircle	https://www.geeksforgeeks.org/differences-between-interface-and-class-in-java/?ref=lbp	https://www.youtube.com/watch?v=sC2DMPzIPFo
28-30	Strings, StringBuffer, StringBuilder & StringTokenizer: Introduction, Immutable String Methods of String class, String Buffer class & StringBuilder class, toString method, StringTokenizer class	https://www.geeksforgeeks.org/java-string-exercise/	https://www.youtube.com/watch?v=sCdgYAcQD5o
31-33	Practice Problem: Capitalize the first letter of each word, Swap first and last character of each word in a string, Find occurrences of palindrome words in a string	https://www.geeksforgeeks.org/swap-the-first-and-last-character-of-a-string-in-java/	https://www.youtube.com/watch?v=aamS7jTsa4k

34-36	Exception Handling: Exception handling fundamentals, Exception types, try and catch Multiple catch clauses, nested try, throw, throws and finally, Creating custom Exception.	https://www.geeksforgeeks.org/exceptions-in-java/?ref=lbp	https://www.youtube.com/watch?v=y-NlcLcxiKY&list=PLlhM4lkb2sEjaU-JAASDG4Tdwpf-JFARN
37-39	Practice Problems: Password too short Exception, Valid email address, Valid index of array	https://www.geeksforgeeks.org/java-program-to-check-the-validity-of-a-password-using-user-defined-exception/	https://www.youtube.com/watch?v=h0lGGZbK9zE
40-42	Multithreading: Java thread model, main thread, creating thread by implementing Runnable and extending thread class. Creating multiple threads, using isAlive() and join(), thread priorities Synchronization	https://www.javatpoint.com/multithreading-in-java	https://www.youtube.com/watch?v=YDH7f9dTXAs
43-45	Practice Problems: Multithreading Java: Greetings in reverse, Transcations in Account with and without Synchronization	https://www.javatpoint.com/multithreading-in-java	https://www.youtube.com/watch?v=YDH7f9dTXAs
46-48	Generics: Introduction, Generic Example, Generic Class,Generic Method	https://www.geeksforgeeks.org/generic-class-in-java/	https://www.youtube.com/watch?v=-5t9oOYBImc
49-51	Generic Constructor and Generic Interfaces Collections Framework: Introduction, Collection Interfaces-List, Queue. Practice Problems: Duplicate the Queue elements, Number is a Happy number or not	https://www.geeksforgeeks.org/generic-constructors-and-interfaces-in-java/	https://www.youtube.com/watch?v=zpXFoplKfrc
52-54	Collections Interfaces- Set (Overview), Collection Classes: ArrayList, LinkedList; Collections Interfaces- Iterator, Working with Maps (Overview), Comparable & Comparator	https://www.javatpoint.com/collections-in-java	https://www.youtube.com/watch?v=VphowcSkBX4
55-57	Practice Problems: Remove duplicates from a vector, Implement Own ArrayList in Java; Collections Interfaces- Arrays, Vector, Stack. Practice Problems: Cut the chocolate smartly for maximum pieces, find all pairs with sum K, Product Array - Ignoring the next	https://www.geeksforgeeks.org/handle-duplicate-elements-in-a-priorityqueue-while-maintaining-order-in-java/	https://www.youtube.com/watch?v=SD-qXsIVu5c

	IO Streams: Stream Classes: Byte Streams, Character Streams, StreamTokenizer. Practice Problems: Capitalize First Letter of every Word in a File, Strip HTML tags from a file		
58-60	JDBC Connectivity: Introduction, Architecture of JDBC Database Connection. JDBC Connectivity: Establishing JDBC Database Connection.	https://www.geeksforgeeks.org/establishing-jdbc-connection-in-java/	https://www.youtube.com/watch?v=7v2OnUti2eM
61-63	Mathematical coding problems (Prime Factorization, GCD of two numbers, Distribute in circle)	https://www.geeksforgeeks.org/distributing-m-items-circle-size-n-starting-k-th-position/	https://www.youtube.com/watch?v=5gFC-ayyQMk
64-66	Basic Sorting Algorithms – Bubble sort, Insertion sort, Selection sort, Divide and Conquer algorithms - Quick Sort and Merge Sort	https://www.khanacademy.org/computing/computer-science/algorithms/merge-sort/	https://rb.gy/s5tk7c
67-69	Searching (Linear and Binary)	Linear Search vs Binary Search - GeeksforGeeks	https://youtu.be/sSYQ1H9-Vks?si=9XDrlDRHVIYzMhsD
70-72	String Algorithms - String Algorithms (KMP, Manacher, Z-value Algorithm)	https://www.geeksforgeeks.org/z-algorithm-linear-time-pattern-searching-algorithm/	https://www.youtube.com/watch?v=V5-7GzOfADQ
73-75	Hash Table: Introduction to Hash Table, Collision, Open Addressing, Linear Probing, Separate Chaining	Hash Table Data Structure - GeeksforGeeks	https://youtu.be/wWgIAphfn2U?si=8EvqAcsvKjAQZYnb
76-78	Heap and Priority Queues : Heap Sort, Priority Queues, Implement Priority Queue using Linked List, Find max/min in the continuous stream of data	https://www.geeksforgeeks.org/priority-queue-using-linked-list/	https://www.youtube.com/watch?v=HqPJF2L5h9U
79-81	Greedy Algorithms: Greedy Algorithms, Fractional Knapsack problem, Interval scheduling, Job Scheduling with deadlines	https://www.geeksforgeeks.org/fractional-knapsack-problem/	https://www.youtube.com/watch?v=oTTzNMHM05I
82-84	Dynamic Programming: Why Dynamic Programming, Memorization, Tabulation, Count number of ways to cover a distance	https://www.geeksforgeeks.org/tabulation-vs-memoization/	https://rb.gy/pjjlrv
85-87	Minimum Cost Path to last element of matrix, Longest Common Subsequence (LCS)	Min Cost Path	DP-6 - GeeksforGeeks	https://youtu.be/sSno9rV8Rhg?si=ROeFYI8ZKDphA3O7

88-90	Binary Trees	https://www.scaler.com/topics/traversal-of-binary-tree/	https://www.youtube.com/watch?v=I_JuQ5ayPmc
91-93	Binary Trees	https://www.scaler.com/topics/traversal-of-binary-tree/	https://www.youtube.com/watch?v=I_JuQ5ayPmc
94-96	Binary Search Trees: Introduction to Binary Search Trees, Traversals (recursive& non recursive), Delete a Node, Find Height of a tree, Path in a tree, Level Order Traversal, Top View and Bottom View of a tree, Lowest Common Ancestor	https://testbook.com/maths/binary-search-tree	https://www.youtube.com/watch?v=cySVml6e_Fc
97-99	Binary Search Trees: Introduction to Binary Search Trees, Traversals (recursive& non recursive), Delete a Node, Find Height of a tree, Path in a tree, Level Order Traversal, Top View and Bottom View of a tree, Lowest Common Ancestor	https://testbook.com/maths/binary-search-tree	https://www.youtube.com/watch?v=cySVml6e_Fc
100-102	AVL Trees: Balanced Trees, Introduction to the AVL trees, Implementation of AVL Trees	https://www.geeksforgeeks.org/insertion-in-an-avl-tree/	https://www.youtube.com/watch?v=YWqla0UX-38
103-105	AVL Trees: Balanced Trees, Introduction to the AVL trees, Implementation of AVL Trees	https://www.geeksforgeeks.org/insertion-in-an-avl-tree/	https://www.youtube.com/watch?v=YWqla0UX-38
106-108	Advance recursion problems and Optimization	Recursive algorithms Separate and conquer (pitt.edu)	https://youtu.be/k-7jJP7QFEM?si=Gur9Xr6-ElbZeG26
109-111	Red Black Trees: Balanced Trees - Red Black Trees, Graphs: Graphs, Edge List, Adjacency Matrix, Adjacency List, Depth first traversal, Breadth first traversal, Shortest Path algorithms	https://www.geeksforgeeks.org/introduction-to-red-black-tree/	https://www.youtube.com/watch?v=3RQtq7PDHog
112-114	Red Black Trees: Balanced Trees - Red Black Trees, Graphs: Graphs, Edge List, Adjacency Matrix, Adjacency List, Depth first traversal, Breadth first traversal, Shortest Path algorithms	https://www.geeksforgeeks.org/introduction-to-red-black-tree/	https://www.youtube.com/watch?v=3RQtq7PDHog
115-117	Tries: Implementing tries, Suffix Arrays: Suffix Arrays, Longest Repeated string - Overlapping and Non overlapping	https://www.geeksforgeeks.org/longest-repeating-and-non-overlapping-substring/	https://www.youtube.com/watch?v=ZyLXuDNIAvQ

| 118-120 | Tries: Implementing tries, Suffix Arrays: Suffix Arrays, Longest Repeated string - Overlapping and Non overlapping | https://www.geeksforgeeks.org/longest-repeating-and-non-overlapping-substring/ | https://www.youtube.com/watch?v=ZyLXuDNIAvQ |

9. **Action plan for different types of learners**

Slow Learners	Average Learners	Fast Learners
• Remedial Classes on Saturdays • Encouragement for improvement using Peer Tutoring • Use of Audio and Visual Materials • Use of Real-Life Examples	• Workshops • Formative Exercises used to highlight concepts and notions • E-notes and E-exercises to read ahead of the pedagogic material.	• Engaging students to hold hands of slow learners by creating a Peer Tutoring Group • Design solutions for complex problems • Design solutions for complex problems • Presentation on topics beyond those covered in CHO

10. **Evaluation Scheme & Components:**

Evaluation Component	Type of Component	No. of Assessments	Weightage of Component	Mode of Assessment
Component 2	Subjective Test/Sessional Tests (STs)	03*	40%	Online on-campus
Component 3	End Term Examinations	01**	60%	Online on-campus
Total			**100%**	

*Best 2 Sessional Test will be counted for final assessment.

**As per Academic Guidelines, a minimum of 75% attendance is required to appear for the End Term Examination.

11. **Syllabus of the Course:**

Subject: APC (Advanced Programming Concepts using Java)/ 22CS027	

S. No.	Topic (s)	No. of Sessions	Weightage %
1	Introduction to JAVA: Java Introduction, History and goals of Java, Fundamentals of OOPs; Overview of JDK, JVM, Garbage Collection; Java Basics: Identifiers, Keywords, Java Data Types & Operators. Practice Problem: Aggregate and Percentage Marks of a student, Gross salary of an employee, Add one to each	42	34%

digit of a 4 digit, Add one to each digit of a 4 digit. Control Statements: Decision Constructs, Using Loop Constructs Command Line Arguments. Practice Problems: The Number is Kaprekar or not, Generate first n Prime numbers, Next Closest Fibonacci. Working with Arrays: Creating and Using Arrays (1D, 2D, Multidimensional); Jagged Arrays; Practice Problems: Matrix Multiplication, spirally traversing a matrix, Rotate a 2-D array by 90 degrees. Classes & Objects: Classes, objects and methods: defining a class Access Control, Method overloading Practice Problems: Convert given number of seconds to days, hours, minutes and second, Class- TimeSpan, class – BankFee. Constructors, constructor overloading, use of this and static. Practice Problems: Class – TollBooth, methods of class: Display of Strings. Inheritance: Working with Inheritance: Inheritance Basics & Types, Using super, Method Overriding. Dynamic method dispatch, final keyword. Practice Problems: class – Box, BookCD, Marketer Abstract Methods & Classes, Packages & Interfaces: Built-In Packages and User Defined Packages. Interfaces: Declaration, Implementation, Extending Classes and Interfaces Practice Problem: Class - Customer and BankAccount, Class - MovablePoint and MovableCircle, Class: Circle and ResizableCircle. Strings, StringBuffer, StringBuilder & StringTokenizer: Introduction, Immutable String Methods of String class, String Buffer class & StringBuilder class, toString method, StringTokenizer class. Practice Problem: Capitalize the first letter of each word, Swap first and last character of each word in a string, Find occurrences of palindrome words in a string. Exception Handling: Exception handling fundamentals, Exception types, try and catch Multiple catch clauses, nested try, throw, throws and finally, Creating custom Exception. Practice Problems: Password too short Exception, Valid email address, Valid index of array. Multithreading: Java thread model, main thread, creating thread by implementing Runnable and extending thread class. Creating multiple threads, using isAlive() and join(), thread priorities Synchronization.		
ST-1 (Covering 34% syllabus)		

	Practice Problems: Multithreading Java: Greetings in reverse, Transcations in Account with and without Synchronization. Generics: Introduction, Generic Example, Generic Class,Generic Method. Generic Constructor and Generic Interfaces Collections Framework: Introduction, Collection Interfaces-List, Queue. Practice Problems: Duplicate the Queue elements, Number is a Happy number or not. Collections Interfaces- Set (Overview), Collection Classes: ArrayList, LinkedList; Collections Interfaces-Iterator, Working with Maps (Overview), Comparable & Comparator. Practice Problems: Remove duplicates from a vector, Implement Own ArrayList in Java; Collections Interfaces- Arrays, Vector, Stack. Practice Problems: Cut the chocolate smartly for maximum pieces, find all pairs with sum K, Product Array - Ignoring the next IO Streams: Stream Classes: Byte Streams, Character Streams, StreamTokenizer. Practice Problems: Capitalize First Letter of every Word in a File, Strip HTML tags from a file. JDBC Connectivity: Introduction, Architecture of JDBC Database Connection. JDBC Connectivity: Establishing JDBC Database Connection. Mathematical coding problems (Prime Factorization, GCD of two numbers, Distribute in circle), Basic Sorting Algorithms – Bubble sort, Insertion sort, Selection sort, Divide and Conquer algorithms - Quick Sort and Merge Sort, Searching (Linear and Binary), String Algorithms - String Algorithms (KMP, Manacher, Z-value Algorithm), Hash Table: Introduction to Hash Table, Collision, Open Addressing, Linear Probing, Separate Chaining, Heap and Priority Queues : Heap Sort, Priority Queues, Implement Priority Queue using Linked List, Find max/min in the continuous stream of data, Greedy Algorithms: Greedy Algorithms, Fractional Knapsack problem, Interval scheduling , Job Scheduling with deadlines.	**39**	**33%**
ST-2 (Covering 33% syllabus)		
2	Dynamic Programming: Why Dynamic Programming, Memorization, Tabulation, Count number of ways to cover a distance, Minimum Cost Path to last element of matrix, Longest Common Subsequence (LCS). Binary Tree. Binary Search Tree. Introduction to Binary Search Trees, Traversals (recursive& non recursive), Delete a Node, Find Height of a tree, Path in a tree, Level Order Traversal, Top View and Bottom View of a tree, Lowest Common Ancestor. AVL Trees:	**39**	**33%**

	Balanced Trees, Introduction to the AVL trees, Implementation of AVL Trees. Advance recursion problems and Optimization. Red Black Trees: Balanced Trees - Red Black Trees, Graphs: Graphs, Edge List, Adjacency Matrix, Adjacency List, Depth first traversal, Breadth first traversal, Shortest Path algorithms. Tries: Implementing tries, Suffix Arrays: Suffix Arrays, Longest Repeated string - Overlapping and Non overlapping.		
ST-3 (Covering 33% syllabus)			
End Term 100% syllabus			

This Document is approved by:

Designation	Name	Signature
Course Coordinator	Dr. Deepak Ahlawat	
Head-Academic Delivery	Dr. Susheela Hooda	
Dean	Dr. Rupali Gill	
Dean Academics	Dr. Monit Kapoor	
Date	23.07.2024	