KALINDI COLLEGE

SEMESTER – III

Bachelor of Vocation- Web Designing

DISCIPLINE SPECIFIC CORE COURSE 07–Data Structures

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Data Structures	4	3	0	1	Class XII Pass	NA

Learning Objectives:

1. To introduce the fundamentals of data structures
2. To get familiar with programming

Learning Outcomes:

1. Develop the ability to use basic data structures like array, stacks, queues, lists, trees andhash tables to solve problems.
2. Use well-organized data structures in solving various problems.
3. Differentiate the usage of various structures in problem solutions.
4. Implement algorithms to solve problems using appropriate data structures.

Unit I **(5 hours)**

Arrays: Single and multi-dimensional arrays, analysis of insert, delete and search operations in arrays (both linear search and binary search), implementing sparse matrices, applicationsof arrays

to sorting: selection sort, insertion sort, bubble sort, comparison of sorting techniques via empirical studies.

Unit II **(5 hours)**

Linked Lists: Singly- linked, doubly-linked and circular lists, analysis of insert, delete and search operations in all the three types, implementing sparse matrices.

Unit III **(10 hours)**

Queues: Array and linked representation of queue, de-queue, comparison of the operations on queues in the two representations. Applications of queues.

Unit IV **(15 hours)**

Stacks: Array and linked representation of stacks, comparison of the operations on stacks in the two representations, implementing multiple stacks in an array; applications of stacks: prefix, infix and postfix expressions, utility and conversion of these expressions from one to another; applications of stacks to recursion: developing recursive solutions to simple problems, advantages and limitations of recursion.

Unit V **(10 hours)**

Trees and Heaps: Introduction to tree as a data structure; binary trees, binary search trees, analysis of insert, delete, search operations, recursive and iterative traversals in binary search trees. Height-balanced trees (AVL), B trees, analysis of insert, delete, search operations on AVL and Btrees. Introduction to heap as a data structure. Analysis of insert, extract-min/max and delete-min/ max operations, applications to priority queues.

Hash Tables: Introduction to hashing, hash tables and hashing functions -insertion, resolving collision by open addressing, deletion, searching and their analysis, properties of a goodhash function.

References

1. Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser (2013), Data Structuresand Algorithms in Python, Wiley.
2. Rance D. Necaise, Data Structures and Algorithms Using Python, John Wiley & Sons, Inc.

3. Introduction to Algorithms, by Cormen, Leiserson, Rivest, and Stein, MIT Press, Third Edition, 2009.

List of Practical (30 hours)

A practical implementation of various data structure such as Array, Queues, Stacks, Linked List and Trees.

DISCIPLINE SPECIFIC CORE COURSE 08– Programming with Java

Course title &Code	Credits	Credit distribution of the course			Eligibility criteria	Pre- requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Programming with Java	4	3	0	1	Class XII Pass	NA

Learning Objectives

This course is designed to develop understanding of object-oriented programming concepts like Classes, Objects, Inheritance and Polymorphism using Java. The course provides understanding of multithreading and exception handling in Java. It also introduces how to create Java applications with graphical user interface (GUI).

Learning Outcomes

On successful completion of the course, students will be able to:

1. Understand the object-oriented concepts – Classes, Objects, Inheritance, Polymorphism– for problem solving.
2. Create and handle multithreading.
3. Handle program exceptions.
4. Handle input/output through files.
5. Create Java applications with graphical user interface (GUI).

SYLLABUS OF DSC-08

Unit 1 Introductory Concepts: (2 weeks)

Program, identifiers, variables, constants, primitive data types, expressions, Naming Conventions, Type casting, operators, control statements, structured data types, arrays, functions.

Unit 2 Object Oriented Concepts: (4 weeks)

Abstraction, encapsulation, objects, classes, methods, constructors, inheritance, polymorphism, static and dynamic binding, Anonymous block, Static Data members, overloading and overriding, Usage of super and this keyword, Abstract classes, Interfaces and Packages, Access modifiers, Object class

Unit 3 Multithreading: (4 weeks)

Creating Threads, Thread Priority, Blocked States, Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization, Sync Code Block, Overriding Synced Methods, Thread Communication, wait, notify and notify all.

Unit 4 Introduction to Exception handling: (3 weeks)

Exception and Error, Throw, try and catch Blocks, Exception handlers, java. Lang Exceptions, Built-In Exceptions.

Unit 5 Introduction to File Handling: (2 weeks)

Byte Stream, Character Stream, File I/O Basics, File Operations, Serialization.

Practical component

Programming exercises using Java.

Essential Readings

1. James Gosling, Bill Joy, Guy L. Steele Jr, Gilad Bracha, Alex Buckley, The Java Language Specification, Java SE 7 th edition, Addison-Wesley, 2013.
2. Herbert Schildt, Java: The Complete Reference, 10th edition, McGraw-Hill Education, 2018.
3. Cay S. Horstmann, Core Java - Vol. I – Fundamentals, 10th edition, Pearson, 2017.
4. Richard Johnson, An Introduction to Java Programming and Object-Oriented Application Development, Thomson Learning, 2006.
5. Kathy Sierra and Bert Bates, Head First Java, 3 rd edition, O'Reilly, 2022

DISCIPLINE SPECIFIC CORE COURSE 07– Data Analysis using Python

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Data Analysis using Python	4	3	0	1	Class XII Pass	NA

Learning Objectives

This course is designed to introduce the students to real-world data analysis problems, use of statistics to get a deterministic view of data and interpret results in the field of exploratory data science using Python. This course is the first in the "Data Science" pathway and builds the foundation of three subsequent courses in the pathway

Learning Outcomes

On successful completion of the course, students will be able to:

1. Apply descriptive statistics to obtain a deterministic view of data.
2. Perform data handling using Numpy arrays.
3. Load, clean, transform, merge and reshape data using Pandas.
4. Visualize data using Pandas and matplot libraries.
5. Solve real world data analysis problems

SYLLABUS OF DSC-09

Unit 1 Introduction to basic statistics and analysis: (4 weeks)

Fundamentals of Data Analysis, Statistical foundations for Data Analysis, Types of data, Descriptive Statistics, Correlation and covariance, Linear Regression, Statistical Hypothesis Generation and Testing, Python Libraries: NumPy, Pandas, Matplotlib

Unit 2 Array manipulation using NumPy: (2 weeks)

NumPy array: Creating NumPy arrays; various data types of NumPy arrays, indexing and slicing, swapping axes, transposing arrays, data processing using NumPy arrays

Unit 3 Data Manipulation using Pandas: (4 weeks)

Data Structures in Pandas: Series, Data Frame, Index objects, loading data into Pandas data frame, Working with Data Frames: Arithmetic, Statistics, Binning, Indexing, Reindexing, Filtering, Handling missing data, Hierarchical indexing, Data wrangling: Data cleaning, transforming, merging and reshaping

Unit 4 Plotting: (3 weeks)

Using Matplotlib to plot data: figures, subplots, markings, color and line styles, labels and legends, Plotting functions in Pandas: Line, bar, Scatter plots, histograms, stacked bars, Heatmap

Unit 5 Data Aggregation and Group operations: (2 weeks)

Group by Mechanics, Data aggregation, General split-apply-combine, Pivot tables and cross tabulation

Practical component

Programming exercises using Python.

Essential Readings:

1. McKinney W. Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython, 2nd edition, O'Reilly Media, 2018.
2. Molin S. Hands-On Data Analysis with Pandas, Packt Publishing, 2019.
3. Gupta S.C., Kapoor V.K. Fundamentals of Mathematical Statistics,12th edition, Sultan Chand & Sons, 2020

Suggested Readings:

(i) Chen D. Y. Pandas for Everyone: Python Data Analysis, 1 st edition, Pearson Education, 2018.

(ii) Miller J.D. Statistics for Data Science, Packt Publishing Limited, 2017.