

(Applicable to the batch of students admitted in the academic year 2025-2026)

B.Sc.(Data Science) (CBCS)

FACULTY OF SCIENCE, IIMC

B.Sc. (M.S.DS.)
Data Science Syllabus (CBCS)
(2026-27)

Semester III & IV



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Department of Computer Science
INDIAN INSTITUTE OF
MANAGEMENT & COMMERCE
Autonomous College (UG & PG)
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P.V. Sridhar

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B.Sc. II-Year, IV-Semester (CBCS) Data Science Syllabus Paper-IV

(Theory): Programming in Java

[4 HPW :: 4 Credits :: 100 Marks (External: 50, Practical:20, Mid Sem.Internal Assessment : 20)]

Course Objectives & Outcomes:

1. Able to know the basic concepts Java Programming.
2. Able to write program using various Object-Oriented Programming concepts.
3. Able to write programs using I/O streams, Applet creation, Event handling and Swings

UNIT – I

Introduction: Java Essentials, JVM, Java Features, Creation and Execution of Programs, Data Types, Structure of Java Program, Type Casting, Conditional Statements, Loops, Classes, Objects, Class Declaration, Creating Objects.

UNIT - II

Methods: Declaration and Invocation, Method Overloading, Constructors – Parameterized Constructors, Constructor Overloading, Cleaning-up unused Objects. Class Variables & Method-static Keyword, this Keyword, One-Dimensional Arrays, Two-Dimensional Arrays, Command-Line Arguments, Inner Class. Inheritance: Introduction, Types of Inheritance, extends Keyword, Examples, Method Overriding, super, final Keyword, Abstract classes, Interfaces, Abstract Classes Verses Interfaces. Packages: Creating and Using Packages, Access Protection, Wrapper Classes, String Class, String Buffer Class.

UNIT – III

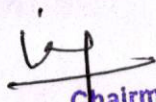
Exception: Introduction, Types, Exception Handling Techniques, User-Defined Exception. Multithreading: Introduction, Main Thread and Creation of New Threads –By Inheriting the Thread Class or Implementing the Runnable Interface, Thread Lifecycle, Thread Priority and Synchronization. Input/Output: Introduction, java.io Package, File Streams, File Input Stream Class, File Output Stream Class, Scanner Class, Buffered Input Stream Class, Buffered Output Stream Class, Random Access File Class.

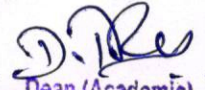
UNIT - IV

Applets: Introduction, Example, Life Cycle, Applet Class, Common Methods Used in Displaying the Output (Graphics Class). Event Handling: Introduction, Types of Events, Example. AWT: Introduction, Components, Containers, Button, Label, Checkbox, Radio Buttons, Container Class, Layouts. Swings: Introduction, Differences between Swing and AWT, JFrame, JApplet, JPanel, Components in Swings, Layout Managers, JTable.

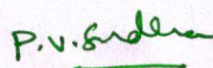
References:

1. Sachin Malhotra, Saurabh Choudhary: Programming in Java (2e)
2. Bruce Eckel: Thinking in Java (4e)
3. Herbert Schildt: Java: The Complete Reference (9e)
4. Y. Daniel Liang: Introduction to Java Programming (10e)
5. Paul Deitel, Harvey Deitel: Java: How To Program (10e)
6. Cay S. Horstmann: Core Java Volume I – Fundamentals (10e)


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B.Sc. II-Year, IV-Semester (CBCS) Data Science Syllabus Paper-IV

(Practical): Programming in Java (Lab)

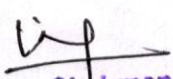
[2 HPW :: 1 Credit :: 20 Marks]

Course objectives and Outcomes:

1. Able to write java programs by developing logic to the given simple problem.
2. Able write java program with using OOPs concepts
3. Able to write java programs with usage of I/O streams, applets, string operations, event handling, swings.

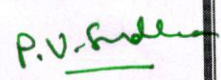
List of Programs:

1. Write a java program to find the largest of 'n' natural numbers.
2. Write a java program to find whether a given number is prime or not.
3. Write a menu driven program for following: Display a Fibonacci series and Compute Factorial of a number.
4. Write a java program to check whether a given number is odd or even.
5. Write a java program to check whether a given string is palindrome or not.
6. Write a java program to print the sum and product of digits of an Integer & reverse the Integer.
7. Write a program to create an array of 10 integers. Accept values from the user in that Array. Input another number from the user and find out how many numbers are equal to the number passed, how many are greater and how many are less than the number passed.
8. Write a java program that will prompt the user for a list of 5 prices. Compute the average of the prices and find out all the prices that are higher than the calculated average.
9. Write a java program in java to input N numbers in an array and print out the Armstrong numbers from the set.
10. Write java program for the following matrix operations: Addition of two matrices and Transpose of a matrix
11. Write a java program that computes the area of a circle, rectangle and a Cylinder using function overloading.
12. Write a java program for the implementation of multiple inheritance using interfaces to calculate the area of a rectangle and triangle.
13. Write a java program to create a frame window in an Applet. Display your name, address and qualification in the frame window.
14. Write a java program to draw a line between two coordinates in a window.
15. Write a java program to display the following graphics in an applet window. a. Rectangles b. Circles c. Ellipses d. Arcs e. Polygons
16. Write a program that reads two integer numbers for the variables a and b. If any other character except number (0-9) is entered then the error is caught by Number Format Exception object. After that ex.get Message () prints the information about the error occurring causes.
17. Write a program for the following string operations: a. Compare two strings b. concatenate two strings c. Compute length of a string.
18. Create a class called Fraction that can be used to represent the ratio of two integers. Include appropriate construction.


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B.Sc. II-Year, III-Semester (CBCS) Data Science Syllabus Paper-

III (Theory): Data Engineering with Python

[4 HPW :: 4 Credits :: 100 Marks (External: 50, Practical:20, Mid Sem.Internal Assessment : 20)]

Course Objectives and Outcomes:

1. Understanding the basic concepts on Data Engineering.
2. Database creation using MySQL and accessing data and performing ETL operations.
3. Able to handle different types of data files using Python.
4. Use of regular expression operations, relational databases via SQL, tabular numeric data, data structures: data series and frames. Usage of PyPlot, Numpy, Pandas on data sets.

UNIT – I

Data Science: Data sets, Data variables, understanding of Datasets, Data Analysis Sequence, Data Acquisition Pipeline, Report Structure. **Files and Working with Text Data:** Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules. **Working with Text Data:** JSON and XML in Python.

UNIT – II

Working with Text Data: Processing HTML Files, Processing Texts in Natural Languages. **Regular Expression Operations:** Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with *glob* Module. **Working with Databases:** Setting Up a MySQL Database, using a MySQL Database: Command Line, Using a MySQL Database, Taming Document Stores: MongoDB

UNIT – III

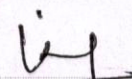
Working with Tabular Numeric Data (NumPy with Python): Introduction to NumPy, NumPy Arrays Creation Using *array()* Function, Array Attributes, NumPy Arrays Creation with Initial Placeholder Content, Integer Indexing, Array Indexing, Boolean Array Indexing, Slicing and Iterating in Arrays, Basic Arithmetic Operations on NumPy Arrays, Mathematical and Statistical Functions in NumPy, Changing the Shape of an Array, Stacking and Splitting of Arrays, Broadcasting in Arrays.

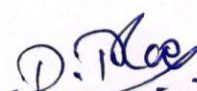
UNIT – IV

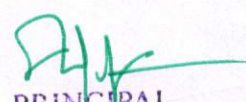
Pandas: Introduction to Pandas, Working with Pandas Data Structures: Data Series and Frames, Renaming and Reshaping Data Using Pandas, Handling Missing Data using Pandas, Merging the Data using Pandas, Ordering and Describing Data, Transforming Data, Taming Pandas File I/O (Explanation of data exchange between frames and series). **Plotting:** Introduction to Basic Plotting with PyPlot, Initializing the Plots object, Types of Plots Getting to Know Other Plot Types, Mastering Embellishments, Plotting with Pandas.

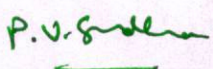
References:

1. Gowrishankar S., Veena A. (2019): Introduction to Python Programming. CRC Press, T&F.
2. Charles R Severance (2016): Python for Everybody: Exploring Data Using Python.
3. Fabio Nelli, (2015): Python Data Analytics – Data Analysis and Science using Pandas, matplotlib and the Python Programming Language, Apress.
4. Chris Albon (2018): Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning. O'Reilly.


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B.Sc. II-Year, III-Semester (CBCS) Data Science Syllabus Paper-III (Practical): Data Engineering with Python (Lab) [2 HPW :: 1 Credit :: 20 Marks]

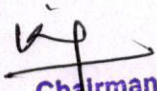
Course Objectives & Outcomes:

1. Able to perform the operations Extract, Transform, Load (ETL) the input data with different file formats. text files, CSV files, XML files, JSON, HTML files, SQL databases, NoSQL databases etc.
2. Able to cleaning and visualize the data.
3. Able to use Python libraries/modules: pandas, NumPy, Beautiful Soup, PyMySQL, pymongo, nltk, matplotlib.
4. Able to perform all the above on various data sets with different file formats.

List Practical's:

1. Write programs to parse text files, CSV, HTML, XML and JSON documents and extract relevant data. After retrieving data check any anomalies in the data, missing values etc.
2. Write programs for reading and writing binary files
3. Write programs for searching, splitting, and replacing strings based on pattern matching using regular expressions
4. Design a relational database for a small application and populate the database. Using SQL do the CRUD (create, read, update and delete) operations.
5. Create a Python MongoDB client using the Python module pymongo. Using a collection object practice functions for inserting, searching, removing, updating, replacing, and aggregating documents, as well as for creating indexes
6. Write programs to create Numpy arrays of different shapes and from different sources, reshape and slice arrays, add array indexes, and apply arithmetic, logic, and aggregation functions to some or all array elements
7. Write programs to use the Pandas data structures: Frames and series as storage containers and for a variety of data-wrangling operations, such as:
 - Single-level and hierarchical indexing
 - Handling missing data
 - Arithmetic and Boolean operations on entire columns and tables
 - Database-type operations (such as merging and aggregation)
 - Plotting individual columns and whole tables
 - Reading data from files and writing data to files

Note: Student has to practice the above on various publicly available *appropriate datasets* for *implementation*. Some of the datasets are like: MNIST (<http://yann.lecun.com/exdb/mnist/>); UCI Machine Learning Repository (<https://archive.ics.uci.edu/ml/datasets.html>), Kaggle datasets (<https://www.kaggle.com/datasets>); Twitter Data


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