Python with Data Analytics – Payilagam Syllabus (Updated)

Including: Python + NumPy + Pandas + SQL + Power BI + Tableau

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Python Core Modules

Python Introduction, Installation

- Python Introduction
- Download & Install Python
- Verify Installation
- Install an IDE (**VS Code / PyCharm**)

Data Types

- Numeric Types
- Text Type
- Sequence Types
- Set Types
- Mapping Type
- Boolean Type
- None Type

Operators

- Arithmetic
- Comparison
- Logical
- Assignment
- Membership
- Identity
- Bitwise

Flow Control Statements

- Conditional Statements
- Looping Statements
- Control Statements
- Exception Handling

- Pass Statement

List

- Creating Lists
- Accessing / Slicing
- Modify / Add / Remove Elements
- **Bubble Sort**
- **Binary Search**
- **Mini Project: Student Management System**

Tuple

- Creating Tuples
- Accessing & Slicing
- Packing and Unpacking
- **Immutable Nature**
- **Mini Projects:**
  - Highest Scorer
  - Coordinate Distance Calculator
  - Café Menu Order App

Set

- Create, Access
- Add / Remove
- Set Operations
- Other Set Functions
- **Mini Projects:**
  - Duplicate Finder
  - Unique Words from a Book
  - Student Attendance Tracker

Dictionary

- Create Dictionary
- Access / Modify Values
- Add / Remove Pairs
- Dictionary Operations
- Nested Dictionaries

- **Mini Projects:**
    - Phone Book
    - Student Marks System
    - Grocery Price Calculator

Functions

- Function Definition & Call
- **Return**
- Default & Variable-Length Arguments
- **Lambda Functions**
- **Recursion**

Package

- Creating Packages
- Importing Modules
- Subpackages

Python OOPs

- Class & Object
- Attributes, Methods
- **Encapsulation**
- **Inheritance**
- **Polymorphism**
- **Abstraction**
- Types of Methods
    - Instance
    - Class
    - Static
- **Dunder Methods**

Exception Handling

- try–except
- Specific Exceptions
- else–finally
- Raise Exceptions
- **Custom Exceptions**

File Handling

- Open, Read, Write, Append
- File Modes
- **With Statement**
- Exception Handling
- Working with Paths
- **Mini Projects:**
  - Simple Notepad
  - Student Record System
  - To-Do List using File

Regular Expressions

- Regex Basics
- Using Regex in Python
- **Mini Projects:**
  - Email Validator
  - Mobile Extractor
  - Password Validator
  - Date Extractor
  - Username Extractor
  - HTML Tag Remover

Multithreading

- Creating Threads
- Synchronization
- Communication
- Daemon Threads
- **Mini Projects:**
  - Multithreaded File Downloader (Simulation)
  - Clock Display

Python DB Programming (SQLite & PostgreSQL)

- Install SQLite
- Connect to DB
- Cursor

- Execute Queries
- Query Data
- Close Connection

Decorator & Generator Functions

- Generator Functions
- Decorator Functions

Data Analytics Modules

NumPy – Data Wrangling & Computation

- **Key Concepts**
    - What is NumPy?
    - Installing & Importing
- **Array Creation**
    - array(), zeros(), ones(), arange(), linspace(), reshape()
- **Array Operations**
    - Indexing, Slicing, Iteration
    - Math & Aggregation
    - Element-wise
    - dot, transpose
    - **Broadcasting**
    - sum(), mean(), std(), argmax()
- **Mini Project:**
    - Simulate student marks using a 2D array, find averages & toppers.

Pandas – Data Analysis

- **Core Structures**
    - Series
    - DataFrame
- **File I/O**
    - read_csv(), read_excel(), read_json()
    - to_csv(), to_excel()
- **DataFrame Operations**
    - loc, iloc

    - Filtering
    - Sorting
- **Data Cleaning**
    - isnull(), fillna(), dropna()
    - replace(), rename(), type conversion
- **Transformations**
    - Add/Remove Columns
    - apply(), lambda
- **Grouping & Aggregation**
    - groupby(), pivot_table(), crosstab
- **Merging/Joining**
    - merge(), join(), concat()
- **Mini Projects:**
    - Titanic Dataset Cleaning
    - HR Employee Analytics
    - Sales Data Trend Analysis

Pandas + SQL Integration

- read_sql(), to_sql()
- Run SQL queries inside Pandas
- Load API data into DataFrame
- **Mini Project:**
    - Fetch OpenWeatherMap API → Clean Data → Store in SQLite

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Power BI Module (BI & Visualization)

- **Introduction**
    - What is Power BI?
    - Interface Overview
- **Data Import**
    - CSV, Excel, SQL import
    - **Power Query (ETL)**
- **DAX (Basic to Intermediate)**
    - Calculated Columns

    - Measures
    - SUM, COUNT, CALCULATE, FILTER
- **Visualizations**
    - Bar, Line, Pie
    - Maps
    - Slicers
    - Drill-Through
    - Tooltips
- **Dashboards & Publishing**
    - Designing Reports
    - Publishing to Power BI Service
    - Sharing Dashboards
- **Mini Projects:**
    - Sales Dashboard
    - Employee Attrition Dashboard
    - Student Performance Dashboard

Tableau Module (Optional but Recommended)

- **Introduction**
    - Tableau Interface
    - Worksheets, Dashboards, Stories
- **Connecting Data**
    - CSV, Excel, SQL
    - Data Cleaning
- **Visual Analytics**
    - Bar/Line Charts
    - Scatter Plots
    - Maps
- **Filters & Parameters**
- **Calculations**
    - Calculated Fields
    - Table Calculations

- **Dashboards**
    - Layouts
    - Actions (Filter, Highlight, URL)
- **Mini Projects:**
    - Superstore Sales Insights Dashboard
    - HR Hiring & Attrition Dashboard
    - Revenue Trend Analysis

Final Project: Student Performance Analytics System

- **Using:** Python + NumPy + Pandas + SQL + Power BI/Tableau
- Import student data
- Clean and process
- Perform analytics
- Visualize in Power BI/Tableau
- Generate dashboard reports
