

# Python for Research & Data Science

## Course Outline

**Instructor: Dewan Mumdoood Ahmed**

Research Assistant at the Bioinformatics Lab (Dry), University of Rajshahi.  
M.Sc. & B.Sc. in Dept. of Statistics, University of Rajshahi.

| Contents         |                                                                                                                                                                                                                                                                                                                                                                |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Chapter 1</b> | <b>Introduction to Computer Programming &amp; Python</b> <ul style="list-style-type: none"> <li>• Computer Programming Fundamentals</li> <li>• Five Operations of a Program</li> <li>• Programming Structures</li> <li>• Variables &amp; Data Types</li> <li>• Loops</li> <li>• Functions &amp; Basic Scripting</li> <li>• Python Environment Setup</li> </ul> |
| <b>Chapter 2</b> | <b>Python for Data Handling</b> <ul style="list-style-type: none"> <li>• Data Structures</li> <li>• NumPy Fundamentals</li> <li>• Pandas Fundamentals</li> <li>• Importing CSV &amp; Excel Data</li> <li>• Data Cleaning &amp; Preprocessing</li> <li>• Data Manipulation</li> </ul>                                                                           |
| <b>Chapter 3</b> | <b>Data Visualization</b> <ul style="list-style-type: none"> <li>• Matplotlib Essentials</li> <li>• Seaborn for Statistical Graphics</li> <li>• Publication-Ready Figures</li> </ul>                                                                                                                                                                           |
| <b>Chapter 4</b> | <b>Statistics with Python</b> <ul style="list-style-type: none"> <li>• Descriptive Statistics</li> <li>• Data Types in Statistics</li> <li>• Normality Testing</li> <li>• Outlier Detection</li> <li>• Parametric Tests</li> <li>• Non-Parametric Tests</li> <li>• Correlation</li> <li>• Regression Analysis</li> </ul>                                       |
| <b>Chapter 5</b> | <b>Working with Real Research Data</b> <ul style="list-style-type: none"> <li>• Clinical Dataset Pipeline</li> <li>• Survey Data Analysis</li> </ul>                                                                                                                                                                                                           |

|                      |                                                                                                                                                                                                                                                                                                                      |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | <ul style="list-style-type: none"> <li>• Biological &amp; Genomic Data</li> <li>• Environmental Time-Series</li> </ul>                                                                                                                                                                                               |
| <b>Chapter 6</b>     | <b>Automation for Researchers</b> <ul style="list-style-type: none"> <li>• Loop-Based Batch Analysis</li> <li>• Automating Repetitive Tasks &amp; File Management</li> <li>• Automatic Data Validation &amp; Flagging</li> <li>• Generating Summary Reports Programmatically</li> <li>• Exporting Outputs</li> </ul> |
| <b>Chapter 7</b>     | <b>Introduction to Machine Learning in Python</b> <ul style="list-style-type: none"> <li>• ML Mindset for Researchers</li> <li>• Scikit-learn Workflow</li> <li>• Core ML Models</li> <li>• Model Evaluation</li> <li>• Model Comparison &amp; Cross-Validation</li> </ul>                                           |
| <b>Final Project</b> |                                                                                                                                                                                                                                                                                                                      |

