TECHNOCATION FREELANCING TRAINING INSTITUTE & SOFTWARE HOUSE

Professional SCIPY Course Outline

Module 1: Introduction to SciPy

- What is SciPy? Why is it Important?
- Installing and Setting Up SciPy (`pip install scipy`)
- SciPy vs. NumPy: Understanding the Differences
- Overview of SciPy Modules (`scipy.linalg`, `scipy.optimize`, `scipy.stats`, etc.)

Module 2: Scientific Computing with SciPy

- Working with NumPy Arrays in SciPy
- Using SciPy for Basic Mathematical Operations
- Special Functions (`scipy.special`)
- Numerical Integration and Differentiation (`scipy.integrate`)

Module 3: Linear Algebra with SciPy

- Matrix Operations (`scipy.linalg`)
- Eigenvalues and Eigenvectors (`scipy.linalg.eig`)
- Solving Linear Systems (`scipy.linalg.solve`)
- Matrix Factorization (LU, QR, Cholesky)

Module 4: Optimization and Root Finding

- Introduction to Optimization Problems
- Unconstrained Optimization (`scipy.optimize.minimize`)
- Constrained Optimization (`scipy.optimize.linprog`)
- Root Finding (`scipy.optimize.root`)

Module 5: Interpolation and Curve Fitting

- Introduction to Interpolation (`scipy.interpolate`)
- Polynomial Interpolation
- Spline Interpolation
- Curve Fitting (`scipy.optimize.curve_fit`)

Module 6: Signal Processing with SciPy

- Working with Fourier Transforms (`scipy.fft`)
- Filtering Signals (`scipy.signal`)
- Convolution and Correlation
- Spectral Analysis

Module 7: Statistical Analysis and Probability Distributions

- Descriptive Statistics (`scipy.stats.describe`)
- Probability Distributions (`scipy.stats.norm`, `scipy.stats.uniform`)
- Hypothesis Testing (`scipy.stats.ttest_ind`, `scipy.stats.chisquare`)
- Statistical Modeling

Module 8: Image Processing with SciPy

- Working with Multi-dimensional Images (`scipy.ndimage`)
- Image Filtering and Edge Detection
- Morphological Operations
- Image Transformations and Object Detection

Module 9: Sparse Matrices and Computational Performance

- Introduction to Sparse Matrices (`scipy.sparse`)
- Creating and Manipulating Sparse Matrices
- Applications of Sparse Matrices in Machine Learning
- Performance Optimization with SciPy

Final Module: Capstone Project & Certification

- Implementing Real-World Computational Solutions Using SciPy
- Data Analysis and Signal Processing Projects
- Performance Optimization Techniques
- Final Presentation and Course Completion Certification