



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

COURSE CONTENT

DATA ANALYTICS AND PYTHON FOR ENGINEERS								
IV Semester: ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2546779	SDC	L	T	P	C	CIA	SEE	Total
		0	0	2	1	40	60	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 30			Total Classes: 30			
Prerequisites: Python Programming Lab								

Course Overview:

This course covers data cleaning, transformation, visualization, and statistical analysis to extract meaningful engineering insights. Learners apply regression and hypothesis testing techniques to analyze system performance and process variations. The course also emphasizes practical analytics on sensor and time-series data for monitoring and predictive analysis in engineering systems.

Course Objectives:

1. To introduce Python programming for data handling and analysis.
2. To enable data import, cleaning, and transformation.
3. To develop skills in data visualization and statistical analysis.
4. To apply data analytics to engineering problem solving.
5. To introduce real time data analysis using tools like Jupyter or Streamlit.

Course Outcomes: After completion of the course, student should be able to

1. Write Python programs for engineering computations and data processing.
3. Create visualizations using Matplotlib and Seaborn.
4. Perform descriptive and predictive statistical analyses.
5. Analyze engineering datasets for performance insights.
6. Apply analytics to real world problems like predictive maintenance.

UNIT - I:

Python Fundamentals for Engineering Applications

Basic Python Programming: Writing simple Python scripts for arithmetic, loops, and functions.

Application: Calculate mechanical or electrical parameters (e.g., stress, power, resistance).

Data Types and Structures: Practice using lists, dictionaries, tuples, sets. Application: Storing sensor data, part specifications, material properties.

File Handling in Python: Read/write data from .txt, .csv files. Application: Reading experimental or log data from machines.

UNIT - II:

Data Handling and Processing

Data Import and Cleaning using Pandas: Load data from Excel/CSV, handle missing data, remove outliers. Application: Clean experimental datasets from lab instruments.

Data Transformation and Aggregation: Grouping, filtering, and summarizing data. Application: Analyze machine run times, failure logs, or production efficiency.

Data Visualization with Matplotlib and Seaborn: Line plots, bar charts, histograms, box plots. Application: Visualize stress, strain graphs, sensor trends, or energy consumption.

UNIT - III:

Statistical Analysis and Engineering Insights

Descriptive Statistics: Mean, median, mode, standard deviation, variance.

Application: Analyze tolerance distribution, process variations.

Correlation and Regression Analysis: Perform and interpret linear regression.

Application: Predict thermal efficiency, or material behavior with respect to time/temp.

Hypothesis Testing: Perform t- tests and ANOVA. Application: Test impact of material changes on performance metrics.

UNIT - IV:

Applied Data Analytics

Sensor Data Analysis: Analyze timeseries data from IoT or sensor logs. Application: Predict motor failure or anomalies in temperature/humidity.

Real-time Data Dashboard (Optional with Jupyter/Streamlit): Build a basic data dashboard using Python tools. Application: Monitor lab machine metrics or simulate process control.

UNIT - V:

Mini Projects / Case Studies

Engineering Case Study – Predictive Maintenance: Analyze historical machine data to predict failure using regression/classification.

Energy Audit Data Analytics: Load and analyze power consumption data from equipment.

Optimization using Python (SciPy): Solve basic optimization problems (e.g., minimize cost, material use).

TEXT BOOKS:

1. Python for Data Analysis, Wes McKinney, O'Reilly Media, 3rd Edition,2022.
2. Think Python: How to Think Like a Computer Scientist, Allen B. Downey, Green Tea Press / O'Reilly Media, 2nd Edition, 2015.
3. Python Programming: An Introduction to Computer Science, John M. Zelle and Franklin,Beedle and Associates Inc.,3rd Edition,2016.
4. Data Analytics: Made Accessible, Anil Maheshwari, Amazon Digital Services / CreateSpace Independent Publishing, 1st Edition, 2014

ELECTRONIC RESOURCES:

1. <https://python-iitk.vlabs.ac.in/exp/built-in-functions/simulation.html>
2. <https://python-iitk.vlabs.ac.in/exp/loops/simulation.html>
3. <https://python-iitk.vlabs.ac.in/exp/built-in-modules/simulation.html>
4. <https://python-iitk.vlabs.ac.in/exp/file-operators/simulation.html>
5. <https://python-iitk.vlabs.ac.in/exp/strings/simulation.html>
6. https://onlinecourses.nptel.ac.in/noc21_cs45/preview

MATERIALS ONLINE:

1. Lab Manual
2. Open-ended experiments