Course Type	Course Code	Name of Course	L	T	P	Credit
DE	**NPED503**	**Introduction to Python and Petroleum Data Analysis**	3	0	0	3

Course Objective
The objective of this course is to provide the introductory knowledge of python and its applications to petroleum data analysis.
Learning Outcomes
Upon successful completion of this course, students will: • Learn implementation of python programming for petroleum data analysis. • Understand and implement various statistical methods for petroleum data analysis. • Implement advanced algorithms for executing some petroleum data related projects.

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
1.	**Overview of Application of Python and Data Analysis in Petroleum Engineering.**	3	Students will learn about relevance and importance of the course in petroleum engineering through examples.
2.	**Python Programming Fundamentals:** Environmental set up- Installation of Python and anaconda, Python packages, basics of data structures. Programming fundamentals (Data types (Immutable & Mutable), Operator types, loops, functions, conditions, objects, and classes)	5	This unit will provide the necessary understanding and tools for Python programming.
3.	**Implementation of Python libraries (PANDAS & NUMPY) & data visualization (Matplotlib):** **Introduction of Pandas and NUMPY** **Pandas:** Environment set up, PANDAS –series, data frame, read CSV, cleaning data, correlations, lotting, panel, basic functionality, descriptive statistics, function application, iteration, and sorting. **NUMPY**: Introduction and environment set up, data types, array, indexing & slicing, binary operators, string functions, mathematical functions, arithmetic operations, statistical functions, sort, search & counting functions, matrix library, linear algebra **Plotting in Python:** Installation of Matplotlib, Pyplot, plotting, markers, line, labels and title, grids, subplot, scatter, bar, histograms, pie-charts	7	This will help students to learn about implementation of python libraries (Pandas & NumPy) using various petroleum engineering data to manipulate according to the defined problem.
4.	**Data wrangling and preprocessing on reservoir/production/drilling data**: Understanding the concept of data wrangling using subsetting, filtering, and grouping, detecting outliers and handling missing values, concatenating, merging, and joining, useful methods of Pandas. Encoding categorical data, dataset splitting into test and training data, Feature scaling.	6	Students will get hands-on experience on data wrangling and preprocessing aspects of data science using the petroleum related examples.
5.	**Data manipulation:** Data cleaning, Data Preprocessing, Feature Engineering	5	This unit will be focused on data organization.
6.	**Algorithms and Application to Petroleum Data:** Supervised, Unsupervised and Reinforcement Learning	8	This unit will get hands on experience on application of various algorithms for Petroleum related problems.

7.	**Regression for Petroleum Engineering Applications:** Linear regression, multiple linear regression, logistics regression, decision tree, and KNN used for regression and classification. Overfitting and under fitting. Model selections.	8	This unit will help students to learn about different regression techniques.
Total Contact Hours:		**42**	

Text Book:

1. Python Data Science Handbook: Essential Tools for Working with Data by Jake VanderPlas , Publisher: O'Reilly Media; 1st edition.
2. Machine Learning Paperback – 1 July 2017 by Tom M. Mitchell (Author), Publisher : McGraw Hill Education; First edition

Reference Book:

1. Python for Everybody: Exploring Data in Python 3. By Dr Charles R. Severance., Publisher : Shroff Publishers; First edition
2. Machine Learning for Subsurface Characterization 1st Edition, Kindle Edition by Siddharth Misra, Hao Li, Jiabo He, Publisher: Gulf Professional Publishing; 1st edition
3. Applied Statistical Modeling and Data Analytics: A Practical Guide for the Petroleum Geosciences by Srikanta Mishra , Akhil Datta-Gupta, Publisher : Elsevier; 1st edition