COURSE TITLE	**PYTHON FOR CHEMICAL ENGINEERS**
COURSE CODE	**01CH0515**
COURSE CREDITS	**1**

Objective:

1 To equip students with hands-on skills in Python programming for solving fundamental and applied chemical engineering problems.

Course Outcomes: After completion of this course, student will be able to:

1 Apply Python programming constructs to chemical engineering calculations.
2 Analyze chemical engineering datasets using Python libraries.
3 Utilize regression and curve fitting techniques for modeling process data.
4 Assess the effectiveness of Python applications in solving chemical engineering problems.

Pre-requisite of course: Basic knowledge of chemical engineering principles, mathematics, and computer usage.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
0	0	2	0	0	0	50	50

Contents : Unit	Topics	Contact Hours
Total Hours		

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiment 1** Getting Started with Python: Installing Anaconda / Jupyter Notebook; Writing and running first Python script (print, simple arithmetic)	2
2	**Experiment 2** Understanding Variables and Data Types: Numbers, strings, lists, dictionaries; Chemical calculations (mole conversions, unit conversions)	2
3	**Experiment 3** Loops and Conditional Statements: for and while loops, if statements; Calculation of factorial, sum of series, basic process mass balance	2

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Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
4	**Experiment 4** Understanding Functions in Python: Defining and calling functions; Function writing to compute Reynolds number for fluid flow	2
5	**Experiment 5** File Handling: Reading/writing text files; Read a dataset of temperatures & pressures, calculate density.	2
6	**Experiment 6** NumPy Basics: Arrays, indexing, operations; Heat capacity data in array form, perform calculations	2
7	**Experiment 7** Curve Fitting & Regression: Using NumPy/Scipy for polynomial fit; Fit Antoine equation to vapor pressure data	2
8	**Experiment 8** Plotting with Matplotlib: Basic line/scatter plots, labels, legends; Plot viscosity vs. temperature data	2
9	**Experiment 9** Pandas for Data Handling: Data Frames- reading CSV/Excel files; Import experimental VLE dataset, clean and describe data	2
10	**Experiment 10** Using ChemPy and Periodic Table in Python: Perform stoichiometric calculations, equilibrium constants, and use periodic table data for chemical property look-up.	2
11	**Experiment 11** Working with External Datasets: Import a Kaggle dataset (e.g., air pollution, toxicological data), clean, analyze, and visualize trends relevant to chemical engineering.	2
12	**Experiment 12** Accessing thermodynamic properties; Calculate enthalpy and entropy of steam at different states	2
13	**Experiment 13** Using Python for heat exchanger design curve, adsorption isotherm fitting, and reactor kinetics	2
14	**Experiment 14** Chemical Process Visualization using Python: Combining multiple skills (data, ODEs, plotting); Simulate CSTR concentration vs. time and plot results	2
Total Hours		**28**

Textbook :

1 Python programming and numerical methods: A guide for engineers and scientists, Kong, Q., Siauw, T., & Bayen, A., Academic Press , 2020

References:

1 Chemical and biomedical engineering calculations using Python, Chemical and biomedical engineering calculations using Python, Heys, J. J. , Wiley & Sons., 2017

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Higher order Thinking / Creative**
0.00	0.00	35.00	35.00	30.00	0.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.

Supplementary Resources:

1 https://github.com/CAChemE/Python-Chemical-Engineers

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