Course Code:	017075601
Course Name:	**Advanced Python Programming**
Category of Course:	Open Elective Course (OEC)
Prerequisite Course:	Database Management System (017075502), Fundamentals of Python Programming (017072402), Probability and Statistics (017071301)

Teaching Scheme				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Total Hours
2	0	6	5	30

Syllabus				
Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	**Python Pandas** 1.1 Series, DataFrame, read_csv(), tail(), head(), info(), shape() 1.2 Cleaning Data -dropna(), fillna(), loc(), drop(), drop_duplicates() 1.3 Statistical Analysis -corr(), parallel_coordinates(), scatter_matrix(), describe() 1.4 Analyzing Qualitative v/s Quantitative Data -two-way cross tabulation 1.5 Detecting and Removing Outliers	---	---	4 (13%)
02	**Data Visualization with Python** 2.1 Basic Visualizations -Area Plots, Box Plots, Scatter Plots 2.2 Advanced Visualizations -Waffle Charts, Word Clouds, Regression Plots, Heatmaps 2.3 Geospatial Data with Folium -Maps with Markers, Choropleth Maps 2.4 Visualizing Graphs with Networkx	Simple Scatterplots with color, size and alpha (017072402-Unit-10) ---	---	2 (7%)
03	**Regular Expressions** 3.1 Metacharacters – [] \ . ^ \$ * + ? {} | Special Sequences -\d, \D, \s, \S, \w, \W Python re -findall(), search(), split(), sub()	---	---	2 (5%)
04	**Introduction to Machine Learning with Python** 4.1 What is Machine Learning?, Supervised Learning (Regression v/s Classification) and its applications 4.2 Data Cleaning/Pre-processing, Feature Engineering –Feature transformation and feature subset selection	---	---	1 (3%)
05	**Regression –Model Training and Evaluation** 5.1 Simple and Multiple Linear Regression and its Evaluation using r-squared 5.2 Polynomial Regression	---	---	3 (11%)
06	**Classification –Model Training and Evaluation** 6.1 kNN (k Nearest Neighbors) Algorithm, Decision Tree using Entropy 6.2 Evaluation of classification models using the confusion matrix	---	---	3 (11%)
07	**Introduction of TensorFlow** 7.1 Introduction to TensorFlow library and its capabilities, Installing TensorFlow and setting up the development environment 7.2 Basic TensorFlow operations: tensors, variables, and operations 7.3 Building and executing a simple TensorFlow graph	---	---	3 (12%)
08	**TensorFlow Basics** 8.1 Working with tensors: creation, manipulation, and slicing, Understanding TensorFlow data types and shapes 8.2 Implementing mathematical operations using TensorFlow 8.3 Introduction to TensorFlow's automatic differentiation and gradient descent 8.4 Hands-on exercises and coding assignments using TensorFlow	---	---	4 (13%)
09	**Web Programming using Python** 9.1 Parsing HTML and web scraping with Beautiful Soup 9.2 Application Programming Interface Demo with Python	---	---	4 (15%)
10	**Introduction to Deep Learning** 10.1 Deep Learning and its applications, Neural Network Implementation for Image Classification Using Tensorflow and Keras, Activation Functions -ReLU, Linear, Sigmoid, Softmax, Cross Entropy to calculate loss	---	---	4 (10%)

	10.2 Using Convolutional Neural Networks for Image Classification - kernels, convolutions, stride, padding, max pooling, dropout, implementation using Tensorflow and Keras	(017072402 -Unit -4)		

Major Components/ Equipment	
Sr. No.	**Component/Equipment**
1	Computer
2	Anaconda (Jupyter Notebook), Google Colab
3	VS Code

Proposed Theory + Practical Evaluation Scheme by Academicians (% Weightage Category Wise and it's Marks Distribution)					
L :	**2**	**T:**	**0**	**P:**	**6**

Note : In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.
Each Test will be of 25 Marks.
Each Test Syllabus Weightage: Range should be 20% - 30%

Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage
Theory			MCQ	16%	40
Theory	2		Theory Descriptive (Mainly Programming)	24%	60
Theory			Formulas and Derivation	0%	0
Theory			Numerical	0%	0
Expected Theory %	**40%**	5	**Calculated Theory %**	**40%**	**100**
Practical			Individual Project	0%	0
Practical			Group Project	42%	70
Practical	3		Internal Practical Evaluation (IPE)	18%	30
Practical			Viva	0%	0
Practical			Seminar	0%	0
Expected Practical %	**60%**		**Calculated Practical %**	**60%**	**100**
Overall %	**100%**			**100%**	**200**

Course Outcome	
1	Understand extracting, manipulating, and visualizing data to provide insightful real-world analysis
2	Learn machine learning algorithms, constructing models, and subsequently, training and evaluating them
3	Understand & Learn tensorflow basics for deep learning
4	Grasp the fundamentals of deep learning, alongside developing skills in web programming

Suggested Reference Books	
1	Pandas for Everyone by Daniel Y. Chen; Pearson Addison Wesley Data & Analytics Series
2	Python Data Visualization: An Easy Introduction to Data Visualization in Python with Matplotlib, Pandas, and Seaborn by Samuel Burns
3	Machine Learning by Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das
4	Python for Everybody -Exploring Data in Python3 by Charles Severance; Shroff Publishers
5	Deep Learning with Tensorflow by Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy

List of Open Source Software/Learning website	
1	Python for Everybody Specialization by University of Michigan, Coursera (https://www.coursera.org/specializations/python)
2	Data Visualization with Python by IBM, Coursera (https://www.coursera.org/learn/python-for-data-visualization)
3	Interactive Python Programming, Rice University, Coursera (https://www.coursera.org/learn/interactive-python-1, https://www.coursera.org/learn/interactive-python-2)
4	Machine Learning Specialization, DeepLearning.AI and Stanford University, Coursera (https://www.coursera.org/specializations/machine-learning-introduction)
5	Getting started with TensorFlow 2, Imperial College London, Coursera (https://www.coursera.org/learn/getting-started-with-tensor-flow2)
6	Meta Back-End Developer Professional Certificate, Coursera (https://www.coursera.org/professional-certificates/meta-back-end-developer)
7	Deep Learning by deeplearning.AI, Coursera (https://www.coursera.org/specializations/deep-learning)

Practical Project/Hands on Project		
Sr. No.	**Project List**	**Linked with Unit**
1	Create a GUI for the following program: A mini-game containing the following functions: ✓ a random function: to generate rock, paper, or scissors. ✓ valid function: to check the validity of the move. ✓ result function: to declare the winner of the round. ✓ scorekeeper: to keep track of the score. The program requires the user to make the first move before it makes one the move. Once the move is validated the input is evaluated, the input entered could be a string or an alphabet. After evaluating the input string a winner is decided by the result function and the score of the round is updated by the scorekeeper function.	All Units
2	Create a GUI for the following two player game of tic-tac-toe: Each player chooses their move and with O or X and marks their square one at each chance. The player who succeeds in making their marks all in one line whether diagonally, horizontally, or vertically wins. The challenge for the other player is to block the game for their opponent and also to make their chain.	All Units
3	A survey was conducted to gauge an audience interest in different data science topics, namely: Big Data (Spark / Hadoop) Data Analysis / Statistics Data Journalism Data Visualization Deep Learning Machine Learning The participants had three options for each topic: Very Interested, Somewhat interested, and Not interested. 2,233 respondents completed the survey. This is the CSV file of the survey results: https://cocl.us/datascience_survey_data Create a bar chart to visualize this data. To create this bar chart, you can follow the following steps: 1. Sort the dataframe in descending order of Very interested. 2. Convert the numbers into percentages of the total number of respondents. Recall that 2,233 respondents completed the survey. Round percentages to 2 decimal places. 3. use a figure size of (20, 8), 4. bar width of 0.8, 5. use color #5cb85c for the Very interested bars, color #5bc0de for the Somewhat interested bars, and color #d9534f for the Not interested bars, 6. use font size 14 for the bar labels, percentages, and legend, 7. use font size 16 for the title, and,display the percentages above the bars and remove the left, top, and right borders.	All Units
4	For this practical, use the following dataset: https://www.un.org/en/development/desa/population/migration/data/empirical2/migrationflows.asp Dataset: Immigration to Canada from 1980 to 2013 - International migration flows to and from selected countries - The 2015 revision from United Nation's website. The dataset contains annual data on the flows of international migrants as recorded by the countries of destination. The data presents both inflows and outflows according to the place of birth, citizenship or place of previous / next residence both for foreigners and nationals. In this lab, we will focus on the Canadian Immigration data. Create a box plot to visualize the distribution of the top 15 countries (based on total immigration) grouped by the decades 1980s, 1990s, and 2000s.	All Units
5	Using TensorFlow explore techniques for compressing and optimizing deep learning models to reduce their memory footprint and computational requirements, making them suitable for deployment on resource-constrained devices or edge devices.	All Units