

Government of Pakistan

National Vocational and Technical Training Commission

Prime Minister's Hunarmand Pakistan Program
"Skills for All"



Course Contents/ Lesson Plan

Course Title: Machine Learning & Deep Learning

Duration: 6 Months

Trainer Name	
Course Title	Artificial Intelligence (Machine Learning and Deep Learning)
Objective of Course	<p>Employable skills and hands on practice for Artificial Intelligence, including specialization in NLP or computer vision</p> <p>The aim for the team of staff responsible for delivery of the advanced IT curriculum is to provide knowledge and develop skills related to the IT. The course will allow participants to gain a comprehensive understanding of all the aspects. It will also develop the participant’s ability to act in a professional and responsible manner.</p> <p>Teaching staff will provide the technical knowledge and abilities required to solve tasks and problems that are goal-oriented. They will use participant-centered, practically oriented methods. They will also develop a program of practical assessment that reflects the learning outcomes stated in the curriculum. Trainees of the IT curriculum will also develop their willingness and ability as individuals to clarify issues, as well as think through and assess development opportunities.</p> <p>Teaching staff will also support trainees in developing characteristics such as self-reliance, reliability, responsibility, a sense of duty and a willingness and ability to criticize and accept criticism well and to adapt their future behavior accordingly.</p> <p>Teaching staff also use the IT curriculum to address the development of professional competence. Trainees will acquire the ability to work in a professional environment.</p> <p>By the end of this course, the trainees should gain the following competencies:</p> <ul style="list-style-type: none"> • Understanding of core concepts of artificial intelligence and machine learning • State of the art machine learning techniques • Hands-on exposure to exploratory data analysis • Practical exposure to model design, evaluation • Familiarity with tools and libraries such as scikit learn, pandas numpy, tensorflow, pytorch and keras

<p>Learning Outcome of the Course</p>	<p>After taking this course, you will be familiar with the fundamentals of Artificial Intelligence. You will gain practical experience in applying AI for problem solving, and will develop a deep understanding of the core concepts by implementing solutions to real world problems.</p> <p>By the end of this course, the trainees should gain the following competencies:</p> <ul style="list-style-type: none"> • Understanding of core concepts of artificial intelligence and machine learning • State of the art machine learning techniques • Hands-on exposure to exploratory data analysis • Practical exposure to model design, evaluation • Familiarity with tools and libraries such as scikit learn, pandas numpy, tensorflow, pytorch and keras <p>After the specialization in NLP, you will be comfortable using TensorFlow pipelines for NLP at the end of the course. Moreover,</p> <ul style="list-style-type: none"> • You will learn to build your own models which will extract information from textual data • You will learn text processing fundamentals, including text normalization, stemming and lemmatization • You will learn about different evaluation metrics for models trained for NLP tasks • You will learn about statistical language models like Hidden Markov Model (HMM) • You will learn to make a part of speech (POS) tagging model • You will learn about named entity recognition • You will learn advanced techniques including word embeddings, deep learning (DL) techniques. • You will learn how to deploy a NLP model
<p>Companies Offering Jobs in the respective trade</p>	<ol style="list-style-type: none"> 1. Careem 2. Afiniti 3. Addo.ai 4. Arbisoft 5. I2c 6. xavor 7. Fiverivers Technologies 8. confiz 9. Crossover 10. NetSol 11. Research institutes 12. All Private Institutes who have an ML department
<p>Course</p>	<p>Total Duration of Course: 6 Months (26 Weeks)</p>

Execution Plan	Class Hours: 4 Hours per day
	Theory: 20% Practical: 80%
	Weekly Hours: 20 Hours Per week
	Total Contact Hours: 520 Hours
Job Opportunities	<p>AI is the buzzword of the century, attracting attention across industries, motivating changes in products as well as services. It is the very nature of the subject that makes its applications infinite, in multiple domains. Whether you belong to a technical background or not, chances are that AI can make your job easier, and push it in the right direction. Dive in to develop an understanding of the core concepts, while gaining hands on experience and training from the industry's finest. Trained resources can find work as one of the following roles</p> <ul style="list-style-type: none"> • AI Associate Engineer • Machine Learning associate analyst • Assistant Data Analyst • Research Assistant
No of Students	20-24
Learning Place	Classroom / Lab
Instructional Resources	<p>Development Platform:</p> <ul style="list-style-type: none"> • https://github.com/, • https://www.anaconda.com/distribution/ • https://www.jetbrains.com/pycharm/ • https://jupyter.org/ <p>Frameworks and Libraries:</p> <ul style="list-style-type: none"> • https://www.tensorflow.org/ • http://keras.io/ • https://pytorch.org/ • https://caffe.berkeleyvision.org/ <p>Learning Material:</p> <ul style="list-style-type: none"> • https://www.kaggle.com/ • https://www.youtube.com/watch?v=UzxYlbK2c7E • https://www.youtube.com/watch?v=UzxYlbK2c7E&list=PLA89DCFA6ADACE599

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Scheduled Week	Module Title	Learning Units	Remarks
Week 1	➤ Introduction Basics of Python	<ul style="list-style-type: none"> • Motivational Lecture • Course Introduction • Success stories • Job market • Course Applications • Institute/work ethics • Introduction to Artificial Intelligence • A brief history of AI • AI terminology • State of the art techniques • Lab <ul style="list-style-type: none"> ○ Anaconda installation ○ Setting up environment and introducing Jupyter notebook ○ Introduction to Python ○ Setup/install python on windows ○ Write your name using print () function ○ Execute/run python operators ○ Basic mathematics function on Python 	Task No. 1 to 11 (Details may be seen in Annexure I)
Week 2	Conditional statement, Loops, Functions and string Handling	<ul style="list-style-type: none"> • Develop a program based on control structures (IF, IF ELSE, AND ELIF) • Develop program using loop structures • String Handling • Develop program using functions 	Task No. 12 to 21 (Details may be seen in Annexure I)
Week 3	Data types and their differences	<ul style="list-style-type: none"> • Develop program using list • Develop program using tuple • Develop program using dictionaries • Develop program using sets • Python exception handling 	Task No. 22 to 28 (Details may be seen in Annexure I)
Week 4	Introduction to NumPy Library	<ul style="list-style-type: none"> • Import and install Numpy • Creating Arrays • Numpy- Data types • Array Attributes • Array creation routine • Indexing and slicing • Arithmetic operations • Comparison operations • Copying arrays • Sorting arrays 	Task No. 29 to 41 (Details may be seen in Annexure I)
Week 5	Introduction to Pandas Library	<ul style="list-style-type: none"> • Pandas data structures (series & data frame) • Input & output operations using pandas • Selection operations 	Task No. 42 to 49 (Details may be seen in

		<ul style="list-style-type: none"> • Dropping • Sort & rank • Retrieving series/ dataframe information • Applying functions • Data alignment • Data preprocessing using pandas 	Annexure I)
Week 6	Graphical interpretation of data	<ul style="list-style-type: none"> • Import and install Matplotlib • Preparing the data • Creating the plot • Plotting routines • Customizing the plot • Saving the plot • Displaying the plot • Types of plots • Problem Representation <ul style="list-style-type: none"> ○ State Space ○ Vector • Knowledge Representation <ul style="list-style-type: none"> ○ Trees 	Task No. 50 to 63 (Details may be seen in Annexure I)
Week 7	Introduction to Machine learning	<ul style="list-style-type: none"> • Graphs • Search Strategies • Brute force search <ul style="list-style-type: none"> ○ Depth first search (https://www.programiz.com/dsa/graph-dfs) ○ Breadth first search (https://www.programiz.com/dsa/graph-bfs) • What is Data • What is Machine Learning • Getting started with Machine learning • Mean, Median & Mode • Standard Deviation • Variance • Percentile • Data distribution • Probability using python • Association Rule • Reinforcement learning 	Task No. 64 to 70 (Details may be seen in Annexure I)
Week 8	Supervised learning part 1	<ul style="list-style-type: none"> • Difference between classification and regression • Supervised vs. Unsupervised learning • Types of supervised learning • Regression () <ul style="list-style-type: none"> ○ Univariate linear regression 	Task No. 71 to 74 (Details may be seen in Annexure I)

		<ul style="list-style-type: none"> ○ Multivariate regression ● Polynomial regression(● Evaluation ● Train-Test split ● Validation 	
Week 9	Supervised learning part 2	<ol style="list-style-type: none"> 1. Logistic Regression () 2. Algorithms <ul style="list-style-type: none"> ○ KNN (https://www.geeksforgeeks.org/k-nearest-neighbor-algorithm-in-python/) ○ Naïve Bayes (https://heartbeat.fritz.ai/naive-bayes-classifier-in-python-using-scikit-learn-13c4deb83bcf) ○ Decision Trees 	Task No. 75 to 79 (Details may be seen in Annexure I)
Week 10	Clustering techniques in Machine learning	<ul style="list-style-type: none"> ○ SVM () ● Clustering <ul style="list-style-type: none"> ○ Classification vs. Clustering () ○ K-means Clustering () ○ Hierarchical Clustering () 	Task No. 80 to 83 (Details may be seen in Annexure I)
Week 11	Time series Analysis	<ul style="list-style-type: none"> ● Time Series Analysis (/) ● Hidden Markov Models () 	Task No. 84 to 85 (Details may be seen in Annexure I)
Week 12	Introduction to Neural network-I	<ul style="list-style-type: none"> ● Introduction to Neural Networks <ul style="list-style-type: none"> ○ MLP ○ Feed Forward neural networks 	Task No. 86 to 88 (Details may be seen in Annexure I)
Week 13	Introduction to Neural Network-II	<ul style="list-style-type: none"> ● Neural Networks () <ul style="list-style-type: none"> ○ Backpropagation ○ Activation Functions ○ Loss Function ○ Optimization 	Task No. 89 (Details may be seen in Annexure I)
Week 14	Dealing with Textual Data-I	<ul style="list-style-type: none"> ● Linguistics () <ul style="list-style-type: none"> ○ NLP ○ Syntax ○ Semantics ○ Pragmatics ○ Discourse ● Pandas, NLTK, WordNet ● Load text data 	Task No. 90 (Details may be seen in Annexure I)
Week 15	Mid-Term Assignment		

Week 16	Dealing with Textual Data-II	<ul style="list-style-type: none"> • Data know-how • Data statistics (categorical data) • Text Analysis • Similarity & distance • Text normalization • Text cleaning • Stemming & lemmatization • Vectorization • Pre-defined word embedding • Regular expression • Introduction to classification • https://medium.com/towards-artificial-intelligence/natural-language-processing-nlp-with-python-tutorial-for-beginners-1f54e610a1a0 	Task No. 91 and 92 (Details may be seen in Annexure I)
Week 17	Introduction to OpenCV-I	<ul style="list-style-type: none"> • Introduction to OpenCV • Image installation and importing basic functions of OpenCV • Display images in multiple modes • Capture videos using openCV • Playing video from file • Draw basic shapes using OpenCV <p>Face detection using OpenCV (optional)</p> <ul style="list-style-type: none"> • (https://towardsdatascience.com/face-detection-in-2-minutes-using-opencv-python-90f89d7c0f81) 	Task No. 93 to 95 (Details may be seen in Annexure I)
Week 18	Introduction to OpenCV-II	<ul style="list-style-type: none"> • Basic operations on images using openCV • Blend two different images • Change basic color spaces • Image Thresholding • Detect face with mask and without mask 	Task No. 96 to 100 (Details may be seen in Annexure I)
Week 19	Introduction to Deep Learning	<ul style="list-style-type: none"> • Introduction to Deep learning • What is Deep Learning • Before deep learning • What makes deep learning different? • Why deep learning Now? • Anatomy of Neural Network • A first look at neural network. 	Task No. 101 and 102 (Details may be seen in Annexure I)
Week 20	Chapter 18 TensorFlow	<ul style="list-style-type: none"> • Introduction to TensorFlow (https://www.edureka.co/blog/tensorflow-tutorial/) • What is Tensor Flow? • Scalar or (0) Dimension Tensor Flow • Vectors or 1 Dimension Tensorflow • Matrices or (2) Dimension Tensor Flow • Building basic computation graph • Running basic computational graph • Tensor Constant • Tensor Placeholder 	Task No. 103 (Details may be seen in Annexure I)

		<ul style="list-style-type: none"> • Tensor Variable 	
Week 21	<p>Employable Project/Assignment (6 weeks i.e. 21-26) in addition of regular classes.</p> <p>OR</p> <p>On job training (2 weeks)</p>	<ul style="list-style-type: none"> • Guidelines to the Trainees for selection of students employable project like final year project (FYP) • Assign Independent project to each Trainee • A project based on trainee’s aptitude and acquired skills. • Designed by keeping in view the emerging trends in the local market as well as across the globe. • The project idea may be based on Entrepreneur. • Leading to the successful employment. • The duration of the project will be 6 weeks • Ideas may be generated via different sites such as: <ul style="list-style-type: none"> https://1000projects.org/ https://nevonprojects.com/ https://www.freestudentprojects.com/ https://technofizi.net/best-computer-science-and-engineering-cse-project-topics-ideas-for-students/ • Final viva/assessment will be conducted on project assignments. • At the end of session the project will be presented in skills competition • The skill competition will be conducted on zonal, regional and National level. • The project will be presented in front of Industrialists for commercialization • The best business idea will be placed in NAVTTC business incubation center for commercialization. <p>-----</p> <p>OR</p> <p>On job training for 2 weeks:</p> <ul style="list-style-type: none"> • Aims to provide 2 weeks industrial training to the Trainees as part of overall training program • Ideal for the manufacturing trades • As an alternate to the projects that involve expensive equipment • Focuses on increasing Trainee’s motivation, productivity, efficiency and quick learning approach. 	
Week 22	<p>Introduction to Convolution Neural Network-I</p>	<ul style="list-style-type: none"> • How CNN works? • Introduction to Convolution Neural Network • How Convolution works? • How Rectified Linear Unit (ReLU) Function works? • How Pooling function works? 	<p>Task No. 104 to 108 (Details may be seen in Annexure I)</p>

Week 23	Introduction to Convolution Neural Network-II	<ul style="list-style-type: none"> • Perform CNN using Keras in Python on MNIST data set (https://www.datacamp.com/community/tutorials/convolutional-neural-networks-python) • Perform evaluation on model • Perform CNN on CIFAR-10 Dataset (https://www.analyticsvidhya.com/blog/2020/02/learn-image-classification-cnn-convolutional-neural-networks-3-datasets/) • Classification of Imagenette dataset using CNN in Python (Optional) • 	Task No. 109 and 110 (Details may be seen in Annexure I)
Week 24	Colorized photo using Deep learning	<ul style="list-style-type: none"> • Colorized photo using Deep learning (https://www.analyticsvidhya.com/blog/2017/02/6-deep-learning-applications-beginner-python/) • 	Task No. 112 (Details may be seen in Annexure I)
Week 25	Chatbot and Text to speech conversion	<ul style="list-style-type: none"> • Building chat bot • Text to speech conversion 	Task No. 113 (Details may be seen in Annexure I)
Week 26	Entrepreneurship and Final Assessment in project	<ul style="list-style-type: none"> • Build your CV • Job Market Searching • Self-employment • Freelancing sites • Introduction • Fundamentals of Business Development • Entrepreneurship • Startup Funding • Business Incubation and Acceleration • Business Value Statement • Business Model Canvas • Sales and Marketing Strategies • How to Reach Customers and Engage CxOs • Stakeholders Power Grid • RACI Model, SWOT Analysis, PEST Analysis • SMART Objectives • OKRs • Cost Management (OPEX, CAPEX, ROCE etc.) • Final Assessment 	Task No. 114

Task No.	Task	Description	Week
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1.	Task 1	How to download and install Anaconda package.	Week 1
2.	Task 2	Installation of Jupyter notebook	Week 1
3.	Task 3	Task-I: <code>print "Hello, Python!"</code>	Week 1
4.	Add Two Numbers	<p>Task-II: Add Two Numbers</p> <pre># This program adds two numbers num1 = 1.5 num2 = 6.3 # Add two numbers sum = num1 + num2 # Display the sum print('The sum of {0} and {1} is {2}'.format(num1, num2, sum))</pre>	Week 1
5.	Add Two Numbers With User Input	<p>Task-III: Add Two Numbers With User Input</p> <pre># Store input numbers num1 = input('Enter first number: ') num2 = input('Enter second number: ') # Add two numbers sum = float(num1) + float(num2) # Display the sum print('The sum of {0} and {1} is {2}'.format(num1, num2, sum))</pre>	Week 1
6.	Understand Programs	<p>Find Square root For positive numbers</p> <pre># Python Program to calculate the square root # Note: change this value for a different result num = 8 # To take the input from the user #num = float(input('Enter a number: ')) num_sqrt = num ** 0.5</pre>	Week 1

		<pre>print('The square root of %0.3f is %0.3f'%(num ,num_sqrt))</pre>	
7.	Understand Programs	<pre>Find square root for real or complex numbers # Find square root of real or complex numbers # Importing the complex math module import cmath num = 1+2j # To take input from the user #num = eval(input('Enter a number: ')) num_sqrt = cmath.sqrt(num) print('The square root of {0} is {1:0.3f}+{2:0.3f}j'.format(num ,num_sqrt.real,num_sqrt.imag))</pre>	Week 1
8.	Understand Programs	<pre>Python Program to Convert Celsius To Fahrenheit # Python Program to convert temperature in celsius to fahrenheit # change this value for a different result celsius = 37.5 # calculate fahrenheit fahrenheit = (celsius * 1.8) + 32 print('%0.1f degree Celsius is equal to %0.1f degree Fahrenheit' %(celsius,fahrenheit))</pre>	Week 1
9.	Illustrate programs	<pre>Area of Triangle # Python Program to find the area of triangle a = 5 b = 6 c = 7 # Uncomment below to take inputs from the user # a = float(input('Enter first side: ')) # b = float(input('Enter second side: '))</pre>	Week 1

		<pre># c = float(input('Enter third side: ')) # calculate the semi-perimeter s = (a + b + c) / 2 # calculate the area area = (s*(s-a)*(s-b)*(s-c)) ** 0.5 print('The area of the triangle is %0.2f' %area)</pre>	
10.	Illustrate programs	<p>Solve basic quadratic equation</p> <pre># Solve the quadratic equation ax**2 + bx + c = 0 # import complex math module import cmath a = 1 b = 5 c = 6 # calculate the discriminant d = (b**2) - (4*a*c) # find two solutions sol1 = (-b-cmath.sqrt(d))/(2*a) sol2 = (-b+cmath.sqrt(d))/(2*a) print('The solution are {0} and {1}'.format(sol1,sol2))</pre>	Week 1
11.	Illustrate programs	<p>Convert Kilometers into Miles</p> <pre># Taking kilometers input from the user kilometers = float(input("Enter value in kilometers: ")) # conversion factor conv_fac = 0.621371 # calculate miles miles = kilometers * conv_fac print('%0.2f kilometers is equal to %0.2f miles')</pre>	Week 1

		<code>%(kilometers,miles))</code>	
12.	Illustrate programs	<code>i = 10 if (i > 15): print ("10 is less than 15") print ("I am Not in if")</code>	Week 2
13.	Illustrate programs	<code>i = 20; if (i < 15): print ("i is smaller than 15") print ("i'm in if Block") else: print ("i is greater than 15") print ("i'm in else Block") print ("i'm not in if and not in else Block")</code>	Week 2
14.	Illustrate programs	<code># python program to illustrate nested If statement #!/usr/bin/python i = 10 if (i == 10): # First if statement if (i < 15): print ("i is smaller than 15") # Nested - if statement # Will only be executed if statement above # it is true if (i < 12): print ("i is smaller than 12 too") else: print ("i is greater than 15")</code>	Week 2
15.	Illustrate programs	<code># Python program to illustrate if-elif-else ladder #!/usr/bin/python i = 20 if (i == 10): print ("i is 10") elif (i == 15): print ("i is 15") elif (i == 20): print ("i is 20") else: print ("i is not present")</code>	Week-2
16.	For loops in Python	Exercise on for loops in Python: https://www.geeksforgeeks.org/python-for-loops/	Week 2
17.	While loops in Python	Exercise on While loops in Python: https://www.geeksforgeeks.org/python-while-loops/	Week 2
18.	Break statement in Python	Exercise on Break statement in Python: https://www.geeksforgeeks.org/python-break-statement/	Week 2
19.	Continue statement in	Exercise on Continue statement in Python:	Week 2

	Python	https://www.geeksforgeeks.org/python-continue-statement/	
20.	looping techniques in Python	Exercise on various looping techniques in Python: https://www.geeksforgeeks.org/looping-techniques-python/	Week 2
21.	User defined functions in Python	Exercise on User defined functions in Python: https://www.geeksforgeeks.org/functions-in-python/	Week 2
22.	List data type in Python	Exercise on List data type in Python: https://www.programiz.com/python-programming/list	Week 3
23.	Tuple data type in Python	Exercise on Tuple data type in Python: https://www.programiz.com/python-programming/tuple	Week 3
24.	String data type in Python	Exercise on String data type in Python: https://www.programiz.com/python-programming/string	Week 3
25.	Set data type in Python	Exercise on Set data type in Python: https://www.programiz.com/python-programming/set	Week 3
26.	Dictionary data type in Python	Exercise on Dictionary data type in Python: https://www.programiz.com/python-programming/dictionary	Week 3
27.	Exception Handling in Python	Exercise on Exception Handling in Python: https://www.programiz.com/python-programming/exception-handling	Week 3
28.	Exception Handling in Python	Exercise on User defined Exception Handling in Python: https://www.programiz.com/python-programming/user-defined-exception	Week 3
29.	Creating Arrays in Numpy	Exercise on Numpy create Array Using Python: https://www.w3schools.com/python/numpy_creating_arrays.asp	Week 4
30.	Numpy Indexing in Array	Exercise on Numpy Indexing in Array Using Python: https://www.w3schools.com/python/numpy_array_indexing.asp	Week 4
31.	Numpy Slicing in Array	Exercise on Numpy Slicing in Array Using Python: https://www.w3schools.com/python/numpy_array_slicing.asp	Week 4
32.	Numpy Slicing in Array	Exercise on Numpy Slicing in Array Using Python: https://www.w3schools.com/python/numpy_data_types.asp	Week 4
33.	Numpy Arrays	Exercise on Numpy Array coping and viewing : https://www.w3schools.com/python/numpy_copy_vs_view.asp	Week 4
34.	Numpy Array Shaping	Exercise on Numpy Array Shaping : https://www.w3schools.com/python/numpy_array_shape.asp	Week 4
35.	Numpy Array reshaping	Exercise on Numpy Array reshaping : https://www.w3schools.com/python/numpy_array_reshape.asp	Week 4
36.	Numpy Array iteration	Exercise on Numpy Array iteration: https://www.w3schools.com/python/numpy_array_iterating.asp	Week 4
37.	Numpy Matrix joining	Exercise on Numpy Matrix joining https://www.w3schools.com/python/numpy_array_join	Week 4

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38.	Numpy splitting	Array	Exercise on Numpy Array splitting https://www.w3schools.com/python/numpy_array_split.asp	Week 4
39.	Numpy searching	Array	Exercise on Numpy Array searching https://www.w3schools.com/python/numpy_array_search.asp	Week 4
40.	Numpy sorting	Array	Exercise on Numpy Array sorting https://www.w3schools.com/python/numpy_array_sort.asp	Week 4
41.	Numpy Array Random technique		Exercise on Numpy Array Random technique https://www.w3schools.com/python/numpy_random.asp	Week 4
42.	Pandas basics		Exercise on Pandas basics: https://www.w3schools.com/python/pandas_tutorial.asp	Week 5
43.	Pandas installation		Exercise on Pandas installation: https://www.w3schools.com/python/pandas_getting_started.asp	Week 5
44.	Pandas Series data		Exercise on Pandas Series data https://www.w3schools.com/python/pandas_series.asp	Week 5
45.	Pandas Data Frame		Exercise on Pandas Data Frame: https://www.w3schools.com/python/pandas_dataframe.asp	Week 5
46.	Use Pandas		Exercise on Pandas Open CSV files: https://www.w3schools.com/python/pandas_csv.asp	Week 5
47.	Pandas analyzation	Data	Exercise on Pandas Data analyzation: https://www.w3schools.com/python/pandas_analyzing.asp	Week 5
48.	Pandas Data Cleaning techniques:		Exercise on Pandas Data Cleaning techniques: https://www.w3schools.com/python/pandas_cleaning.asp	Week 5
49.	Pandas Correlation	Data	Exercise on Pandas Data Correlation: https://www.w3schools.com/python/pandas_correlations.asp	Week 5
50.	Matplotlib introduction	Basic	Exercise on Matplotlib Basic introduction: https://www.w3schools.com/python/matplotlib_intro.asp	Week 6
51.	Matplotlib functions	Basic	Exercise on Matplotlib Basic functions and installation: https://www.w3schools.com/python/matplotlib_getting_started.asp	Week 6
52.	Matplotlib Pyplot		Exercise on Matplotlib Pyplot: https://www.w3schools.com/python/matplotlib_pyplot.asp	Week 6
53.	Matplotlib Plotting	Data	Exercise on Matplotlib Data Plotting: https://www.w3schools.com/python/matplotlib_plotting.asp	Week 6
54.	Matplotlib formatting	Markers	Exercise on Matplotlib Markers formatting: https://www.w3schools.com/python/matplotlib_markers.asp	Week 6
55.	Matplotlib Formating	Line	Exercise on Matplotlib Line Formating: https://www.w3schools.com/python/matplotlib_line.asp	Week 6
56.	Use Matplotlib		Exercise on Matplotlib Plots Labeling: https://www.w3schools.com/python/matplotlib_label	

		s.asp	Week 6
57.	Use Matplotlib	Exercise on Matplotlib Plots Grid: https://www.w3schools.com/python/matplotlib_grid.asp	Week 6
58.	Use Matplotlib	Exercise on Matplotlib Subplotting techniques: https://www.w3schools.com/python/matplotlib_subplots.asp	Week 6
59.	Use Matplotlib	Exercise on Matplotlib Scatter plot: https://www.w3schools.com/python/matplotlib_scatter.asp	Week 6
60.	Use Matplotlib	Exercise on Matplotlib Bar Plots: https://www.w3schools.com/python/matplotlib_bars.asp	Week 6
61.	Use Matplotlib	Exercise on Matplotlib Histogram plot: https://www.w3schools.com/python/matplotlib_histograms.asp	Week 6
62.	Use Matplotlib	Exercise on Matplotlib Pie chart plot: https://www.w3schools.com/python/matplotlib_pie_charts.asp	Week 6
63.	Develop basic Concepts on ML	Get concepts on: https://www.oreilly.com/library/view/machine-learning-with/9781491989371/ch01.html	Week 6
64.	Search Techniques	Perform search Techniques: (https://www.programiz.com/dsa/graph-dfs)	Week 7
65.	Search Techniques	Perform search Techniques: (https://www.programiz.com/dsa/graph-bfs)	Week 7
66.	Steps In Machine Learning	Basic steps for Machine learning: https://www.w3schools.com/python/python_ml_getting_started.asp	Week 7
67.	Mean, Midian and Mode	Perform Mean, Midian and mode: https://www.w3schools.com/python/python_ml_mean_median_mode.asp	Week 7
68.	Standard Deviation	Perform Standard Deviation: https://www.w3schools.com/python/python_ml_standard_deviation.asp	Week 7
69.	Apply Probabilistic Models	Perform Basic probability in python: https://www.datacamp.com/community/tutorials/statistics-python-tutorial-probability-1	Week 7
70.	Understand Different Data Distributions	Develop concept of various data distributions https://www.datacamp.com/community/tutorials/probability-distributions-python	Week 7
71.	Supervised vs Unsupervised Learning	Develop concept of difference b/w supervised and unsupervised ML: https://www.guru99.com/supervised-vs-unsupervised-learning.html	Week 8
72.	Supervised Machine Learning	Develop concept on supervised ML: https://www.upgrad.com/blog/types-of-supervised-learning/	Week 8
73.	Perform Linear Regression	Linear Regression: https://stackabuse.com/linear-regression-in-python-with-scikit-learn/	Week 8
74.	Perform Polynomial	Polynomial Regression:	Week 8

	Regression	https://www.geeksforgeeks.org/python-implementation-of-polynomial-regression/)	
75.	Perform Logistics Regression	Perform Logistics Regression: https://www.datacamp.com/community/tutorials/understanding-logistic-regression-python	Week 9
76.	Perform Logistics Regression	Perform Logistics Regression: https://towardsdatascience.com/logistic-regression-using-python-sklearn-numpy-mnist-handwriting-recognition-matplotlib-a6b31e2b166a https://www.datacamp.com/community/tutorials/understanding-logistic-regression-python	Week 9
77.	Use KNN	Exercise on KNN: https://www.geeksforgeeks.org/k-nearest-neighbor-algorithm-in-python/	Week 9
78.	Apply Naïve bayes Algorithm	Exercise on Naïve Bayes: https://towardsdatascience.com/implementing-naive-bayes-in-2-minutes-with-python-3ecd78803fe)	Week 9
79.	Use Decision Tree	Exercise on Decision Tree: https://www.datacamp.com/community/tutorials/decision-tree-classification-python	Week 9
80.	Perform SVM	Exercise on SVM: https://stackabuse.com/implementing-svm-and-kernel-svm-with-pythons-scikit-learn/	Week 10
81.	Classification vs Clustering	Differentiate between Clustering and Classification https://techdifferences.com/difference-between-classification-and-clustering.html	Week 10
82.	Perform K-Means Clustering	Exercise on K-Means Clustering: https://jakevdp.github.io/PythonDataScienceHandbook/05.11-k-means.html	Week 10
83.	Perform Hierarchical Clustering	Exercise on Hierarchical Clustering: https://www.askpython.com/python/examples/hierarchical-clustering	Week 10
84.	Perform Time Series Analysis	Exercise on Time Series Analysis: https://www.dataquest.io/blog/tutorial-time-series-analysis-with-pandas	Week 11
85.	Perform an Example on Hidden Markov Model	Exercise on Hidden Markov Model: https://www.tutorialspoint.com/artificial_intelligence_with_python/artificial_intelligence_with_python_analyzing_time_series_data.htm	Week 11
86.	Demonstrate Neural Networks	Demonstration of Neural Networks: https://www.analyticsvidhya.com/blog/2020/07/neural-networks-from-scratch-in-python-and-r/	Week 12
87.	Perform an Example on NLP	Exercise on MLP:	Week 12

			https://machinelearningmastery.com/neural-networks-crash-course/	
88.	Perform an Example on Feed Forward Neural Networks		Exercise on Feed Forward neural networks: https://builtin.com/data-science/feedforward-neural-network-intro	Week 12
89.	Perform an Example on Neural Networks		Exercise on Neural Network: https://www.analyticsvidhya.com/blog/2019/08/detailed-guide-7-loss-functions-machine-learning-python-code/	Week 13
90.	Perform an Example on Linguistics		Exercise on Linguistics using Machine learning in python: https://medium.com/towards-artificial-intelligence/natural-language-processing-nlp-with-python-tutorial-for-beginners-1f54e610a1a0	Week 14
91.	Perform Text Processing		Text processing: https://pythonspot.com/category/nltk/	Week 16
92.	Perform Text Analysis		Text Analysis https://medium.com/towards-artificial-intelligence/natural-language-processing-nlp-with-python-tutorial-for-beginners-1f54e610a1a0	Week 16
93.	Perform basic operations on images using OpenCV		Basic operation on images using OpenCV: https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_gui/py_image_display/py_image_display.html#display-image	Week 17
94.	Perform basic operations on videos using OpenCV		Basic operations on videos using OpenCV: https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_gui/py_video_display/py_video_display.html	Week 17
95.	Draw basic shapes using OpenCV		Draw basic shapes using OpenCV: https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_gui/py_drawing_functions/py_drawing_functions.html	Week 17
96.	Perform basic operations on images		Basic operations on images using openCV (https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_core/py_basic_ops/py_basic_ops.html#basic-ops)	Week 18
97.	Blend Images		Blend two different images https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_core/py_i	Week 18

		image arithmetics/py image arithmetics.html	
98.	Change basic color space	Change basic color space: https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_colorspaces/py_colorspaces.html	Week 18
99.	Perform Image Thresholding	Image thresholding: https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_thresholding/py_thresholding.html	Week 18
100.	Detect a face with mask and without mask	Detect face with mask and without mask: https://www.youtube.com/watch?v=csYkGeJ5bCM	Week 18
101.	Introduction to Deep Learning	Intro to Deep Learning: https://www.youtube.com/watch?v=6M5VXKLf4D4	Week 19
102.	Introduction to Neural Network	Intro to Neural network: https://towardsdatascience.com/a-gentle-introduction-to-neural-networks-series-part-1-2b90b87795bc#:~:text=A%20feedforward%20neural%20network%20is,or%20loops%20in%20the%20network.	Week 19
103.	Use Tensor Flow Library	Exercise on Introduction to TensorFlow Library: https://www.edureka.co/blog/tensorflow-tutorial/	Week 20
104.	Introduction to Convolution Neural Network	Demonstrate Convolution Neural Network: https://towardsdatascience.com/a-comprehensive-guide-to-convolutional-neural-networks-the-eli5-way-3bd2b1164a53	Week 22
105.	Perform Padding	How to perform Padding: https://www.youtube.com/watch?v=smHa2442Ah4&list=PLkDaE6sCZn6GI29AoE31iwdVwSG-KnDzF&index=4	Week 22
106.	Working of Stride	How Stride works: https://www.youtube.com/watch?v=tQYZaDn_kSg&list=PLkDaE6sCZn6GI29AoE31iwdVwSG-KnDzF&index=5	Week 22
107.	Working of Pooling functions	How Pooling layer works: https://www.youtube.com/watch?v=8oOgPUO-TBY&list=PLkDaE6sCZn6GI29AoE31iwdVwSG-KnDzF&index=9	Week 22
108.	Working of ReLU function	How ReLU function works: https://www.youtube.com/watch?v=9vB5nZrL4hY	Week 22
109.	Perform CNN using Keras in	Perform CNN using Keras in Python on MNIST data set: https://www.datacamp.com/community/tutorials/convolut	Week23

	Python	ional-neural-networks-python	
110.	Perform CNN on CIFAR-10 Dataset	Perform CNN on CIFAR-10 Dataset (https://www.analyticsvidhya.com/blog/2020/02/learn-image-classification-cnn-convolutional-neural-networks-3-datasets/)	Week 23
111.	Produce Colored Photo	Colorized photo using Deep learning (https://www.analyticsvidhya.com/blog/2017/02/6-deep-learning-applications-beginner-python/)	Week 24
112.	Build Chatbot	Building of chat bot: https://www.youtube.com/watch?v=FFT4p6me2g0	Week 25
113.	Convert Text to Speech	Text to speech conversion: https://www.geeksforgeeks.org/convert-text-speech-python/	Week 25
114.	Build your CV	Download professional CV template from any good site (https://www.coolfreecv.com or relevant) <ul style="list-style-type: none"> • Add Personal Information • Add Educational details • Add Experience/Portfolio Add contact details/profile links	
115.	Create an account profile on Fiverr (at least two gigs) and Upwork	Create an account by following these steps: Step 1: Personal Info Step 2: Professional Info Step 3: Linked Accounts Step 4: Account Security Step 5: Sort out top freelancers and study their profile. Step 6: Update your profile following the style of shortlisted profiles.	

List of Machinery / Equipment

Sr. No	Name of item as per curriculum	Quantity physically available at the training location
1	Computers Minimum Corei5 <ul style="list-style-type: none"> • LCD Display 17" with built in speakers 	25
2	Mobiles with Android OS	25
3	DSL Internet Connection (Minimum 1 MB)	Available on every PC
4	Accessories/Devices <ul style="list-style-type: none"> • Connectors • Multimedia • Printer (NW printer) • Audio/visual aid • White Board • Pin Board • Flip Chart Board • Hard copy of Training Material • Mobile Phones 	25 each
5	Wires, data cables, power plugs, power supply	For every PC
6	UPS	Available
7	Generator / Solar Backup	Available
8	Air Conditioner (2 Tons)	Available

Software List

Sr. No	Software Name
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1.	Google chrome
2.	Anaconda
3.	Jupyter notebook
4.	Python
5.	Pycharm.

Minimum Qualification of Teachers / Instructor

The qualification of teachers / instructor of this course should be minimum of **bachelors in Computer science with minimum 3 years of development experience** in relevant trade.

- Bachelors of Computers Science / Computer Engineering / Electrical Engineering (Hons)

Supportive Notes

Teaching Learning Material

Books Name	Author
Introduction to Machine Learning with Python: A Guide for Data Scientists	Book by Andreas Muller
Introduction to data mining	by Tan, Steinbach & Kumar
Data Mining: The Textbook	by Aggarwal
Introduction to Machine Learning with Python: A Guide for Data Scientists	Book by Andreas Muller
Python code for Artificial Intelligence: Foundations of Computational Agents	David L. Poole and Alan K. Mackworth
NLP at work	Sue Knight

Online Material:

FukatSoft Online Learning System

Stanford Lectures on Deep Learning

Machine Learning by Andrew Ng