**AI Using Python Duration:6 Months**

**Python**

* **Introduction To Python**
  + Why Python
  + Application Areas of Python
  + Features and Limitations of Python
  + Python Software Foundation
  + Python Implementations
    - Cpython
    - Jython
    - IronPython
    - PyPy
  + Python Versions
  + Installing Python
  + Python Interpreter Architecture
    - Python Byte Code Compiler
    - Python Virtual Machine(PVM)
* **Writing and Executing First Python Program**
  + Using Interactive Mode
  + Using Script Mode
    - General Text Editor and Command Window
    - IDLE Editor and IDLE Shell
  + Understanding print() function
  + How to compile python program explicitly
* **Python Language Fundamentals**
  + Character Set
  + Keywords
  + Identifiers
  + Comments
  + Variables
  + Literals
  + Operators
  + Reading input from console
  + Parsing String to int , float
* **Python Conditional Statements**
  + If Statement
  + If else Statement
  + If elif Statement
  + If elif else Statement
  + Nested If Statement
  + Practice Questions
* **Looping Statements**
  + While Loop
  + While else
  + For Loop
  + For else
  + Nested Loops
  + Pass ,Break and Continue keywords
  + Pattern printing
  + Practice Questions
* **Standard Data Types** 
  + int , float , complex
  + bool , NoneType
  + str , list , tuple
  + bytes , bytearray , range
  + dict , set , frozenset
* **String Handling**
  + What is string
  + String representations
  + Unicode String
  + String Functions, Methods
  + String Repetition and concatenation
  + String Indexing and Slicing
  + String Formatting
  + Practice Questions
* **Python List**
  + Creating and Accessing Lists
  + Indexing and Slicing Lists
  + List Methods
  + Nested Lists
  + Shallow v/s Deep Copy
  + List Comprehension
  + List as Stack
  + List as Queue
  + Practice Questions
* **Python Tuple**
  + Creating Tuple
  + Accessing Tuple
  + Immutability of tuple
  + Tuple to list
  + List to tuple
  + Practice Questions
* **Python Set**
  + How to create a set
  + Iteration Over Sets
  + Python Set Methods
  + Union ,intersection ,difference of sets
  + List, tuple to set
  + Set to list and tuple
  + Python Frozenset
  + Practice Questions
* **Python Dictionary**
  + Creating a Dictionary
  + Dictionary Methods
  + Accessing values from Dictionary
  + Updating dictionary
  + Iterating dictionary
  + Nested Dictionaries
  + Dictionary Comprehension
  + Practice Questions
* **Python Functions**
  + Defining a Function
  + Calling a Function
  + Types of Functions
  + Function v/s Method
  + Function Arguments
    - Positional arguments , Keyword arguments ,
    - Default arguments , Non default arguments ,
    - Arbitrary arguments ,Keyword Arbitrary arguments
  + Function Return Statement
  + Nested Function
  + Function as argument
  + Function as return statement
  + Decorator function
  + Closure
  + map(),filter() ,reduce(),any() functions
  + Anonymous or lambda Function
  + Practice Questions
* **Namespaces & Scopes**
  + Why Namespaces
  + Types of Namespaces
  + Scopes
  + Types of Scopes
    - built-in & global
    - enclosed & local
* **Modules & Packages**
  + Why Modules
  + Script v/s Module
  + Importing Module
  + Reloading of module
  + Understanding PYTHONPATH Variable
  + Commonly Used Library Modules
    - random , math , os , sys , builtins , etc
  + Why Packages
  + Understanding \_\_init\_\_.py file
  + Understanding pip utility
* **File I/O**
  + Why File Handling
  + File Pointer/Cursor
  + Buffering of Data
  + File modes
  + Functions and methods related to File Handling
  + Understanding with block
  + Working with directories
* **Object Oriented Programming**
  + Procedural v/s Object Oriented Programming
  + OOP Principles
  + Defining a Class & Object Creation
  + Attributes
    - Data attributes
      * Instance data
      * Class or static data
    - Methods
      * Instance methods
      * Class methods (@classmethod decorator)
      * Static methods (@staticmethod decorator)
  + Inheritance
    - Single & Multi-level
    - Multiple & Hybrid
    - Hierarchical
  + Object class and it’s methods
  + Super() method
  + Private data
  + Encapsulation
    - Getter and setter methods
    - Property() function
    - @property decorator
  + Polymorphism
    - Method overloading….is really supported?
    - Method overriding
    - Operator overloading and overriding
  + Abstraction
    - Abstract Base Class(ABC)
    - @abstractmethod decorator
  + Garbage Collection
  + Iterator & Generator
* **Exception Handling**
  + Difference Between Syntax Errors and Exceptions
  + Keywords used in Exception Handling
    - try , except , finally , raise , assert
  + Types of Except Blocks
    - Except block to handle specific Exception
    - Except block to handle multiple Exceptions
    - Except block to handle Parent Exception
    - Default except block
  + User-defined Exceptions
* **Python Database Connectivity**
  + Introduction to Databases
  + Installing MySQL Server
  + Understanding basic SQL Statements
  + Database Drivers and connectors
  + Creating connection object
  + Understanding cursor object
  + Executing SQL statements using cursor
  + Fetching records from cursor
  + Transactions
  + Storing and retrieving Date and Time
* **GUI Programming**
  + Introduction to Tkinter Programming
  + Tkinter Widgets
    - Tk , Label , Entry , TextBox , Buttons
    - Frame , messagebox , filedialogetc
  + Layout Managers
  + Event handling
  + Displaying image
  + Class based window
  + Window navigation
* **Multi-Threading Programming**
  + Multi-processingv/sMulti-threading
  + Need of threads
  + Understanding main thread
  + Creating child threads
  + Defining threads
    - Using function
    - Using method (class based)
  + Functions /methods related to threads
  + Thread synchronization and locking
* **Socket Programming**
  + Inter-process communication
  + Sockets
  + Functions/methods related to sockets
  + Getting IP Address
  + Multi-threaded Server and Client
* **Regular Expressions(Regex)**
  + Need of regular Expressions
  + re module
  + Functions /Methods related to regex
  + Meta Characters & Special Sequences
* **Projects**
  + Top N Words in a Text File
  + Restaurant Billing Automation
  + Bank Account Automation
  + You tube Video Downloader
  + Expense Tracker

Statistics:

* Statistics definition
* Sample and Population
* Mean , Mode , Median
* Standard deviation and Variance
* Probability Theory

Data Analysis:

* **Installing Anaconda** 
  + Jupyter lab
  + Kernel
  + Understanding User Interfacing
* **Numpy Package**
  + Difference between list and numpy array
  + Vector and Matrix operations
  + Array indexing and slicing
* **Pandas Package**
  + Series and DataFrame Objects
  + Exploratory Data Analysis (EDA)
  + Understanding loc and iloc
  + Groupby(),map(),apply()
  + Handling missing values
  + Handling duplicacy
  + Handling Categorical data
  + Label and One Hot Encoding
  + Handling Date and Time
* **Data Visualization using matplotlib and seaborn packages**
  + Scatter plot, lineplot, bar plot
  + Histogram, pie chart, etc**.**

**Machine Learning:**

* **Introduction To Machine Learning**
  + Traditional v/s Machine Learning Programming
  + Real life examples based on ML
  + Steps of ML Programming
  + Data Preprocessing revised
  + Data Transformation /Scaling
    - MinMaxScalar
    - MaxAbsScalar
    - StandardScalar
    - Binarizer
* **Types of ML**
  + Supervised Learning
    - Classification
    - Regression
  + Unsupervised Learning
    - clustering
  + Reinforcement Learning
* **Terminology Related To ML**
  + Attributes ,Features ,Target ,Instances
  + Sklearn package
  + Algorithms, Model
  + Train Set, Validation Set, Test Set
* **KNN Classification** 
  + Math behind KNN
  + KNN implementation
  + Understanding hyper parameters
* **Performance metrics for classification**
  + Confusion Matrix
  + Accuracy Score
  + Recall & Precision
  + F-1 Score
  + AUC ,ROC
* **Regression**
  + Math behind Regression
  + Simple Linear Regression
  + Multiple Linear Regression
  + Polynomial Regression
  + Boston Price Prediction
  + Cost or Loss Functions
    - Mean absolute error
    - Mean squared error
    - Root mean squared error
    - Least Square Error
  + Regularization
    - Ridge Regression
    - Lasso Regression
* **Performance metrics for regression**
  + R2 Score
  + Adjusted R2 Score
* **Bias and Variance Trade-Off**
  + Overfitting
  + Underfitting
  + Best Fit
* **Logistic Regression for classification**
  + Theory of Logistic Regression
  + Binary and Multiclass classification
  + Implementing titanic dataset
  + Implementing iris dataset
  + Sigmoid and softmax functions
  + solver,C parameter,max\_iter
  + Cross Entropy Loss
* **Support Vector Machines**
  + Theory of SVM
  + SVM Implementation
  + kernel,gamma,alpha
  + Hinge Loss
* **Decision Tree Classification**
  + Theory of Decision Tree
  + Node Splitting
  + Implementation with iris dataset
  + Visualizing Tree
  + max\_features , max\_depth
  + min\_sample\_leaf , min\_sample\_split
* **Ensemble Learning**
  + Random Forest
  + Bagging and Boosting
  + AdaBoost,GradientBoost,XGBoost
  + Voting Classifier
* **Model Selection Techniques**
  + Cross Validation
  + Grid and Random Search for hyper parameter tuning
* **Text Analysis**
  + Install NLTK
  + Tokenize words
  + Tokenizing sentences
  + Stop words customization
  + Stemming and Lemmatization
  + Speech tagging
  + Feature Extraction
  + Sentiment Analysis
  + Count Vectorizer
  + TfidfVectorizer
  + Naive Bayes Algorithms
    - GaussianNB
    - MultinomialNB
    - BernoulliNB
* **Dimensionality Reduction** 
  + Principal Component Analysis(PCA)
  + Linear Discriminant Analysis(LDA)
* **Open CV**
  + Reading images
  + Understanding Gray Scale Image
  + Resizing image
  + Understanding Haar Classifiers
  + Face , eyes classification
  + How to use webcam in open cv
  + Building image data set
  + Capturing video
  + Face classification in video
* **Clustering**
  + K-means Clustering
  + Hierarchical Clustering
  + DBSCAN Clustering
* **Projects**
  + **Spam Filter**
  + **Review Analysis**

**Deep Learning& AI:**

* **Introduction To ArtificialNeural Network**
  + What is Artificial Neural Network (ANN)?
  + How Neural Network Works?
  + Perceptron
  + Multilayer Perceptron
  + Feed Forward
  + Back propagation
* **Introduction To Deep Learning**
  + What is Deep Learning?
  + Deep Learning Packages
  + Deep Learning Applications
  + Building Deep Learning Environment
    - Installing Tensor Flow Locally
    - Understanding Google Colab
* **Tensor Flow Basics**
  + What is Tensorflow?
  + Tensorflow 1.x V/S Tensorflow 2.x
  + Variables, Constants
  + Scalar, Vector, Matrix
  + Operations using tensorflow
  + Difference between tensorflow and numpy operations
  + Computational Graph
  + Visualizing Graph using Tensorboard
* **Optimizers**
  + What does optimizers do?
  + Gradient Descent (full batch and min batch)
  + Stochastic Gradient Descent
  + Learning rate , epoch
* **Activation Functions**
  + What does Activation Functions do?
  + Sigmoid Function,
  + Hyperbolic Tangent Function (tanh)
  + ReLU –Rectified Linear Unit
  + Softmax Function
  + Vanishing Gradient Problem
* **Building Artificial Neural Network**
  + Using scikit implementation
  + Using Tensorflow
  + Understanding MNIST Dataset
  + Initializing weights and biases
  + Gradient Tape
  + Defining loss/cost Function
  + Train the Neural Network
  + Minimizing the loss by adjusting weights and biases
* **Modern Deep Learning Optimizers and Regularization**
  + SGD with Momentum
  + RMSprop
  + AdaGrad
  + Adam
  + Dropout Layers and Regularization
  + Batch Normalization
* **Building Deep Neural Network Using Keras**
  + What is Keras?
  + Keras Fundamental For Deep Learning
  + Keras Sequential Model and Functional API
  + Solve a Linear Regression and Classification Problem with Example
  + Saving and Loading a Keras Model
* **Convolutional Neural Networks (CNNs)**
  + Introduction to CNN
  + CNN Architecture
  + Convolutional Operations
  + Pooling , Stride and Padding Operations
  + Data Augmentation
  + Building ,Training and Evaluating First CNN Model
  + Model Performance Optimization
  + Auto encoders for CNN
  + Transfer Learning and Object Detection Using Pre-trained CNN Models
    - LeNet
    - AlexNet
    - VGG16
    - ResNet50
    - Yolo algorithm
    - Faster R-CNN
* **Recurrent Neural Networks (RNNs)**
  + Introduction to RNN
  + RNN Architecture
  + Types of RNN
  + Implementing basic RNN in tensorflow
  + Need for LSTM and GRU
  + Deep RNN/LSTM/GRU
  + Text Classification Using LSTM
  + Prediction for Time Series problem
* **Word Embedding**
  + What is Word Embedding?
  + Word2Vec Embedding
    - CBOW
    - skipgram
  + Keras Embedding Layers
  + Visualize Word Embedding
  + Google Word2Vec Embedding
  + GloVe Embedding
* **Advance NLP**
  + Bidirectional RNN/LSTM
  + Seq-2-Seq Modeling
  + Encoder-Decoder Model
  + Attention Mechanism
* **Generative Adversarial Networks (GANs)**
  + Introduction to GAN
  + Generator
  + Discriminator
  + Types of GAN
  + Implementing GAN using Neural Network
* **Speech Recognition APIs**
  + Text To Speech
  + Speech To Text
  + Automate task using voice
  + Voice Search on Web
* **Projects(Any Five)**
  + Stock Price Prediction Using LSTM
  + Object Detection
  + Attendance System Using Face Recognition
  + Facial Expression and Age Prediction
  + Chabot Application
  + Neural Machine Translation
  + Hand Written Digits& Letters Prediction
  + Number Plate Recognition
  + Gender Classification
  + My Assistant for Desktop
  + Suspect Detection using CCTV
  + Hardware operations using gesture detection
  + Cat v/s Dog Image Classification