Introduction To Python
- Why Python
- Application areas of python
- Python implementations
- Python versions
- Installing pythonPython 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
- 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

Looping Statements
- While loop
- For loop
- Nested loops
- Pass, break and continue keywords

Standard Data Types
- Int, float, complex, bool, nonetype
- Str, list, tuple, range
- Dict, set, frozenset

String Handling
- What is string
- String representations
- Unicode string
- String functions, methods
- String indexing and slicing
- String formatting

Python List
- Creating and accessing lists
- Indexing and slicing lists
- List methods
- Nested lists
- List comprehension

Python Tuple
- Creating tuple
- Accessing tuple
- Immutability of tuple

Python Set
- How to create a set
- Iteration over sets
- Python set methods
- Python frozenset

Python Dictionary
- Creating a dictionaryDictionary methods
- Accessing values from dictionary
- Updating dictionary

- Iterating dictionary
- Dictionary comprehension

Python Functions

- Defining a function
- Calling a function
- Types of functions
- 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

Modules & Packages

- Why modules
- Script v/s module
- Importing module
- Standard v/s third party modules
- Modules Why packages
- Understanding pip utility

File I/O

- Introduction to file handling
- Handling File modes
- Functions and methods related to file handling
- Handling Understanding with block

Object Oriented Programming

- Procedural v/s Object Oriented Programming
- OOP Principles
- Defining a Class & Object Creation
- Inheritance
- Encapsulation
- Polymorphism
- Abstraction
- 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
- User-defined Exceptions

GUI Programming

- Introduction to Tkinter Programming
- Tkinter Widgets
- Layout Managers
- Event Handling
- Displaying image
- Multi-processing v/s Multi-threading
- Need of threads
- Creating child threads
- Functions /methods related to threads
- Thread synchronization and locking

Statistics, Probability & Analytics:

Introduction to Statistics

- Sample or population
- Measures of central tendency
  - Arithmetic mean
  - Harmonic mean
  - Geometric mean
  - Mode
  - Quartile
    - First quartileSecond quartile(median)
    - Third quartile
  - Standard deviation

Probability Distributions

- Introduction to probability
- Conditional probability
- Normal distribution
- Uniform distribution
- Exponential distribution
- Right & left skewed distribution
- Random distribution
- Cen.tral limit theorem

Hypothesis Testing

- Normality test
- Mean test
  - T-test
  - Z-test
  - ANOVA test
- Chi square test
- Correlation and covariance

Numpy● Package

- Difference between list and numpy array
- Vector and matrix operations
- Array indexing and slicing

Package
Introduction to pandas

- Labeled and structured data
- Series and dataframe objects

How to load datasets

- From excel
- From csv
- From html table

Accessing data from Data Frame

- at & iat
- loc & iloc
- head() & tail()

Exploratory Data Analysis (EDA)

- describe()
- groupby()
- crosstab()
- boolean slicing / query()

Data Manipulation & Cleaning

- Map(), apply()
- Combining data frames
- Adding/removing rows & columns
- Sorting data
- Handling missing values
- Handling duplicacy
- Handling data error

Handling Date and Time
Data Visualization using matplotlib and seaborn packages

- Scatter plot, lineplot, bar plotHistogram, pie chart,
- Jointplot, pairplot, heatmap
- Outlier detection using boxplot

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
- Terminology related to ML

Supervised Learning

- Classification
- Regression

Unsupervised Learning

- Clustering

KNN Classification

- Math behind KNN
- KNN implementation
- Understanding hyper parameters

Performance metrics

- Math behind KNN
- KNN implementation
- Understanding hyper parameters

Regression

- Maths 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

Logistic Regression for classification

- Theory of logistic regression
- Binary and multiclass classification
- Implementing titanic dataset
- Implementing iris dataset
- Sigmoid and softmax functions

Support Vector Machines

- Theory of SVM
- SVM Implementation
- kernel, gamma, alpha

Decision Tree Classification

- Theory of decision tree
- Node splitting
- Implementation with iris dataset
- Visualizing tree

Ensemble Learning

- Random forest
- Bagging and boosting
- Voting classifier

Model Selection Techniques

- Cross validation
- Grid and random search for hyper parameter tuning

Recommendation System

- Content based technique
- Collaborative filtering technique
- Evaluating similarity based on correlation
- Classification-based recommendations

Clustering

- K-means clustering
- Hierarchical clustering
- Elbow technique

- Silhouette coefficient
- Dendogram

Text Analysis

- Install nltk
- Tokenize words
- Tokenizing sentences
- Stop words customization
- Stemming and lemmatization
- Feature extraction
- Sentiment analysis
- CountVectorizer
- TfidfVectorizer
- Naive bayes algorithms

Dimensionality Reduction

- Principal component analysis(PCA)

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
- Creating model for gender prediction

Deep Learning & Neural Networks:

Introduction To Artificial Neural Network

- What is artificial neural network (ANN)?
- How neural network works?
- Perceptron
- Multilayer perceptron
- Feedforward
- Back propagation

Introduction To Deep Learning

- What is deep learning?
- Deep learning packagesDeep 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

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 augmentationBuilding,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

Word Embedding

- What is word embedding?
- Word2vec embedding
- CBOW
- Skipgram
- Keras embedding layers
- Visualize word embedding
- Google word2vec embedding
- Glove embedding

Recurrent Neural Networks (RNNs)

- Introduction to RNN
- RNN architecture
- Implementing basic RNN in tensorflow

- Need for LSTM and GRU
- Deep RNN/LSTM/GRU
- Text classification using LSTM
- Prediction for time series problem
- Seq-2-seq modeling
- Encoder-decoder model

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 Four)

- Stock Price Prediction Using LSTM
- Object Detection
- Attendance System Using Face Recognition
- Facial Expression and Age Prediction
- Neural Machine Translation
- Hand Written Digits& Letters Prediction
- Number Plate Recognition
- Gender Classification
- My Assistant for Desktop
- Cat v/s Dog Image Classification

Data Science

Numpy Package
- Difference between list and numpy
- array Vector and Matrix operations
- Array indexing and slicing

Pandas Package

Introduction to pandas
- Labelled and structured data
- Series and DataFrame Objects

How to load datasets
- From excel
- From csv
- From html table
- From database table

Accessing data from Data Frame
- at & iat
- loc & iloc
- head() & tail()

Exploratory Data Analysis (EDA)
- Describe()
- Groupby()
- Crosstab()
- boolean slicing / query()

Data Manipulation & Cleaning
- Map(),apply()
- Combining data frames
- Adding/removing rows & columns
- Sorting data
- Handling missing values
- Handling duplicates
- Handling Data Error

Categorical Data Encoding
- Label Encoding
- One Hot Encoding

Data Visualization using matplotlib and seaborn packages
- Scatter plot, lineplot, bar plot
- Histogram, pie chart,
- Jointplot, pairplot ,Heatmap
- Outlier detection using boxplot

Introduction To Machine Learning
- Traditional v/s Machine Learning
- Programming Real life examples based on ML

- Steps of ML
- Programming Data
- Preprocessing revised
- Terminology related to ML

Supervised Learning

- Classification
- Regression

KNN Classification

- Maths behind KNN
- KNN implementation
- Understanding hyper parameters

Performance metrics

- Confusion Matrix
- Accuracy Score
- Recall & Precision
- F-1 Score
- R2 Score

Regression

- Math behind Regression
- Simple Linear Regression
- MultipleLinear Regression
- Polynomial Regression
- Boston Price Prediction
- Cost or Loss Functions
- Mean absolute error
- Mean squared error
- Root mean squared error
- Least Square Error

Logistic Regression for classification

- Theory of Logistic Regression Binary and
- Multiclass classification
- Implementing titanic dataset
- Implementing iris dataset
- Sigmoid and softmax functions

Decision Tree Classification

- Theory of   Decision Tree
- Node Splitting
- Implementation with iris dataset
- Visualizing Tree

Model Selection Techniques

- Cross Validation
- Grid and Random Search for hyper parameter tuning

Recommendation System

- Content based technique
- Collaborative filtering technique
- Evaluating similarity based on correlation
- Classification-based recommendations

Text Analysis

- Install NLTK
- Tokenize words
- Tokenizing sentences
- Stop words customization
- Stemming and
- Lemmatization
- Feature Extraction
- Sentiment Analysis
- Countvectorizer
- TfidfVectorizer
- Naive Bayes Algorithms

Dimensionality Reduction

- Principal Component Analysis(PCA)

Open CV

- Reading images
- Understanding GrayScale Image
- Resize image
- Understanding Haar classifiers
- Face, eyes,classification
- How to use webcam in open CV
- Building image data set
- Capturing video
- Face classification in video

Project

- One project using Python &SQL
- One project using Python &SQL
- One Dashboard using Power BI