COMPLETE PYTHON FOR DEVELOPMENT AND DATA SCIENCE

By K.S.Chandre

Sr. No	Major module	Course Content
1	**Python Introduction- Part 1**	• Introduction class- (Glass breaking, Team building approach, Industry scenarios, Market conditions, Supply-demand opportunities) • Syllabus declaration and time management • What is Language?, Types of languages, Introduction to Translators, Compiler, Interpreter, Debugger etc
2	**Python Introduction- Part 2**	• What is Python? • WHY PYTHON? • History of Python • Features of Python. • Why Python is General Language?/HLL? • Limitations of Python
3	**Python software Installation and Introduction**	• Python Distributions, Anaconda Navigator • Download &Python Installation Process in Windows, Unix, Linux and Mac • Online Python IDLE • Python Real-time IDEs like Spyder, Jupyter Note Book, PyCharm, Different Modes of Python
4	**Language Initials**	Python Identifiers(Rules and Regulations) Basic Data types in Python(Sequencial, non-sequencial, ordered, non-ordered)

Basic Python

Sr. No	Major module	Course Content
5	**List**	What is list? Properties of List. Types of List. List support indexing(forward and Reverse) Orered and unordered nature. Mutable and immutable nature. Operations/ Methods/ Functions of List- Part 1 Operations/ Methods/ Functions of List- Part 2
6	**Tuple**	What is a Tuple? Properties of tuple. Types of tuple. Operations/ Methods/ Functions of tuple
7	**Set**	• What is set? • Different ways of creating set • Difference between list and set • Accessing elements of set • Python Set Methods • Python Set Operations • Union of sets

8	**Dictionary**	• What is dictionary? • Difference between list, set and dictionary • How to create a dictionary? • Accessing values of dictionary • Copying dictionary • Updating Dictionary • Reading keys from Dictionary • Reading values from Dictionary • Reading items from Dictionary • Delete Keys from the dictionary • Sorting the Dictionary • Python Dictionary Functions and methods
9	**String**	• What is String? • Properties of string. • Processing elements using indexing • Processing elements using Iterators • Manipulation of String using Indexing and Slicing • String operators • Methods of String object
10		String Formatting and Type casting
11	**Operators**	• Arithmetic Operators • Comparison Operators • Python Assignment Operators • Logical Operators • Bitwise Operators • Shift operators • Membership Operators • Identity Operators • Ternary Operator • Operator precedence • Difference between "is" vs "=="
12	**Control statements**	• Conditional control statements • If • If-else • If-elif-else • Nested-if • Loop control statements • for • while • Nested for loops • Branching statements • Break • Continue • Pass • Case studies- Pattern making (letters and Diagrams)
13	**Functions**	What is Function?
		Advantages of functions
		Syntax and Writing function

		Calling or Invoking function
		Classification of Functions- On the basis of argument and return value
		No arguments and No return values
		With arguments and No return values
		With arguments and with return values
		No arguments and with return values
		Classification of Functions- On the basis of parameters or Arguments
		Positional argument type functions
		Default argument functions
		variable length arguments function
		Keyword arguments function(*arg)
		Variable length keyword arguments functions(*kwargs)
		zip() in Python
14	**Anonymous functions**	Lambda functions
		· map ()
		· filter ()
		· reduce ()
15	**Code optimization**	List comprehension,tuple ,dict
16	**Variables**	What is variable?
		Global variable and local variable?
17	**Function Alising**	What is Function Alising?
		use of Function Alising.
18	**Decorators**	what is a decorator?
		Uses of a decorator?
		Syntax of writing a decorator?
		Closures
		Generators
		Iterators
		Monkey patching ? ---interview
19	**Extras**	Doubt solving session.

Advanced Python

		Procedural v/s Object oriented programming
		Principles of OOP – Encapsulation, Abstraction (Data Hiding)
		Classes and Objects
		How to define class in python
		Types of variables – instance variables, class variables.
		Types of methods – instance methods, class method, static method
		Object initialization
		'self' reference variable
		'cls' reference variable
20	**Object oriented programming**	Property () object threory
		Creating object properties using setaltr, getaltr functions\
		Inner classes
		Introduction
		Writing inner class
		Accessing class level members of inner class
		Accessing object level members of inner class
		Local inner classes
		Complex inner classes

		Encapsulation (Data Binding)
		Access modifiers – private (__), protected (_), public
		Class re-usability
		Inheritance – single, multi-level, multiple, hierarchical and hybrid inheritance and Diamond inheritance
		Method resolution order (MRO)
		super ()
		Constructors in inheritance
		Object class
		Duck typing interview question
		Concrete Methods in Abstract Base Classes
		Difference between Abstraction & Encapsulation ---interview question
		What is polymorphism
		Runtime polymorphism
		Overriding
		i) Method overriding
		ii) Constructor overriding
		Method overriding in Multiple inheritance and Hybrid Inheritance
		Overloading
		i) Method Overloading
		ii) Constructor Overloading
		iii) Operator Overloading
21	**Python Modules**	Importance of modular programming
		What is module
		Types of Modules – Pre defined; User defined.
		User defined modules creation
		Functions based modules
		Class based modules
		Connecting modules
		Import module
		From … import
		Module alias / Renaming module
		Built In properties of module
		Math module, random module
22	**Packages**	Organizing python project into packages
		Types of packages – pre defined, user defined.
		Package v/s Folder
		.py file
		Importing package
		PIP
		Introduction to PIP
		Installing PIP
		Installing Python packages
		Un installing Python packages
23	**Exception Handling & Types of Errors**	What is Exception?
		Why exception handling?
		Syntax error v/s Runtime error
		Exception codes – AttributeError, ValueError, IndexError, TypeError…
		o Handling exception – try except block
		o Try with multi except

		o Handling multiple exceptions with single except block
		Finally block
		o Try-except-finally
		o Try with finally
		o Case study of finally block
		Raise keyword
		o Custom exceptions / User defined exceptions
		o Need to Custom exceptions
		Case studies
24	**File &Directory handling**	Introduction to files
		Opening file
		File modes
		Reading data from file
		Writing data into file
		Appending data into file
		Line count in File
		CSV module
		Creating CSV file
		Reading from CSV file
		Writing into CSV file
25	**Multi-threading & Multi Processing**	Introduction
		Multi tasking v/s Multi threading
		Threading module
		Creating thread – inheriting Thread class , Using callable object
		Life cycle of thread
		Single threaded application
		Multi threaded application
		Can we call run() directly?
		Need to start() method
		Sleep()
		Join()
		Synchronization – Lock class – acquire(), release() functions
26	**Object serialization – pickle module**	XML parsing
		JSON parsing
27	**Python Logging**	Logging Levels
		implement Logging
		Configure Log File in over writing Mode
		Timestamp in the Log Messages
		Python Program Exceptions to the Log File
		Requirement of Our Own Customized Logger
		Features of Customized Logger
28	**Assertion in Python**	· Types of assertion
		· Simple, Augmented type
		· Use of assertion in real time
29	**OS module**	Shell script commands
		Various OS operations in Python
		Python file system shell methods
		Creating files and directories
		Removing files and directories

		Shutdown and Restart system
		Renaming files and directories
		Executing system commands
30	**Garbage collection**	Introduction
		Importance of Manual garbage collection
		Self reference objects garbage collection
		'gc' module
		Collect() method
		Threshold function
		Case studies
31	**Database Connection**	Introduction to DBMS applications
		File system v/s DBMS
		Communicating with MySQL
		Python – MySQL connector
		connector module
		connect () method
		Oracle Database
		Install cx_Oracle
		Cursor Object methods
		execute () method
		execute Many () method
		fetchone()
		fetchmany()
		fetchall()
		Static queries v/s Dynamic queries
		Transaction management
		Case studies
	****End of Python Syllabus****	

Important Module

1. Git and Docker
2. Session Management -- Django
3. Memory Management in python and Architechture
4. AWS EC2 & different Services AWS S3 ,
5. Python Collection
6. Regular Expression
7. Putty and GitBash
8. Api Integration
9. Web Scrapping
10. DB == Mysql,MongoDB
11. Deep Learning and Nural Network
12. ETL Python Related
13. Jenkins Python , Ansible Python or Devops
14. Flask Session
15. Jira tool
16. Interview Question session disscution with Answers

Data science with Python

Numpy
- Arrays
- Basic Operations in Numpy
- Indexing
- Array Processing

Pandas
- Series
- Data Frames
- Indexing and slicing
- Groupby
- Concatenating
- Merging Joining
- Missing Values
- Operations
- Data Input and Output
- Pivot
- Cross tab

Data Visualization
- **Introduction to Matplotlib**
  - Line plots
  - Histograms
  - Box and Violin Plots
  - Scatterplot
  - Heatmaps
  - Subplots

Visualization with Seaborn

12. Regular Expressions
- Literals and Meta Characters
- How to Regular Expressions using Pandas?
- Inbuilt Methods
- Pattern Matching

Projects
- **Data Mining**

This project starts completely from scratch which involves collection of Raw Data from different sources and converting the unstructured data to a structured format to apply Machine Learning and NLP models. This project covers the main four steps of Data Science Life Cycle which involves

1. Data Collection
2. Data Mining

3. Data Preprocessing
4. Data Visualization.
 Ex: Text, CSV, TSV, Excel Files, Matrices, Images

Statistics - DESCRIPTIVE & INFERENTIAL

Basic Statistics Terminology
- What is Statistics?
- How Statistics is used in Data Science
- What is Probability?
- Population and Sample
- Sampling Techniques
  - Convenience Sampling
  - Simple Random Sampling
  - Systematic Random Sampling
  - Stratified Sampling
  - Cluster Sampling
  - **Variables**
    - Dependent and Independent Variables
    - Qualitative and Quantitative Data
      - Categorical Data
        - Nominal
        - Ordinal
      - Numerical Data
        - Interval
        - Ratio
      - Discrete and Continuous Data

Central Tendencies
- Mean, Median and Mode
- Standard Deviation and Variance
- Box Plot and Distribution

Basics of Probability
- Probability vs Statistics
- Terminology
- Probability Rules
- Probability Types
  - Marginal Probability
  - Joint Probability
  - Union Probability
  - Conditional Probability

Probability Theory
- Conditional Probability
- Bayes Theorem
- Confusion Matrix
- Z-Score
- Histogram

Probability Distribution
- Expectation
- Variance of Distribution
- Skewness

- Kurtosis
- Discrete Probability Distribution
  - Bernoulli
  - Binomial
  - Geometric
  - Poison
- Continuous Probability Distribution
  - Exponential
  - Normal Distribution
  - Gaussian Distribution
  - t-Distribution
  - **Confidence Interval**
    - Standard Error
    - Margin of Error
  - **Statistical Testing**
    - Hypothesis Testing
    - Chi-square test
    - t-test
    - ANOVA

3.MACHINE LEARNING – SUPERVISED LEARNING

1. INTRODUCTION
- What is Machine Learning?
- Difference between Supervised Learning and Unsupervised Learning?
- Difference between Regression and Classification Models?

2. Linear and Multiple Regression
- Relationship between variables: Regression (Linear, Multivariate Linear Regression) in prediction.
- Hands on Linear and Multiple Regression using a use case.
- Understanding the summary output of Linear Regression
- Residual Analysis
- Identifying significant features, feature reduction using AIC, multi-collinearity check, observing influential points, etc.
- Hypothesis testing of Regression Model
- Confidence intervals of Slope
- R-square and goodness of fit
- Influential Observation – Leverage
- Polynomial Regression
- Categorical Variable in Regression

3. Logistic Regression
- **Logistic Regression Intuition**
- Understanding Logit Function.
- Hands-on Python Session on Logistic Regression using business case.
- Measuring the Evaluation Metrics – Confusion Metrics, Accuracy, Precision, recall and ROC Curve.

4. Navie Bayes Classifier
- Review probability distributions, Joint and conditional probabilities
- Model Assumptions, Probability estimation

- Required data processing
- Feature Selection
- Classifier

5. Principal Compound Analysis (PCA)
- Introduction to dimensionality reduction and it's necessity
- Background: Eigen values, Eigen vectors, Orthogonality
- Principal components analysis (PCA)
- Feature Extraction
- Advantage and application of Dimensionality reduction.

6. Time Series (Forecasting)
- Trend analysis
- Cyclical and Seasonal analysis
- Smoothing; Moving averages; Auto-correlation; ARIMA
- Application of Time Series in financial markets

7. Decision Tree (Rule – Based)
- Decision nodes and leaf nodes
- Variable Selection, Parent and child nodes branching
- Stopping Criterion
- Tree pruning and Depth of a tree
- Overfitting
- Metrics for decision trees-Gini impurity, Information Gain, Variance Reduction
- Regression using decision tree
- Interpretation of a decision tree using If-else
- Pros and cons of a decision tree
- Accuracy estimation using cross-validation

8. K-Nearest Neighbor (Distance Based Learning)
- What is KNN and why do we use it?
- KNN-algorithm and regression
- Curse of dimensionality and brief introduction to dimension reduction
- KNN-outlier treatment and anomaly detection
- Cross-Validation
- Pros and cons of KNN

9. Support Vector Machine (Distance Based Learning)
- Linear learning machines and Kernel space, making kernels and working in feature space
- Hands on example of SVM classification and regression problems using a business case in Python.

10. Esemble Methods
- Introduction to Ensemble
- Bias and Tradeoff
- Bagging & boosting and its impact on bias and variance
- Random forest
- Gradient Boosting
- XGBoost

Case Studies:
- Predictive Analytics
- Banking Use cases – Customer Service prediction,
- Health care Use cases – Heart Disease, Diabetics
- Insurance Use cases
- Telecom Churn Prediction

- Bike Sharing
- Air Quality

4.MACHINE LEARNING – UNSUPERVISED LEARNING

1. Clustering
- Different clustering methods
- review of several distance measures
- Iterative distance-based clustering
- Dealing with continuous, categorical values in K-Means
- Constructing a hierarchical cluster, and density-based clustering.
- Test for stability check of clusters
- Hands-on implementation of each of these methods in Python

2. Recommendation Systems
- Association Rules:
  - How to combine clustering and classification;
  - A mathematical model for association analysis
  - Apriori: Constructs large item sets with mini sup by iterations
  - Metrics of rules-Lift, Support, Confidence, Conviction
- Recommendation Rules:
  - Collaborative Filters
  - Content based Learning

5.Natural Language Processing (NLP) – Text Mining

1. INTRODUCTION
- What is Text Mining?
- Libraries
  - NLTK
  - Spacy
  - TextBlob
- Structured and Unstructured Data
  - Extracting Unstructured text from files and websites

2. Text Preprocessing
- Regular Expressions for Pattern Matching
- Text Normalization
- Text Tokenization
  - Sentence Tokenization
  - Word Tokenization
- Text Segmentation
  - Stemming
  - Lemmatization

3. Natural Language Understanding (NLP Statistical)
- Automatic Tagging
- N-grams Tagging
- Transformation based Tagging
- Bag of Words
- POS Tagging
- TF – IDF
- Cosine Similarity

- Thinking about the math behind text; Properties of words; Vector Space Model
- Named Entity Recognition
- Relation Extraction

4. Matrix Factorization
- Singular Value Decomposition

5. Text Indexing
- Inverted Indexes
- Boolean query processing
- Handling phrase queries, proximity queries
- Latent Sematic Analysis

6. Text Classification

Case Studies:
- Text Mining
- Sentiment Analysis
- Spam Detection
- Dialogue Prediction

6. Artificial Intelligence

1. Introduction to Neural Networks
- Introduction to Neural Network
- Introduction to Perceptron
- Activation Functions
- Cost Functions
- Gradient Decent
- Stochastic Gradient Descent
- Back propagation

2. Deep Frameworks
- Installing Tensorflow and Keras
- Tensorflow and Keras Basic Syntax
- Tensorflow Graphs
- Variables and Placeholder
- Saving and Restoring Models
- Tensorboard

3. Artificial Neural Network with Tensorflow
- Neural Network for Regression
- Neural Network for Classification
- Evaluating the ANN
- Improving and tuning the ANN

4. Convolution Neural Networks
- Convolution Operation
- ReLU Layer
- Pooling
- Flattening
- Full Connection
- Softmax and Cross Entropy

5. Building Convolution Neural Network in Python
- Introduction to Computer Vision
  - OpenCV library in Python
- Getting Started with Images/Videos

- Operations on Images
- Image Processing in OpenCV
  - Geometric Transformation of Images
    - Rotation
    - Affine Transformation
    - Perspective Transformation
  - Imaging Thresholding
  - Contours
  - Edge Detections
  - Morphological Transformation
  - Harris Corner Detection
- Reshaping Images
- Normalizing Images
- Building Convolutional Network with Tensorflow
- Training CNN for Image Classification

Case Studies:
- Image Classification

6. Keras (Backend Tensorflow)
- Keras vs Tensorflow
- Introduction to Keras
- Building Artificial Neural Network with Keras
- Building Convolution Neural Network with Keras

7. Natural Processing Language (Sequential Process)
- The Idea behind Recurrent Neural Networks
- Vanishing Gradient Problem
- LSTM (Long Short-Term Memory)
- GRU (Gated Recurrent Unit)

Projects
- **Face Recognition**

Face Recognition project gives details of the person and can recognize the gender and names. This project involves in

1. Collection of images
2. Preprocessing the data
3. Applying the Model (Machine Learning or Deep Learning)
4. Training and Testing using the model

Ex: Security Unlock, Gender Recognition, Identity Recognition
- **Chatbot**

Virtual Assistants are now a common requirement for an Organization. But, to make the assistant more effective we are now into the chatbots which involves Natural Language Process, Deep Learning and Artificial Intelligence. This interactive chatbots are designed to serve as an intellectual responsive process.

Ex: Alexa, Siri, Google Assistant

7. Deployment

- Creating pickle and frozen files
- Cloud Deploying Machine Learning and Deep Learning model for production

Complete Django for Development and Deployment