

ARTIFICIAL INTELLIGENCE WITH PYTHON CURRICULLUM



GAIN FUTURE
READY SKILLS



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PROGRAM OVERVIEW

Program Pedagogy

Workshop mode
Brainstorming sessions
Presentations
Simulation exercises
Internship

Eligibility Criteria

Graduates
Post-Graduates
Working Professionals
Final Year Under Graduates

Program Duration

4 Months
400 Hrs of Experiential Learning
Hybrid -Classroom & Online

Evaluation & Certification

“Artificial Intelligence with Python” Certification
By KEONICS

About Artificial Intelligence

AI is transforming how we live, work, and play. By enabling new technologies like self-driving cars and recommendation systems or improving old ones like medical diagnostics and search engines, the demand for expertise in AI and machine learning is growing rapidly. This course will enable you to take the first step towards solving important real-world problems and future-proofing your career. **KEONICS' AI with Python** program has been designed specifically for present days professionals to—

- get hands-on training,
- develop and practice AI tools.
- gain expert level skills and confidence with rigorous assessments and certification process.
- experience practical learning through mandatory internship programs.

Program OBJECTIVES

KEONICS' Artificial Intelligence with Python program offers an innovative milestone-based learning initiative for students to build their skills using a step-by-step process.

The primary objective of this accelerated rigorous application-oriented program is to:

- Impart knowledge on **Artificial Intelligence (AI)**, help understand it's usage and understand how AI can be applied to various domains.
- Make professionals & students of the course experts on AI tools and techniques.
- Ensure professionals & students learn on-the-job training during Internship programs.

Program OUTCOMES

- Facilitating learning based on latest tools in Artificial intelligence
- Help expand student's skills by outcome-based learning.
- Assisting students by developing a concrete action plan for career planning in AI opportunities.
- Imparting in-depth learning on practical applications of AI.

CURRICULUM

01

Python Foundation

Theory: 20 Hrs
Practical: 20 Hrs

THEORY

Python Programming Introduction

- Learn why we program?
- Prepare for the course ahead with a detailed topic overview
- Advantages of Python programming
- Basic understanding of Python syntax

Data Types and Operators

- Understand how data types and operators are the building blocks for programming in Python.
- Use the following standard data types: integers, floats, boolean, strings, lists, tuples, sets, dictionaries.
- Use the following operators: arithmetic, assignment, comparison, logical, membership, identity etc.

Control Flow

- Implement decision-making in your code with conditionals.
- Repeat code with for and while loops.
- Exit a loop with break and skip an iteration of a loop with continue.
- Use helpful built-in functions like zip and enumerate.

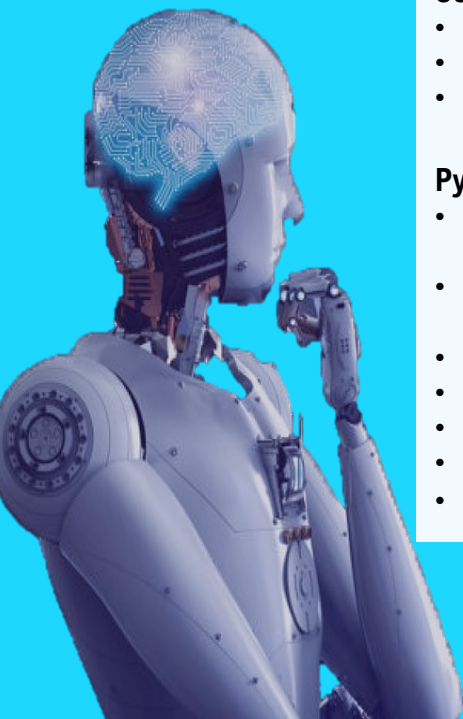
PRACTICE

Setting up Python

- Downloading Python
- Configuring Python and setting up path
- Validating the installation and running python

Python Programming

- Practice using the following data types: integers, floats, boolean, strings, lists, tuples, sets, dictionaries.
- Practice using the following operators: arithmetic, assignment, comparison, logical, membership, identity etc.
- Practice implementing decision-making in your code with conditionals.
- Practice repeating code with for and while loops.
- Exit a loop with break and skip an iteration of a loop with continue.
- Use helpful built-in functions like zip and enumerate.
- Construct lists in a natural way with list comprehensions.



02

Python Advanced

Theory: 20 Hrs
Practical: 20 Hrs

THEORY

Python Functions

- Write your own functions to modularize the code
- Understand variable scope, i.e., which parts of a program variable can be referenced from.
- Importance of well documented code.
- Use lambda expressions, iterators, and generators.

Advanced Concepts using Python lists, tuples, sets and dictionaries

- Working with python lists and built-in functions
- Construct lists in a natural way with list comprehensions.
- Understanding of tuples and differences with Python list
- Deep dive into sets, dictionaries and work with loops

Python Scripting

- Write and run scripts locally on your computer.
- Work with raw input from users.
- Read and write files, handle errors, and import local scripts.
- Reading and loading text, csv data files using python
- Use modules from the Python standard library and from third-party libraries.
- Debugging Python code
- Understand packaging of python code to EXE

Python Classes

- Introduction to object-oriented programming (OOPs) using python
- Create Objects using Python Classes

PRACTICE

- Create Python Functions and calling it to build program logics
- Practice variable scope
- Use lambda expressions, iterators, and generators.
- Create Objects using Python Classes
- Write and run scripts locally on your computer.
- Work with raw input from users.
- Read and write files, handle errors, and import local scripts.
- Import third-party libraries to extend functionalities.
- Practice coding using online resources in solving problems.

03

Business Statistics

Theory: 20 Hrs
Practical: 20 Hrs

THEORY

Introduction to statistics

- What is Statistical Learning?
- Introduction to Data, Data presentations using Charts and Diagrams
- Measure of Central Tendency, Variance
- Understanding of Normal Distribution
- Data Pre-processing
- Feature Engineering (Feature Extraction and Normalization)

Linear Algebra essentials

- Introduction
- Vectors
- Linear combination
- Linear transformation and Matrices
- Linear algebra in Neural Networks

Probability

- Probability, Bayesian Theory
- Joint and Marginal Probabilities
- Probability Distribution
- Random Variables

Theory of Estimation and Testing of Hypothesis

- Theory of Estimation, Estimation Process, Statistical Inference
- Test of Hypothesis, Decision Errors, One Level of Significance
- Degree of Freedom

Regression Models

- Regression, Linear Regression, Multiple Linear Regression
- Coefficient of Determination, R-square, Adjusted R-square

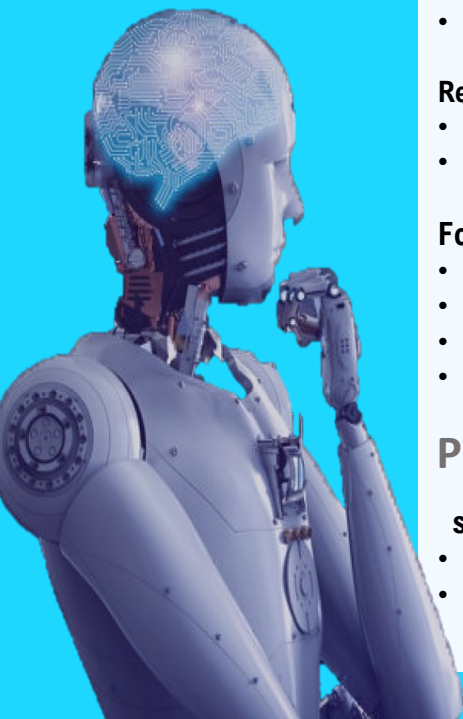
Forecasting Techniques

- Forecasting & Time Series Analysis
- Time series components
- Various Forecasting Techniques
- The Classification Problem

PRACTICE

scikit-learn

- Data Pre-processing for feature extraction and normalization
- Solve Regression and Classification problems using scikit-learn



04

Python for AI/ML

Theory: 20 Hrs
Practical: 20 Hrs

THEORY

Anaconda

- Learn how to use Anaconda to manage packages and python environments

Jupyter Notebooks

- Learn how to use Jupyter Notebooks to create documents combining code, text, images, and more.

Numpy Basics

- Learn the value of NumPy and how to use it to manipulate data for AI problems.
- Use NumPy to Mean Normalize a ndarray and separate it into several smaller ndarrays.

Pandas Basics

- Learn to use Pandas to load and process data for machine learning problems.
- Understand the concept of data frame and working with various built-in functions
- Use Pandas to plot and get statistics from stock data.

Matplotlib Basics

- Learn how to use Matplotlib to choose appropriate plots for one and two variables based on the given data.

PRACTICE

NumPy Basics

- Practice how to use NumPy and to manipulate data for AI problems.
- Use NumPy to Mean Normalize a ndarray and separate it into several smaller ndarrays.

Pandas Basics

- Practice using Pandas to load and process data for machine learning problems.
- Pre-processing of data to eliminate missing data using Pandas
- Use Pandas to plot and get statistics from stock data.

Matplotlib Basics

- Practice using Matplotlib to choose appropriate plots for the given data set.
- Analyze data for central tendency, variance, outliers etc. and do feature extraction.

05

Machine Learning

Theory: 40 Hrs
Practical: 40 Hrs

THEORY

Basic Concepts of Machine Learning

- Understanding Machine learning
- The Necessity of Machine learning
- Types of Machine learning

Types of Machine Learning

- Supervised machine learning algorithms
- Understanding classification and regression
- Unsupervised machine learning algorithms
- Understanding clustering and associations
- Reinforced machine learning algorithms

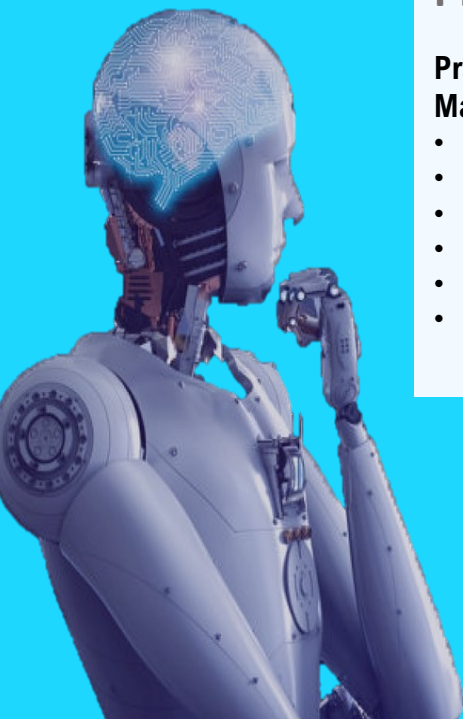
Understanding most common machine learning algorithms

- Basic concepts on supervised and un-supervised learning
- Linear regression – Simple and Multiple
- Logistic regression
- Decision tree
- Support vector machine
- Naïve Bayes
- K-Nearest neighbors
- K-Means clustering
- Random forest

PRACTICE

Practice Machine Learning using scikit-learn, Pandas, Numpy, Matplotlib

- Supervised machine learning algorithms
- Understanding classification and regression
- Unsupervised machine learning algorithms
- Understanding clustering and classification problem
- Practice K-Means , K-Nearest, Random Forest technics
- Practice Decision Tree with an example



06

Artificial Intelligence

Theory: 40 Hrs
Practical: 40 Hrs

THEORY

Basic Concept of Artificial Intelligence

- The Necessity of Learning AI
- Understanding Intelligence
- What is Intelligence?
- Types of Intelligence
 - Linguistic Intelligence
 - Musical Intelligence
 - Logical Mathematical Intelligence
 - Spatial Intelligence
 - Intra and Interpersonal intelligence

Deep Dive into Machine Artificial Intelligence

- Introduction to Neural Networks
- Artificial Neural Network (ANN)
- Convolution Neural Network (CNN)
- Recurrent Neural Network (RNN)
- Deep learning
- Cognitive computing
- Natural Language processing
- Computer vision

Learn the application of AI in

- Healthcare
- Government
- Manufacturing
- Finance
- Retail
- Social Media

PRACTICE

KERAS

- Practice Keras with code examples for Timeseries, reinforcement learning, Support Vector Machine(SVM) etc.
- Loading Data, defining Training models and predict results in Keras

07

Neural Networks and Deep Learning

Theory: 20 Hrs
Practical: 20 Hrs

THEORY

Introduction to Deep Learning

- Understand the major trends driving the rise of deep learning
- Be able to explain how deep learning is applied to supervised learning
- Understand what are the major categories of models (such as CNNs and RNNs), and when they should be applied
- Be able to recognize the basics of when deep learning will (or will not) work well

Deep Learning Continued

- Build a logistic regression model, structured as a shallow neural network
- Implement the main steps of a ML algorithm, including making predictions, derivative computation, and gradient descent
- Implement computationally efficient and highly vectorized versions of models
- Understand how to compute derivatives for logistic regression, using a backpropagation mindset
- Become familiar with Numpy
- Logistic Regression as a Neural Network
- Python and Vectorization

Introduction to Shallow Neural Networks

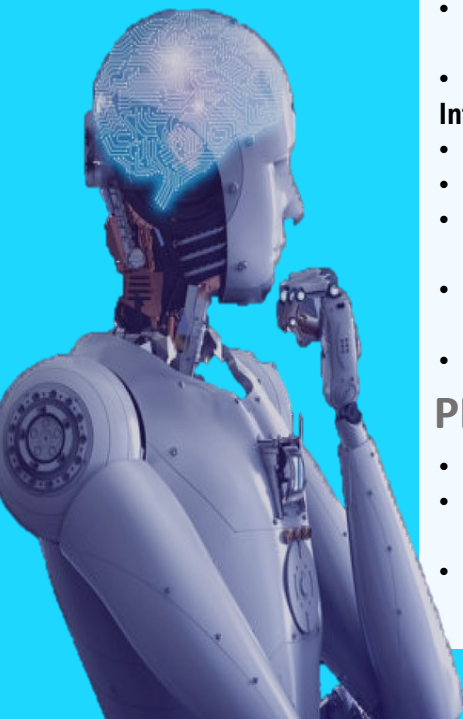
- Understand hidden units and hidden layers
- Be able to apply a variety of activation functions in a neural network.
- Build your first forward and backward propagation with a hidden layer
- Apply random initialization to your neural network
- Become fluent with Deep Learning notations and Neural Network representations
- Build and train a neural network with one hidden layer

Introduction to Deep Neural Networks

- See deep neural networks as successive blocks put one after each other
- Build and train a deep L-layer Neural Network
- Analyze matrix and vector dimensions to check neural network implementations
- Understand how to use a cache to pass information from forward-propagation to back-propagation
- Understand the role of hyperparameters in deep learning

PRACTICE

- Practice Artificial Neural Network (ANN)
- Practice Image classification example using Convolution Neural Network(CNN)
- Work with Recurrent Neural Network(RNN) for sentiment Analysis of product ratings data set.



08

Computer Vision and Natural Language Processing

Theory: 20 Hrs
Practical: 20 Hrs

THEORY

Computer Vision

- Introduction to Convolutional Neural Networks
- Introduction to Images
- Working with OpenCV python library for image pre-processing
- Convolution, Pooling, Padding & its Mechanisms
- Forward-Propagation & Back-propagation for CNNs
- CNN architectures like AlexNet, VGGNet, InceptionNet & ResNet
- Transfer Learning
- Object Detection
- YOLO, R-CNN, SSD
- Semantic Segmentation
- U-Net
- Face Recognition using Siamese Networks
- Instance Segmentation

Natural Language Processing

- Introduction to NLP
- Stop Words
- Tokenization
- Stemming and Lemmatization
- Bag of Words Model
- Word Vectorizer
- TF-IDF
- POS Tagging
- Named Entity Recognition
- Introduction to Sequential data
- RNNs and its Mechanisms
- Vanishing & Exploding gradients in RNNs
- LSTMs - Long short-term memory
- GRUs - Gated Recurrent Unit
- LSTMs Applications
- Time Series Analysis
- LSTMs with Attention Mechanism
- Neural Machine Translation
- Advanced Language Models: Transformers, BERT, XLNet

PRACTICE

- Project Work on Image Detection problem using OpenCV, Keras/ TensorFlow.
- Work with Transfer Learning for Face Detection example
- Sentiment Analysis for Retail data set using NLTK (Natural Language Toolkit)

09

ELECTIVE - 1 ML with AWS

Theory: 20 Hrs
Practical: 20 Hrs

THEORY

Introduction to Machine Learning

- Use AWS SageMaker Studio to access datasets from S3 and perform data analysis functions using AWS tools
- Perform data analysis and feature engineering with Data Wrangler
- Perform data analysis and feature engineering with Pandas in SageMaker Studio
- Label new data for a dataset with SageMaker ground truth
- Load new dataset, create 3 data set types, and identify features/values in SageMaker
- Train (fit) a regression/classification model using scikit-learn
- Evaluate a trained model using methods like mse, rmse, r2, accuracy, f1, and precision

Building ML Workflows

- Launch training jobs within SageMaker
- Create Lambda functions
- Trigger Lambda functions utilizing both the SDK and other AWS Services
- Design and execute a workflow utilizing State Machines
- Use SageMaker Feature Store to serve and monitor model data

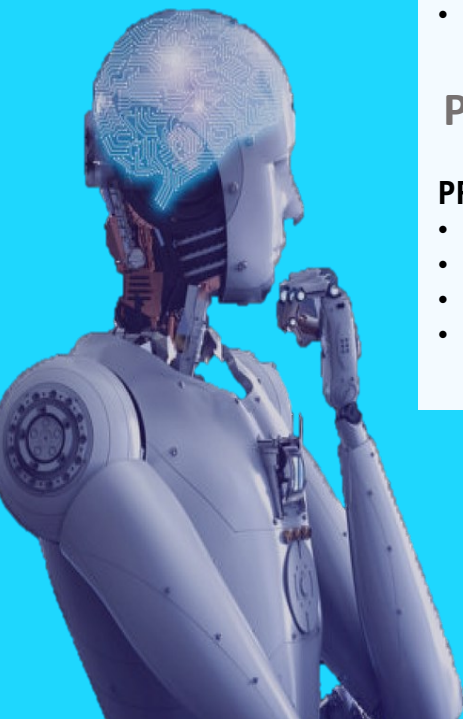
Deep Learning with Computer Vision and NLP

- Finetune models for image and text classification using SageMaker JumpStart
- Debug and profile training jobs using SageMaker Debugger
- Package a model in a Dockerfile for deployment

PRACTICE

PRACTICE AWS ML

- Manage compute resources in AWS accounts to ensure efficient utilization
- Train models on large-scale datasets using distributed training
- Construct pipelines for high throughput, low latency models
- Design secure machine learning projects in AWS



10

ELECTIVE - 2 ML with Azure

Theory: 20 Hrs
Practical: 20 Hrs

THEORY

Introduction to Machine Learning

- Use Azure tools to access datasets and perform data analysis functions
- Interpret the Azure ML Platform
- Compose solutions to manage data drift and deal with sensitive data
- Organize and run hyperparameter experiments
- Utilize data with the SDK
- Create pipelines
- Design solutions with AutoML and the SDK
- Analyze model interpretation experiments
- Create portable ML models with ONNX

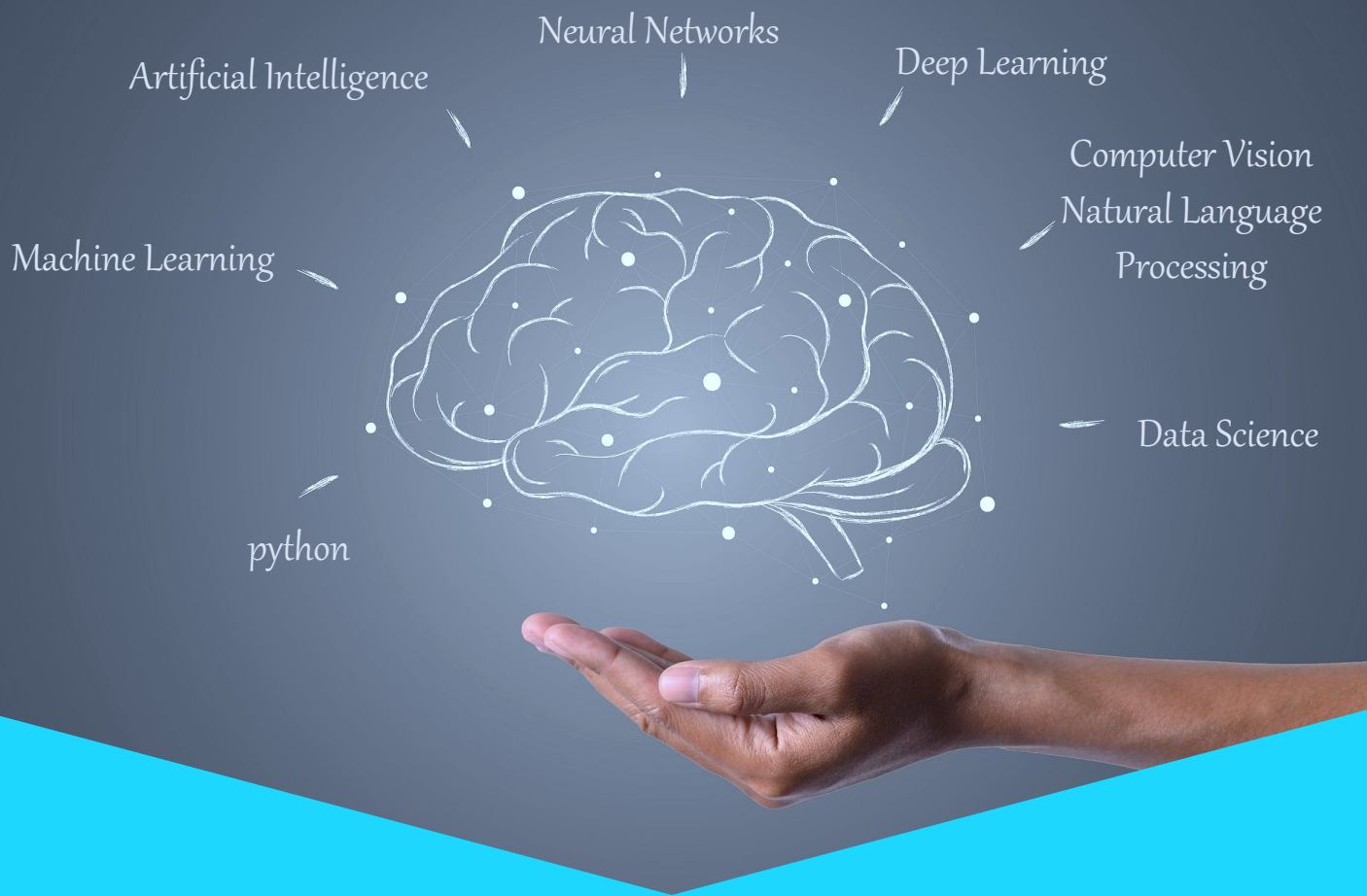
Machine Learning Operations

- Create a Service Principal account for different types of roles
- Determine what the differences are in various forms of authentication
- Use a specific type of authentication when selecting deployment settings
- Use a production environment for deployment
- Enable authentication in the deployment cluster
- Discover the differences between container-based deployment and kubernetes.
- Use a proven tool to find what a baseline for performance is.
- Gather information about an endpoint input to interact with it.
- Find what potential issues can happen with incorrect input.
- Create a pipeline to further automation when training models
- Enable a REST API for the pipeline, so other services can interact with it

PRACTICE

PRACTICE Azure ML

- Using both the hyperdrive and AutoML API from AzureML to build a project.
- Import the dataset into the Azure ecosystem.
- Train a model on that dataset using automated ML and then train a custom model whose hyperparameters you have tuned using HyperDrive.
- Use ML models through Scikit-learn or Deep Learning models like ANNs and CNNs through Keras, TensorFlow, or PyTorch.
- After you have trained both the models, compare their performance, deploy the best model as a webservice and test the model endpoint.



“

“Artificial intelligence is one of the most profound things we're working on as humanity. It is more profound than fire or electricity.”

Sundar Pichai, 2020



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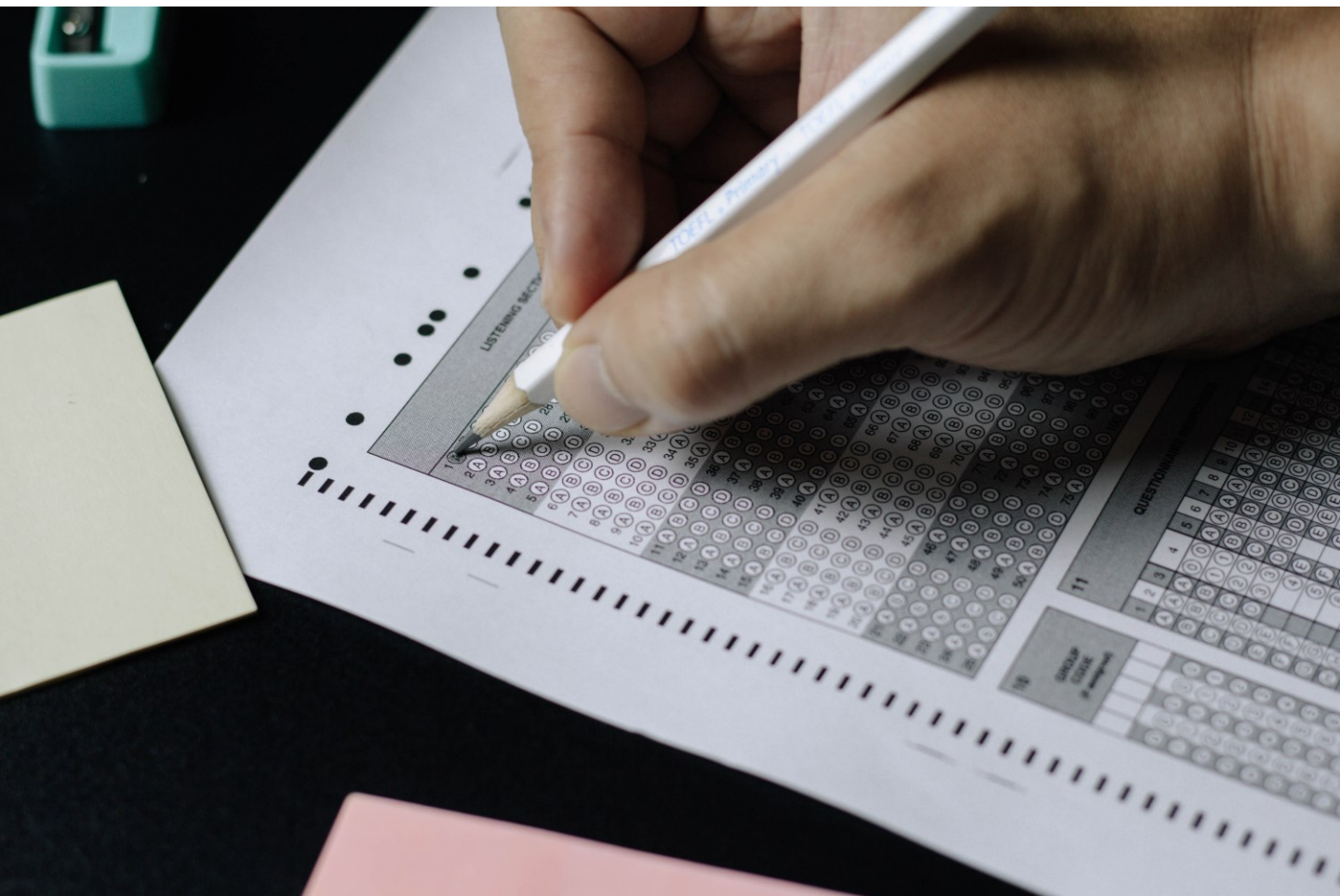
ASSESSMENT PLAN

Sr. No	Modules	Assessment Criteria	Theory	Practical
1	Introduction to Python and Advanced Python(15 Marks)			
1.1	Introduction to Python Programming and syntax	Assignment	2	
1.2	Data Types, Operators and Control Flow	Assignment	2	
1.3	Python Functions	MCQ & Assignment	3	2
1.4	Python Scripting and Python Classes	MCQ & Assignment	3	3
2	Business Statistics, Machine learning and Artificial Intelligence (20 Marks)			
2.1	Introduction to statistics, Linear Algebra essentials, Probability, Theory of Estimation and Testing of Hypothesis, Regression Models and Forecasting Techniques	MCQ	4	
2.2	Anaconda, Jupyter Notebooks, Numpy Basics, Pandas Basics, and Matplotlib Basics	Assignment		4
2.3	Basic Concepts and Types of Machine Learning	MCQ	2	
2.4	Understanding most common machine learning algorithms and its application in various domains	Assignment		4
2.5	Basic Concept of Artificial Intelligence, and working with various algorithms using Python AI/ML Libraries	Assignment		4
2.6	Understanding the fields of study of AI and its applications in various domains	MCQ	2	
3	Neural Networks, Deep Learning, Computer Vision and NLP(18 Marks)			
3.1	Introduction to Deep Learning and advanced deep learning concepts	MCQ	4	
3.2	Introduction to Shallow and Deep Neural Networks	MCQ's & Assignment	4	2
3.3	Understanding Computer Vision	MCQ	4	
3.4	Understanding Natural Language Processing	MCQ's & Assignment	3	1
4	Elective - 1 : ML with AWS (12 Marks) Elective - 2 : ML with AZURE (12 Marks)			
4.1	Elective 1 or Elective 2 Theory	MCQ & Assignment	7	5
4.2	Elective 1 or Elective 2 Practice	MCQ & Assignment	7	5
5	Internship (10 Marks)			
5.1	3 Weeks Mandatory Internship with report submission	Assignment		10
6	Detailed Project Work (DPR) - (15 Marks)	Assignment		15
7	Final Project Presentation (VIVA) – (10 Marks)	Assignment		10
Total Marks : 100 Marks, Pass: 60% Minimum			40	60

ASSESSMENT CRITERIA

Guidelines for Assessment

- Criteria for assessment will be created by KEONICS. Each Performance Criteria (PC) will be assigned marks proportional to its importance given based on syllabus.
- KEONICS will also lay down proportion of marks for Theory and Practical for each module.
- The assessment for both the theory and practical part will be based on question bank created by KEONICS.
- Assessment will be conducted for all compulsory modules.
- Attendance is compulsory.
- Total Marks considered for Assessment is 100 as per the guidelines set by KEONICS. (40% Theory, 30% Practice, 20% Application, 10 % VIVA).
- To pass a course, a trainee should score an average of 60% of the total score.
- In case of unsuccessful completion, the trainee may seek Re-Assessment for respective course.



FACULTY PREREQUISITES

The Faculty should be a Certified Professional with an ability to deliver Accredited Training Service, mapping to the curriculum detailed in the curriculum document.

JOB REQUIREMENTS

- Expertise to deliver the curriculum outlined.
- Deep knowledge in Business Statistics
- Strong programming skills in Python
- Working experience on delivering Machine learning and Artificial Intelligence training with all the relevant technical skills on python AI/ML libraries like scikit-learn, Pandas, Keras, pyTorch, TensorFlow etc.
- Have relevant skills on current trends in Machine Learning and Artificial Intelligence and have experience in working on various data sets.
- Ability to develop course plan and content along with structured execution plan
- Ability to define and evaluate Program Assessment and Project Work
- Any Industry domain expertise

QUALIFICATION PREREQUISITES

- Postgraduate preferably MCA/ME with minimum of 3 years of experience
- Graduates preferably BE with minimum of 5 years of experience
- Excellent Communication Skills both in English and Regional Language
- Strong Technical Knowledge and Experience in Python, Machine learning, Artificial Intelligence and deep learning
- Strong Analytical & Problem-Solving Skills
- Commitment and Accountability



INFRASTRUCTURE PREREQUISITES

CLASSROOM & EQUIPMENTS

- Well-equipped classroom
- LCD Projector and System/Laptop for live demonstration
- Whiteboard, Markers & Eraser
- Chart paper & Markers
- Sticky Pads

IT INFRASTRUCTURE REQUIREMENTS

- Lab equipped with the following
 - PCs/Laptops
 - Internet with Wi-Fi (Min 2 Mbps Dedicated)
- Virtual Classroom Setup – Official Zoom Or Microsoft Teams License
- Official Microsoft Office 360 License
- Licensed Google Drive or Google Classroom for sharing documents





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ARTIFICIAL
INTELLIGENCE
WITH PYTHON

