



## CENTRE FOR DEVELOPMENT OF ADVANCED COMPUTING

A-34, PHASE VIII, INDUSTRIAL AREA, MOHALI

TELEPHONE NO: 0172-2237052-55, 6619000 FAX: 0172-2237050

E-mail: [etd@cdac.in](mailto:etd@cdac.in), [enquiry-mohali@cdac.in](mailto:enquiry-mohali@cdac.in), Whatsapp: 76278 90037, Website: [www.cdac.in](http://www.cdac.in),

### **Industrial Training on Artificial Intelligence and Data Analytics**

**Duration:** 26 Weeks @ 3 hrs./day

**ELIGIBILITY:** B.E./B.TECH., MCA, M.Sc., M.Tech. Final year students

#### **COURSE CONTENT:**

S. No.	Topic
1	<b>Python Programming for Artificial Intelligence</b> <ul style="list-style-type: none"><li>- Introduction, Keywords and Identifiers, data types, variables, operators, Input and output operations; Environment Setup.</li><li>- Control Flow - Decision Control, Loop statements etc.; File Handling, Exception Handling</li><li>- Data Structures - Lists, Tuples, String, Dictionary, Sets;</li><li>- Functional Programming - function types, Recursive Functions, Lambda functions, modules and packages;</li><li>- Python Libraries - numPy, Numerical operations, matplotlib, Pandas, etc.</li></ul>
2	<b>Mathematics for Artificial Intelligence (AI) and Data Analytics</b> <ul style="list-style-type: none"><li>- Linear Algebra – Vector, Scalar, Matrix and operations on matrix;</li><li>- Probability – Basics, sampling, conditional probability, dependent and independent events;</li><li>- Basics of Statistics - Measures of Central Tendencies, Variance; Probability Distribution, Sampling Theory, Correlation, Regression, Outliers</li></ul>
3	<b>Introduction to AI and Data Analytics</b> <ul style="list-style-type: none"><li>- Introduction, Evolution &amp; History of AI, Various application areas (Healthcare, Surveillance, Analytics, and Cyber Security etc.), Scientific Applications;</li><li>- Introduction to Machine Learning (ML) and Deep Learning (DL), AI vs. ML vs. DL, ML algorithms, Purpose or Objective, Variety of Algorithms</li><li>- Introduction to Data &amp; it's analysis process, Types of Data, Data vs. Information vs. Knowledge, Data Analytics Ecosystem</li></ul>
4	<b>Exploratory Data Analysis (EDA) &amp; Visualization</b> <ul style="list-style-type: none"><li>- <b>Data Processing</b> – Data preparation, pre-processing (balance, noise, co-linearity, normalization/rescaling), Data cleaning and transformation, validation and modelling of data; Feature Engineering – feature selection techniques, feature optimization, dimensionality reduction (Principal Component Analysis), eigenvalues and eigenvectors;</li><li>- <b>Data Visualization</b> – Histogram, 2D and 3D scatter plot, pair plots, Limitations of pair plots, Box-plot, time-series plot, Contour Plot</li></ul>

5	<p><b>Machine Learning</b></p> <ul style="list-style-type: none"> <li>- Basics of Machine Learning, ML Types – Supervised, Unsupervised and Reinforcement Learning, Applications of ML;</li> <li>- Classification Algorithms – Linear &amp; logistic regressions (gradient descent, MSE, loss function, cross-entropy),</li> <li>- Support Vector Machine (kernel function, support vector), Naïve Bayesian Classifier, Decision Tree, Random Forest;</li> <li>- Clustering Algorithm – k-means, Hierarchical</li> <li>- Model evaluation – under fitting vs. over fitting, confusion matrix, ROC, precision, recall, F1, MSE, bias &amp; variance.</li> </ul>
6	<p><b>Deep Learning</b></p> <ul style="list-style-type: none"> <li>- Introduction, History of Neural Networks and Deep Learning, Basics of Biological Neurons;</li> <li>- Deep Multi-layer Perceptron (MLP): Notation, Back propagation algorithm, Activation functions, Dropout layers &amp; Regularization, Rectified Linear Units (ReLU), Weight initialization, Batch Normalization, Softmax for multi-class classification;</li> <li>- Artificial Neural Network – Convolution Neural Network (CNN), Convolution, Edge Detection on images, Padding and strides, Convolution over RGB images, Convolutional layer, Max-pooling, RNN, LSTM, Neural network models using Keras using Tensorflow, Transfer Learning.</li> </ul>
7	<p><b>Tools &amp; Applications for AI and Data Analytics</b></p> <ul style="list-style-type: none"> <li>- Hands-on with Data Analytics Tools – Tableau, PowerBI</li> <li>- Case Studies – Healthcare data processing, Agriculture Data Processing, Image/Video Processing – Face recognition, object classification</li> </ul>
8	<p><b>Project Work</b></p>