**3. Ai and Ml Syllabus ­­**

**(K.M.IQBAL, Duration : 16weeks – 180 Hours, lessons - 18)**

Here’s a **general employability-focused AI and ML syllabus** designed to help you acquire practical skills and knowledge needed to secure a role in AI, Machine Learning, or related fields. This syllabus emphasizes hands-on experience and real-world applications.

**Topics Covered:**

**1. Foundations of AI and ML**

* Introduction to Artificial Intelligence and Machine Learning
* Differences between AI, ML, and Deep Learning
* Applications of AI and ML in Industry

**2. Mathematics and Statistics for AI/ML**

**Linear Algebra**

* Vectors and Matrices
* Matrix Operations
* Eigenvalues and Eigenvectors

**Calculus**

* Derivatives and Integrals
* Partial Derivatives
* Gradient and Optimization

**Probability and Statistics**

* Basic Probability Theory
* Probability Distributions (Normal, Binomial, Poisson)
* Hypothesis Testing
* Bayesian Inference

**3. Programming and Implementation Skills**

**Python Programming**

* Syntax and Control Structures
* Functions, Lambda Expressions
* Object-Oriented Programming

**Libraries and Frameworks**

* **NumPy:** Numerical operations
* **Pandas:** Data manipulation and cleaning
* **Scikit-learn:** ML algorithms and model evaluation
* **TensorFlow & Keras:** Deep learning models
* **PyTorch:** Neural networks and deep learning

**Data Handling and Preprocessing**

* Data Cleaning and Transformation
* Handling Missing Values and Outliers
* Data Encoding and Normalization
* Feature Engineering and Extraction

**4. Machine Learning Algorithms**

**Supervised Learning**

* Regression Techniques:
* Linear Regression
* Polynomial Regression
* Ridge and Lasso Regression
* Classification Algorithms:
* Logistic Regression
* Decision Trees and Random Forests
* Support Vector Machines (SVM)
* Naive Bayes
* k-Nearest Neighbors (KNN)

**Unsupervised Learning**

* Clustering Techniques:
* K-Means Clustering
* Hierarchical Clustering
* DBSCAN
* Dimensionality Reduction:
* Principal Component Analysis (PCA)
* t-SNE

**Reinforcement Learning**

* Markov Decision Processes (MDP)
* Q-Learning
* Deep Q-Networks (DQNs)
* Policy Gradient Methods

**5. Deep Learning and Neural Networks**

**Neural Network Fundamentals**

* Perceptron and Multilayer Perceptrons (MLP)
* Activation Functions (ReLU, Sigmoid, Tanh)
* Backpropagation and Gradient Descent
* Optimization Techniques: Adam, RMSprop

**Deep Learning Architectures**

* Convolutional Neural Networks (CNNs):
* Image Processing and Feature Extraction
* Recurrent Neural Networks (RNNs):
* Sequence and Time Series Data
* Long Short-Term Memory (LSTM) Networks:
* Handling Long-Term Dependencies
* Autoencoders:
* Dimensionality Reduction and Anomaly Detection
* Generative Adversarial Networks (GANs):
* Image Generation and Data Augmentation

**6. Natural Language Processing (NLP)**

* Text Preprocessing:
* Tokenization, Lemmatization, Stemming
* Text Representation:
* Bag of Words (BoW)
* TF-IDF (Term Frequency-Inverse Document Frequency)
* Word Embeddings (Word2Vec, GloVe)
* Deep Learning for NLP:
* Transformers (BERT, GPT)
* Sequence-to-Sequence Models (Seq2Seq)
* Attention Mechanisms
* Applications:
* Sentiment Analysis
* Named Entity Recognition (NER)
* Machine Translation
* Text Summarization

**7. Model Evaluation and Optimization**

* Model Performance Metrics:
* Classification: Accuracy, Precision, Recall, F1-Score, ROC-AUC
* Regression: MSE, RMSE, MAE, R²
* Cross-Validation Techniques:
* K-Fold Cross-Validation
* Leave-One-Out Cross-Validation
* Hyperparameter Tuning:
* Grid Search
* Random Search
* Bayesian Optimization

**8. AI and ML System Design**

* Data Pipeline and Workflow Management
* MLOps and CI/CD for ML Models
* Model Versioning and Experiment Tracking (MLflow)
* Model Deployment:
* RESTful APIs using Flask or FastAPI
* Model Serving with TensorFlow Serving or TorchServe
* Containerization using Docker and Kubernetes

**9. Big Data and Distributed Computing**

* Distributed Data Processing:
* Hadoop and MapReduce
* Apache Spark for Big Data Analytics
* Data Storage Solutions:
* SQL and NoSQL Databases
* Data Lakes and Data Warehousing

**10. Cloud Platforms and Deployment**

* Cloud AI and ML Services:
* AWS SageMaker
* Google AI Platform
* Azure Machine Learning
* Model Deployment on Cloud
* Edge AI and On-Device Learning

**11. AI Ethics and Fairness**

* Bias and Fairness in Machine Learning Models
* Explainable AI and Accountability
* Data Privacy and GDPR Compliance

**12. Choose something a project.**

* **Project 1:** Image Classification with CNNs (Keras)
* **Project 2:** Sentiment Analysis with Transformers (BERT)
* **Project 3:** Predictive Maintenance with Time Series Analysis
* **Project 4:** Fraud Detection with Anomaly Detection Techniques

**13. Soft Skills and Interview Preparation**

* Problem-Solving and Critical Thinking
* Communication Skills for Technical and Non-Technical Audiences
* Resume Building and Portfolio Creation
* Mock Interviews and Coding Challenges
* Building a GitHub Portfolio with Real-World Projects

**Educational Background**

* **Bachelor’s Degree** in:
* BE / B.Tech (From any Branch)
* BBA / B.Com / BSc (in any Branch)
* **Master’s Degree**
* M.Tech / MBA / MCA / M.Sc. / M.Com (in any Branch)

**AI and ML tools**

**TensorFlow** / **PyTorch** / **Scikit-learn** / **Keras** / **XGBoost** / **CatBoost / OpenCV**

**Hugging Face Transformers /**  **Fast.ai** / **Apache MXNet** / **MLflow** / **DVC** / **Airflow** / **Kubeflow**