PROGRAMMING FOR ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Code: CS33111CS	Course Type: Core	Semester: I
Evolution Scheme (TA-MSE-ESE): 20-30-100	Total Marks: 150	L-T-P (Credits): 2-0-2 (3)

Pre-Requisites: Programming in Python, Data Structures, Probability & Statistics, Linear Algebra

To equip students with advanced programming skills, mathematical foundations, and practical implementation techniques required for developing intelligent systems using Artificial Intelligence and Machine Learning frameworks.

Course Outcomes: At the end of the course, the student will be able to

CO-1	Understand programming paradigms and computational foundations for AI and ML.
CO-2	Develop machine learning models using modern programming libraries and frameworks.
CO-3	Implement deep learning architectures for real-world AI applications
CO-4	Design and optimize end-to-end AI pipelines for research and industrial deployment.

Course Articulation Matrix:

PO	PEO-1	PEO-2	PEO-3	PEO-4	PEO-5
CO 1	3	2	1	-	-
CO 2	3	3	2	1	-
CO 3	3	2	3	2	1
CO 4	3	3	2	1	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Unit-1: Foundations of AI Programming

Introduction to Artificial Intelligence and Machine Learning, AI problem-solving paradigms, intelligent agents, search algorithms, state-space representation, Python programming for AI, NumPy, Pandas, matrix operations, statistical computation, data preprocessing, feature engineering, handling missing data, normalization, and standardization.

Unit-2: Machine Learning Programming Frameworks

Supervised and unsupervised learning implementation using Scikit-learn, regression algorithms, classification algorithms, clustering, dimensionality reduction, cross-validation, hyperparameter tuning, performance metrics, ROC-AUC, confusion matrix, model evaluation techniques, and pipeline creation.

Unit-3: Deep Learning Programming
Introduction to neural networks, backpropagation, activation functions, optimization techniques, programming with PyTorch / TensorFlow, CNNs, RNNs, LSTM, transfer learning, model fine tuning, GPU programming, batch training, checkpointing, early stopping.

Unit-4: Advanced AI Programming and Applications
Transformer models, attention mechanisms, NLP programming, computer vision pipelines, reinforcement learning basics, model deployment using APIs, cloud-based AI services, explainable AI, model interpretability using Grad-CAM, SHAP, prototype-based learning, and real-world case studies.

Learning Resources:

Text Books:

1. **Aurélien Géron**, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 3rd Edition, O'Reilly Media, 2022.
2. **Ian Goodfellow, Yoshua Bengio, Aaron Courville**, *Deep Learning*, MIT Press, 2016. 3. **Christopher M. Bishop**, *Pattern Recognition and Machine Learning*, Springer, 2006. 4. **Kevin P. Murphy**, *Machine Learning: A Probabilistic Perspective*, MIT Press, 2012. 5. **Stuart Russell and Peter Norvig**, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson, 2021.

Reference Books:

1. **Trevor Hastie, Robert Tibshirani, Jerome Friedman**, *The Elements of Statistical Learning*, 2nd Edition, Springer, 2009.
2. 2. **François Chollet**, *Deep Learning with Python*, 2nd Edition, Manning Publications, 2021. 3. **Richard S. Sutton and Andrew G. Barto**, *Reinforcement Learning: An Introduction*, 2nd Edition, MIT Press, 2018.