COURSE CONTENT

MACHINE LEARNING								
II Semester: CSD / CSE / CSM								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
2540513	Core	3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		
Prerequisites: Data Structures, Mathematical Statistical Foundation								

Course Overview:

Machine learning is a subset of AI, which uses algorithms that learn from data to make predictions. These predictions can be generated through supervised learning, where algorithms learn patterns from existing data, or unsupervised learning, where they discover general patterns in data. Supervised Learning: Uses labeled data to train models (e.g., classification and regression).Unsupervised Learning: Finds hidden patterns in unlabeled data (e.g., clustering and dimensionality reduction).Reinforcement Learning: Trains agents to make decisions through trial and error to maximize rewards.

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To have a thorough understanding of the Supervised and Unsupervised learning techniques
3. To study the various probability-based learning techniques

Course Outcomes: After Completion of the Course, Students should be able to

1. Explain core concepts of machine learning including learning types, problem formulation, model preparation, evaluation techniques, and feature engineering principles.
2. Analyze feature transformation and selection techniques along with probability foundations and Bayesian models for classification and reasoning under uncertainty.
3. Apply supervised learning methods involving regression and classification algorithms such as linear models, KNN, decision trees, support vector machines, and ensemble techniques.
4. Examine unsupervised learning approaches including clustering methods such as k-Means, hierarchical clustering, and density-based algorithms for pattern discovery.
5. Interpret artificial neural networks, deep learning fundamentals, reinforcement learning concepts, and real-world machine learning applications.

UNIT - I

Introduction to Machine Learning: Types of Human learning, machine learning process, Well-posed learning problem, Types of machine learning and comparison, applications of machine learning. Model Preparation, Evaluation and feature engineering: Machine learning activities, Types of data in machine learning, dataset understanding, plotting and exploration, checking data quality, remediation, data pre-processing, selecting a model, predictive and descriptive models, supervised learning model training, cross-validation and boot strapping,

lazy vs eager learner, interpreting the model- underfitting, overfitting, bias-variance trade-off. Parameter for evaluating performance of classification, regression, and clustering model. Improving performance of a model.

UNIT - II

Feature Engineering: Feature transformation - feature construction, feature extraction by PCA, SVD, LDA. Feature subset selection — feature relevancy and redundancy measures. Feature selection process and approaches.

Review of Probability concepts: joint probability, conditional probability, bayes rule, Common discrete and continuous distributions, dealing with multiple random variables, central limit theorem. Bayes classifier, Multi-class Classification, Naïve Bayes classifier, Bayesian belief network.

UNIT - III

Supervised Learning - Introduction to supervised learning

Regression: Introduction of regression, Regression algorithms: Simple linear regression, Multiple linear regression, Polynomial regression model, Logistic regression, Maximum likelihood estimation.

Classification: Classification model and learning steps, Classification algorithms: Naïve Bayes classifier, Distance measures, k-Nearest Neighbor (kNN), Decision tree, Support vector machines, Kernel trick, Random Forest.

UNIT - IV

Unsupervised Learning: Introduction to unsupervised learning, Unsupervised vs supervised learning, Application of unsupervised learning, Clustering and its types, Partitioning method: k-Means and K- Medoids, Hierarchical clustering, Density-based methods – DBSCAN.

UNIT - V

Artificial Neural Network: Biological neuron, Artificial neuron, Activation functions, neural network architecture, perceptron, learning process in ANN, Back propagation.

Introduction to deep learning, overview of reinforcement learning, Representation learning, Evolutionary learning. Case-study of ML applications: Image recognition, Email spam filtering, Online fraud detection.

TEXT BOOKS:

1. Saikat Dutt, S. Chjandramouli, Das – Machine Learning, Frist Edition, Pearson
2. M N Murty, Anathanarayana V S – Machine Learning, First Edition, University Press
3. Tom M Mitchell, ―Machine Learning, First Edition, McGraw Hill Education, 2013.

REFERENCE BOOKS:

1. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective, Second Edition,
2. Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

ELECTRONIC RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc19_cs52/preview
2. https://ece.iisc.ac.in/~parimal/2019/ml.html
3. https://www.springer.com/gp/book/9780387848570
4. https://www.cse.iitb.ac.in/~sunita/cs725/calendar.html

5. https://www.analyticsvidhya.com/blog/2018/12/guide,convolutional,neural,network,cn/
6. https://cs.nyu.edu/~mohri/mlu11/

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)