COURSE CONTENT

MACHINE LEARNING								
II Semester: M.Tech CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BCSE04	Core	3	0	0	3	40	60	100
Contact Classes: 45	Total Tutorials: Nil	Total Practical Classes: Nil				Total Classes: 45		
Prerequisites: There are no prerequisites to take this course.								

I. COURSE OVERVIEW:

The Machine Learning course provides a comprehensive introduction to the core principles, algorithms, and applications of machine learning. It begins with foundational concepts, exploring types of learning, supervised models, and hypothesis evaluation through linear models like perceptron and regression. The course advances into deep learning with multi,layer perceptrons and backpropagation, and introduces alternative models like radial basis function networks and support vector machines. Decision tree learning and ensemble techniques such as bagging and boosting are covered along with clustering methods and Gaussian mixture models. Dimensionality reduction techniques including PCA, LDA, and Isomap are presented to handle high, dimensional data, followed by evolutionary approaches using genetic algorithms. The final module emphasizes real, world applications, covering time series forecasting, recommender systems, and text analytics, with use cases across various sectors such as healthcare, transport, and retail. Overall, the course balances theory and practical insights to prepare students for applying machine learning techniques in diverse domains.

II. COURSES OBJECTIVES:

The students will try to learn:

I. Fundamental concepts and types of machine learning and enable students to understand and implement basic supervised learning algorithms such as perceptrons, linear regression, and concept learning models.
II. The ability to apply and analyze advanced learning models, including multi,layer perceptrons, backpropagation, radial basis functions, and support vector machines for real,world classification and regression tasks.
III. Techniques for unsupervised learning, dimensionality reduction, and ensemble methods, fostering skills in clustering, decision tree construction, PCA, and evolutionary algorithms.
IV. Practical machine learning applications and advanced topics such as time series forecasting, recommender systems, sentiment analysis, and their deployment in sectors like healthcare, transport, and retail.

III. COURSE OUTCOMES:

At the end of the course, students should be able to:

CO1 Explain the types of machine learning and the fundamentals of supervised learning by relating it to biological models like the brain and neuron structure.
CO2 Apply the backpropagation algorithm to train MLPs and demonstrate their use in practical scenarios.
CO3 Implement unsupervised learning techniques, particularly K, Means clustering, for pattern discovery in unlabeled datasets
CO4 Illustrate the concept of evolutionary learning and analyze the functioning of genetic algorithms, including genetic operators and offspring generation.
CO5 Design and implement basic genetic algorithm, based solutions for real,world problem, solving scenarios.
CO6 Evaluate the applicability of various machine learning algorithms in real, world domains such as manufacturing, retail, transport, healthcare, weather, and insurance.

V. COURSE CONTENT:

MODULE, I: Introduction to Machine Learning (9)

Learning, Types of Machine Learning, Supervised Learning, The Brain and the Neuron, Design a Learning System, Perspectives and Issues in Machine Learning, Concept Learning Task, Concept Learning as Search, Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Linear Discriminants:,Perceptron, Linear Separability, Linear Regression.

MODULE, II: Multi layer Perceptron (8)

Multilayer Perceptron, Going Forwards, Going Backwards: Back Propagation Error, Multilayer Perceptron in Practice, Examples of using the MLP, Overview, Deriving Back, Propagation, Radial Basis Functions and Splines, Concepts, RBF Network, Curse of Dimensionality, Interpolations and Basis Functions, Support Vector Machines

MODULE, III: Learning with Trees (10)

Learning with Trees, Decision Trees, Constructing Decision Trees, Classification and Regression Trees, Ensemble Learning, Boosting, Bagging, Different ways to Combine Classifiers, Basic Statistics, Gaussian Mixture Models, Nearest Neighbor Methods, Unsupervised Learning, K means Algorithms

MODULE, IV: Dimensionality Reduction (9)

Dimensionality Reduction, Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis, Locally Linear Embedding, Isomap, Least Squares Optimization Evolutionary Learning, Genetic algorithms, Genetic Offspring: Genetic Operators, Using Genetic Algorithms

MODULE -V: Advanced Topics and use Cases (8)

Forecasting: Decomposing Time Series, ARIMA Model, Recommender Systems: Association Rules, Collaborative Filtering, Matrix Factorization, Text Analysis: Sentiment Classification, Navie Bayes Model for Sentiment Classification, Use Cases of various ML Algorithms: Manufacturing, Retail, Transport, Healthcare, weather, insurance sectors.

VI. TEXTBOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, PHI, 3rd Edition, 2014.
2. Stephen Marsland, “Machine Learning, An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. M Pradhan and U Dinesh Kumar, “Machine Learning using Python”, WILEY, 2019.

VII. REFERENCE BOOKS:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, MIT Press, 2nd Edition, 2018.
2. Tom M Mitchell, “Machine Learning”, First Edition, McGraw Hill Education, 2013.
3. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, First Edition, Cambridge University Press, 2012.
4. Jason Bell, “Machine learning, Hands on for Developers and Technical Professionals”, First Edition, Wiley, 2014

VIII.WEB REFERENCES:

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,cnn/
6. https://cs.nyu.edu/~mohri/mlu11/

IX. MATERIALS ONLINE

1. Course template
2. Tutorial question bank

3. Tech talk 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. Power Point presentation
11. E-Learning Readiness Videos (ELRV)