	MACHINE LEARNING		Semester	6
	Course Code	**BCS602**	CIE Marks	50
	Teaching Hours/Week (L: T:P: S)	4:0:0:0	SEE Marks	50
	Total Hours of Pedagogy	50	Total Marks	100
	Credits	04	Exam Hours	03
	Examination type (SEE)	Theory		

Course objectives:

- To introduce the fundamental concepts and techniques of machine learning.
- To understanding of various types of machine learning and the challenges faced in real-world applications.
- To familiarize the machine learning algorithms such as regression, decision trees, Bayesian models, clustering, and neural networks.
- To explore advanced concept like reinforcement learning and provide practical insight into its applications.
- To enable students to model and evaluate machine learning solutions for different types of problems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation/Demonstration to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem/Practical Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills, and practical skill such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Use animations/videos to help the students to understand the concepts.
7. Demonstrate the concepts using PYTHON and its libraries wherever possible

Module-1

Introduction: Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Applications.

Understanding Data – 1: Introduction, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization.

Chapter-1, 2 (2.1-2.5)

Module-2

Understanding Data – 2: Bivariate Data and Multivariate Data, Multivariate Statistics, Essential Mathematics for Multivariate Data, Feature Engineering and Dimensionality Reduction Techniques.

Basic Learning Theory: Design of Learning System, Introduction to Concept of Learning, Modelling in Machine Learning.

Chapter-2 (2.6-2.8, 2.10), Chapter-3 (3.3, 3.4, 3.6)

Module-3

	Similarity-based Learning: Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR). **Regression Analysis:** Introduction to Regression, Introduction to Linear Regression, Multiple Linear Regression, Polynomial Regression, Logistic Regression. **Decision Tree Learning:** Introduction to Decision Tree Learning Model, Decision Tree Induction Algorithms. **Chapter-4 (4.2-4.5), Chapter-5 (5.1-5.3, 5.5-5.7), Chapter-6 (6.1, 6.2)**
	Module-4
	Bayesian Learning: Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model, Naïve Bayes Algorithm for Continuous Attributes. **Artificial Neural Networks:** Introduction, Biological Neurons, Artificial Neurons, Perceptron and Learning Theory, Types of Artificial Neural Networks, Popular Applications of Artificial Neural Networks, Advantages and Disadvantages of ANN, Challenges of ANN. **Chapter-8 (8.1-8.4), Chapter-10 (10.1-10.5, 10.9-10.11)**
	Module-5
	Clustering Algorithms: Introduction to Clustering Approaches, Proximity Measures, Hierarchical Clustering Algorithms, Partitional Clustering Algorithm, Density-based Methods, Grid-based Approach. **Reinforcement Learning:** Overview of Reinforcement Learning, Scope of Reinforcement Learning, Reinforcement Learning as Machine Learning, Components of Reinforcement Learning, Markov Decision Process, Multi-Arm Bandit Problem and Reinforcement Problem Types, Model-based Learning, Model Free Methods, Q-Learning, SARSA Learning. **Chapter -13 (13.1-13.6), Chapter-14 (14-1-14.10)**

Course outcome (Course Skill Set)

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

1. Describe the machine learning techniques, their types and data analysis framework.
2. Apply mathematical concepts for feature engineering and perform dimensionality reduction to enhance model performance.
3. Develop similarity-based learning models and regression models for solving classification and prediction tasks.
4. Build probabilistic learning models and design neural network models using perceptrons and multilayer architectures
5. Utilize clustering algorithms to identify patterns in data and implement reinforcement learning techniques

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. S Sridhar, M Vijayalakshmi, "Machine Learning", OXFORD University Press 2021, First Edition.

Reference Books

1. Murty, M. N., and V. S. Ananthanarayana. Machine Learning: Theory and Practice, Universities Press, 2024.
2. T. M. Mitchell, "Machine Learning", McGraw Hill, 1997.
3. Burkov, Andriy. *The hundred-page machine learning book*. Vol. 1. Quebec City, QC, Canada: Andriy Burkov, 2019.

Web links and Video Lectures (e-Resources):

- **https://www.universitiespress.com/resources?id=9789393330697**
- https://www.drssridhar.com/?page_id=1053
- Machine Learning Tutorials: https://www.geeksforgeeks.org/machine-learning/
- Machine Learning Tutorials: https://www.tutorialspoint.com/machine_learning/index.htm
- Python for Machine Learning: https://www.w3schools.com/python/python_ml_getting_started.asp
- Introduction to Machine Learning: https://onlinecourses.nptel.ac.in/noc22_cs29/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Practical Assignment: Implementation of Practical Exercises Chapter 2: Q1-Q4, Chapter 3: Q1, Chapter-4: Q1, Chapter-7: Q1, Chapter-8: Q1 **- 10 Marks.**
  (Note: Refer to ***Reference book 1*** for programming assignments **https://www.universitiespress.com/resources?id=9789393330697)**
- Course project: By considering suitable machine learning-based real-world application problem **[15 Marks]**

	Blockchain Technology		Semester	6
	Course Code	**BCS613A**	CIE Marks	50
	Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
	Total Hours of Pedagogy	40	Total Marks	100
	Credits	03	Exam Hours	03
	Examination type (SEE)	Theory		

Course objectives:

- To Understand Blockchain terminologies with its applications. design
- To learn working principles of Blockchain and methodologies used in Bitcoin
- To gain knowledge on Ethereum Network, Wallets, Nodes, Smart contract & DApps
- To learn blockchain Based Application Architecture using Hyperledger and the Smart Contract Lifecycle

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation/Demonstration to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
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6. Use animations/videos to help the students to understand the concepts.

Module-1

Distributed systems, CAP theorem, Byzantine Generals problem, Consensus. The history of blockchain, Introduction to blockchain, Various technical definitions of blockchains, Generic elements of a blockchain, Features of a blockchain, Applications of blockchain technology, Tiers of blockchain technology, Consensus in blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain.

Chapter 1

Module-2

Decentralization using blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, Decentralized autonomous organizations, Decentralized autonomous corporations, Decentralized autonomous societies Decentralized applications, Platforms for decentralization.

Cryptographic primitives: Symmetric cryptography, Asymmetric cryptography, Public and private keys, Hash functions: Compression of arbitrary messages into fixed length digest, Easy to compute, Pre-image resistance, Second pre-image resistance, Collision resistance, Message Digest (MD),Secure Hash Algorithms (SHAs), Merkle trees, Patricia trees, Distributed hash tables (DHTs), Digital signatures, Elliptic Curve Digital signature algorithm (ECDSA).

Chapter 2, Chapter 3: pg:56-105

Module-3