WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(AN AUTONOMOUS INSTITUTE)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University,
Solapur

Computer Science and Engineering

CHOICE BASED CREDIT SYSTEM (CBCS)

Structure and Syllabus for
Honors Degree in
Artificial Intelligence and Machine Learning

S.Y. B. Tech. Computer Science and Engineering W.E.F. 2023-24

Computer Science and Engineering Department

Department Vision

To produce globally competent engineers in Computer Science & Engineering with ethical values and research aptitude, who will address the challenges of modernization in the IT industry and aim at overall sustainable development of the society.

Department Mission

- **M1** - To impart quality education in the field of Computer Science & Engineering in accordance with the needs of the Modernization & Globalization through technology enabled education.
- **M2 -** To inculcate lifelong learning in students to face challenges posed by ever-changing IT career landscape as a disciplined professional with a sense of professional ethics.
- **M3 -** To develop critical thinking and creativity for identifying various societal issues and to provide solutions.
- **M4 -** To enhance career opportunities for students through academia-industry interaction and research.

Computer Science & Engineering Department
Under Graduate Programme
Program Educational Objectives (PEOs)

1. Graduates will exhibit strong fundamental knowledge and technical skills in the field of Computer Science & Engineering to pursue successful professional career, higher studies and research.
2. Graduates will exhibit capabilities to understand and resolve various societal issues through their problem solving skills.
3. Graduates will be sensitive to ethical, societal and environmental issues as a software engineering professional and be committed to life-long learning.

Program Outcomes (POs)

The program outcomes of B. Tech. Computer Science & Engineering Programme are summarized as follows:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. - Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Engineering graduate in Computer Science & Engineering Programme will be able to do-

1. Apply the principles of computational mathematics, computer systems and programming paradigms to solve computational problems.
2. Design and develop application software with functionalities applicable for desktop, web and mobile applications with due consideration of system software constraints.
3. Apply software engineering methods, cutting edge technologies, and ICT using appropriate tools and FOSS alternatives for designing, developing & testing application software.

Legends used–

L	Lecture Hours / week
T	Tutorial Hours / week
P	PracticalHours / week
FA	Formative Assessment
SA	Summative Assessment
ESE	End Semester Examination
ISE	In Semester Evaluation
ICA	Internal Continuous Assessment
POE	Practical and Oral Exam
OE	Oral Exam
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B.Tech.	Bachelor of Technology

Course Code Format for Honors:

2	**1**	**E**	**T**	**U/P**	**2**	**H**	**A**	**C**	**C**	**1**	**T/L**
Year of Syllabus revision		Program Code		U-Under Graduate, P-Post Graduate	Semester No. / Year 1/2/3/…8	Honors Code		Course Code		Course Serial No. 1-9	T-Theory, L-Lab session

Program Code	
CS	Computer Science and Engineering
Honors Code	
HA	Honors in Artificial Intelligence and Machine Learning

Sample Course Code:

21CSU4HA1T	Foundations and Applications of Machine Learning

Walchand Institute of Technology, Solapur
Computer Science and Engineering
Honors in Artificial Intelligence and Machine Learning

Structure of S. Y. B. Tech. Computer Science and Engineering
(W.E.F. 2023-2024)

Semester- IV

Course Code	Theory Course Name	Engagement Hours			Credits	FA	SA		Total
		L	T	P		ESE	ISE	ICA	
22CSU4HA1T	Foundations and Applications of Machine Learning	3	-	-	3	60	40	--	100
22CSU4HA1L	Foundations and Applications of Machine Learning	--	1	--	1			25	25
	Grand Total	**3**	**1**	**-**	**4**	**60**	**40**	**25**	**125**

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

S.Y. B. Tech. (Computer Science and Engineering), Semester-IV

22CSU4HA1T – FOUNDATIONS AND APPLICATIONS OF MACHINE LEARNING

Teaching Scheme:
Lecture: 3 hrs/week, 3 credits
Tutorial : 1 hrs/week, 1 credit

Examination Scheme:
ESE : 60 Marks
ISE : 40 Marks
ICA : 25 Marks

Introduction: This course provides a foundational understanding of machine learning models as well as demonstrates, how these models can solve the real-time problems.,

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Course Prerequisite: Basics of Data Structures and Programming, Probability, Statistics

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Course Objectives:

1. To introduce various types of machine learning algorithms.
2. To enable the designing of a model selecting appropriate machine learning algorithms for a given problem.
3. To study methods to validate previously designed machine learning models.
4. To introduce methods to evaluate and tune machine learning models.

Course Outcomes:

At the end of the course, students will be able to

1. Demonstrate types of machine learning algorithms.
2. Design a model by selecting an appropriate machine learning algorithm for a given Problem.
3. Validate the designed machine learning model.
4. Evaluate and tune machine learning models based on various parameters.
5. Apply machine learning algorithms for various use cases.

SECTION-I

Unit 1 - Introduction to Machine Learning **(07)**

What is Machine Learning? How do machines learn, Well-posted learning problem Types of Machine Learning: Supervised learning, unsupervised learning, Reinforcement learning, Comparison – supervised, unsupervised and reinforcement learning, Problems not to be solved using Machine Learning, State-of-The-Art Languages/Tools in Machine Learning.

Unit 2 – Preparing to Model **(07)**

Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Basics of Feature Engineering: Introduction, Feature Transformation, Importance of Statistical Tools in Machine Learning, Data Pre-processing,

Unit 3 – Modeling and Evaluation **(06)**

Introduction, Selecting a Model, Training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model.

SECTION-II

Unit 4: Supervised Learning **(12)**

Classification: Introduction, Examples of Supervised Learning, Classification model, Classification learning steps, Common Classification Algorithms-Naïve Bayes classifier- Bayes theorem, Applications of Bayes classifier, Handling continuous numeric features in Bayes classifier, k-Nearest Neighbors (k-NN), Decision tree, Random Forest model, Support Vector Machine.

Regression: Introduction, Examples of regression, Common regression algorithms-Simple Linear regression, Multiple linear regression, Assumptions in regression analysis, Main Problems in regression analysis, Improving the accuracy of the linear regression model, Polynomial regression model, logistic regression model.

Unit 5: Unsupervised Learning **(08)**

Introduction, Unsupervised vs Supervised learning, Applications of Unsupervised learning, Clustering: Clustering as a Machine learning task, different types of clustering techniques, Partitioning methods, k-means algorithm, k-medoids, Hierarchical clustering, Density based methods-DBSCAN, finding patterns using association rule-Definition of common terms, Association rule, Apriori algorithm.

Unit 6: Applications of Machine learning **(5)**

Applying Learning to Real Problems, Classifying Images, Scoring Opinions and Sentiments, Recommending Products and Movies, Using Machine Learning to Provide Solutions to Business Problems, Future of Machine Learning.

ISE Evaluation: ISE Evaluation for the course will consist of three tests based on the topics mentioned in the syllabus .

Internal Continuous Assessment (ICA):

Minimum 10 assignments requiring students to develop machine learning applications for real-world problems/use- cases/scenarios based on any of the following topics:

1. Basic mathematics for Machine Learning – Simulating solutions using Python to: I. Matrix operations II. Problems using Probability
2. Data exploration, Visualization and Preprocessing
3. Linear and Multilinear Regression
4. Decision Tree regressor
5. K-Nearest Neighbour (KNN) classifier
6. Logistic Regression classifier
7. Support vector machine (SVM) Classifier
8. Decision Tree classifier
9. Naive-Bayes classifier

10. Ensemble Models
11. K-means clustering (Unsupervised Learning)
12. Improving Machine Learning models using cross-validation and Hyper parameters tuning

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Text Books:

1. Machine Learning - Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson Publication.
2. Machine Learning for Dummies by John Paul Mueller, Luca Massaron (Published by For Dummies; First edition).

Reference Books:

1. Machine Learning by Tom M. Mitchell (Publisher: McGraw Hill Education; First edition + New Chapters from Second edition).
2. 2. Introduction to Machine Learning (Second Edition) by Ethem Alpaydın (published by The MIT Press Cambridge, Massachusetts London, England
3. Machine Learning with Python for Everyone by Mark E. Fenner , Pearson Publication