WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(AN AUTONOMOUS INSTITUTE)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University, Solapur

B.Tech. Electronics and Telecommunication Engineering

CHOICE BASED CREDIT SYSTEM (CBCS)

Structure and Syllabus for

Honors Degree in Artificial Intelligence and Machine Learning

S.Y. B. Tech. Electronics and Telecommunication Engineering W.E.F. 2022-23
T.Y. B. Tech. Electronics and Telecommunication Engineering W.E.F. 2023-24
Final Year B. Tech Electronics and Telecommunication Engineering W.E.F. 2024-25

Electronics and Telecommunication Engineering Department

Department Vision

To be a distinguished center for nurturing the holistic development of competent young engineers in the electronics and allied field.

Department Mission

1. To inculcate and stimulate Electronics & allied Engineering proficiency amongst students through quality education and innovative educational practices.
2. To create engineering professionals with social consciousness.
3. To foster technical skills of students through creativity and critical thinking.
4. To enhance soft skill set of students which is crucial for career success through effectual training.

Electronics and Telecommunication Engineering
Under Graduate Program

Program Educational Objectives (PEOs)

1. Graduates will exhibit strong fundamental knowledge and technical skills in Electronics and Telecommunication Engineering and allied fields.
2. Graduates will manifest technological progression, hardware & software skills to fabricate sustainable, energy efficient and futuristic solutions to pursue successful professional careers in multidisciplinary fields.
3. Graduates will demonstrate professional ethics, effective communication, teamwork, leadership qualities and ability to relate engineering issues to broader social context along with lifelong learning.

Program Outcomes (POs)

The program outcomes of B. Tech. E&TC Engineering Program are summarized as following:

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 modelling 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 lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Engineering graduate in Electronics and Telecommunication Engineering Programme will be able to do-

1. Graduates will be able to attain a solid foundation in Electronics and Telecommunication Engineering with an ability to function in multidisciplinary environment.
2. Graduates will be able to use techniques and skills to design, analyze, synthesize, and simulate Electronics and Telecommunication Engineering components and systems.
3. Graduate will be capable of developing programs in Assembly, High level and HDL languages using contemporary tools for software development.

Legends used–

L	Lecture Hours / week
T	Tutorial Hours / week
P	Practical Hours / 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	1	T / L
Batch Entry Year		Program Code		U-Under Graduate, P-Post Graduate	Semester No. / Year 1/2/3/…8	Honors Code		Course Serial No. 1-9	T-Theory, L-Lab session A- Tutorial P-Programming/ Drawing / Design

Program Code	
ET	Electronics and Telecommunication Engineering
Honors Code	
HA	Honors in Artificial Intelligence and Machine Learning

Sample Course Code:

21ETU4HA1T	Computational Statistics

Walchand Institute of Technology, Solapur
Electronics and Telecommunication Engineering
Honors in Artificial Intelligence and Machine Learning

Structure of S. Y. B. Tech. Electronics and Telecommunication Engineering
(W.E.F. 2022-2023)

Semester- IV

Course Code	Theory Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
21ETU4HA1T	Computational Statistics	3		-	3	60	40		100
21ETU4HA1A	Computational Statistics Tut		1		1			25	25
	Grand Total	**3**	**1**		**4**	**60**	**40**	**25**	**125**

Walchand Institute of Technology, Solapur
Electronics and Telecommunication Engineering
Honors in Artificial Intelligence and Machine Learning

Structure of T. Y. B. Tech. Electronics and Telecommunication Engineering
(W.E.F. 2023-2024)

Semester- V

Course Code	Theory Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
21ETU5HA1T	Machine Learning	3			3	60	40		100
	Laboratory:								
21ETU5HA1L	Machine Learning Lab			2	1			25	25
	Grand Total	**3**		**2**	**4**	**60**	**40**	**25**	**125**

Structure of T. Y. B. Tech. Electronics and Telecommunication Engineering.,
(W.E.F. 2023-2024)

Semester- VI

Course Code	Theory Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
21ETU6HA1T	Artificial Intelligence	3			3	60	40		100
	Laboratory:								
21ETU6HA1L	Artificial Intelligence Lab			2	1			25	25
	Grand Total	**3**		**2**	**4**	**60**	**40**	**25**	**125**

Walchand Institute of Technology, Solapur
Electronics and Telecommunication Engineering
Honors in Artificial Intelligence and Machine Learning

Structure of Final Year B. Tech. Electronics and Telecommunication Engineering (W.E.F. 2024-2025)

Semester- VII

Course Code	Theory Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
21ETU7HA1T	Artificial Intelligence Applications	3			3	60	40		100
	Laboratory:					**OE**			
21ETU7HA1L	Artificial Intelligence Applications Lab			2	1			25	25
21ETU7HA2L	Mini project			4	2	50		50	100
	Grand Total	**3**		**6**	**6**	**110**	**40**	**75**	**225**

Note: -These courses are to be completed by the student in addition to the courses of B. Tech Electronics & Telecommunication Engineering

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

S.Y.B.Tech. (Electronics & Telecommunication Engineering), Semester-IV

21ETU4HA1T – Computational Statistics

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Tutorial: 1 hr/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

The goal of this course is to provide students with an introduction to a variety of modern computational statistical techniques and the role of computation as a tool of discovery.

Course Prerequisite:
Students shall have knowledge of the programming language python, also some background in probability and statistical inference.

Course Objectives:

1. To make students learn efficient numerical methods for solving problems in statistical analysis.
2. To make students use computational statistics in applications like statistical machine learning.
3. To describe the Dimensionality reduction method.
4. To introduce the basics of Learning theory.

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

1. Describe fundamental aspects of efficient numerical methods for statistical analysis
2. Explore modern computational statistical techniques
3. Describe the role of computation as a tool of discovery.
4. Apply statistical methods for Univariate, Bivariate, and Multivariate data

SECTION I

Unit 1: Matrix fundamentals **(07 Hrs)**
Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces

Unit 2: Matrix decomposition **(07 Hrs)**
Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation

Unit 3: Probability Distributions **(08 Hrs)**
Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, Bayes' Theorem, Statistics and Independence, Gaussian distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform

SECTION II

Unit 4: Descriptive statistics and analysis: (07 Hrs)
Scale Types, Descriptive Univariate Analysis, Univariate Statistics, Descriptive Bivariate Analysis, Multivariate Frequencies, Multivariate Statistics.

Unit 5: Linear Regression (07 Hrs)
Problem Formulation, Parameter Estimation, Bayesian Linear Regression, Maximum Likelihood as Orthogonal Projection

Unit 6: Dimensionality reduction (08 Hrs)
Problem Setting, Maximum Variance Perspective, Projection Perspective, Eigenvector Computation and Low-Rank Approximations, PCA in High Dimensions, Key Steps of PCA in Practice, Latent Variable Perspective

Internal Continuous Assessment:
ICA consists of a minimum of eight tutorials based upon the above syllabus.

Textbooks:

1. Peter Givens, G. H. and Hoeting, J. A. (2005) Computational Statistics, 2nd Edition, Wiley-Interscience
2. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong.
3. A General Introduction to Data Analytics, by Joao Moreira, Andre Carvalho, Tomas Horvath, Wiley Publication.

Reference Books:

1. Liu, J. (2001). Monte Carlo Strategies in Scientific Computing, Springer-Verlag.
2. Lange, K. (2002). Numerical Analysis for Statisticians, Springer-Verlag, 2nd Edition.
3. Hastie, T., Tibshirani, R. and Friedman, J. (2009). The Elements of Statistical Learning, 2nd Edition, Springer.
4. Goodfellow, I., Bengio, Y. and Courville, A. (2016). Deep Learning, MIT Press.

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

T.Y.B.Tech. (Electronics & Telecommunication Engineering), Semester-V

21ETU5HA1T – Machine Learning

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Practical : 2 hrs/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

This course introduces Machine Learning applications perspective. The course also introduces practical design aspects of Machine Learning Models.

Course Prerequisite:
Students shall have knowledge of programming languages and fundamentals of probability and Statistics.

Course Objectives:
1. To make student learn necessity and different aspects of Machine Learning.
2. To make student understand Machine Learning Models.
3. To make student understand Classification and Regression.
4. To introduce to student real world applications of Machine Learning.

Course Outcomes:
At the end of this course, student will be able to –
1. Describe fundamental aspects of Machine Learning.
2. Distinguish between various characteristics of ML
3. Explore classification and regression algorithm
4. Design neural network for classification
5. Design and implement different Machine Learning models
6. Apply Machine learning techniques that enable to solve real world problems.

Course Prerequisite:
Student shall have knowledge of programming language like python / R, also fundamentals of probability and Statistics.

SECTION I

Unit 1:Introduction to Machine Learning **[08Hrs]**
Basics of Statistics, what is Machine learning? Examples of Machine Learning Problems, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, database and data processing for ML.

Unit 2: Theory of Machine Learning **[05Hrs]**
Definition of learning systems, Types: Supervised, Unsupervised, Semi Supervised, Reinforcement learning with examples. hypothesis space and inductive bias, evaluation, cross-validation, what is a feature? feature construction, feature extraction.

Unit 3: Supervised Learning **[08Hrs]**

Classification: Binary Classification- Assessing Classification performance.
Common classification algorithms: K Nearest Neighbor, Decision Tree, Random Forest model, Support vector machines. Probabilistic Models: Naïve Bayes Classifier.
Regression: Assessing performance of Regression- Error measures, Overfitting, underfitting, linear regression, logistic Regression. Multivariate Linear Regression.

SECTION II

Unit 4: Unsupervised Learning **[08Hrs]**

Unsupervised Vs supervised learning, Applications of unsupervised learning, Clustering, clustering as ML task, Different clustering techniques, partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN, Finding pattern using association rule, Association rule, apriori algorithm for association rule learning, Build the apriori principle rules.

Unit 5: Artificial Neural Networks **[08 Hrs]**

Introduction, Exploring Artificial Neuron, Types of activation functions, Early implementations of ANN, Architectures of Neural Network, Learning process in ANN, Backpropagation, Deep learning

Unit 6: Applications of Machine Learning **[05Hrs]**

Email Spam and Malware Filtering, Image recognition, Speech Recognition, Traffic Prediction, Self-driving Cars, Virtual Personal Assistant, Medical Diagnosis.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 practical based upon above curriculum.

Text books:

1. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rdEdition, 1997.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. .Ethem Alpaydin, ”Introduction to Machine Learning”, MIT Press, Prentice Hall of India,3rd Edition2014.
4. Dutt, Chandramouli, Das, “Machine Learning” Pearson publication, Eighth Impression,2022.

Reference Books:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar ” Foundations of Machine Learning”, MIT Press,2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. Kevin P. Murphy “Machine Learning: A Probabilistic Perspective”, The MIT Press, 2012
4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.
5. Charu C. Aggarwal,“Data Classification Algorithms and Applications”, CRCPress,2014.
6. Charu C. Aggarwal, “DATA CLUSTERING Algorithms and Applications”, CRC Press,2014.
7. Machine Learning Mastery With Python 2016 by Jason Brownlee.

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

T.Y.B.Tech. (Electronics & Telecommunication Engineering), Semester-VI

21ETU6HA1T – Artificial Intelligence

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Practical : 2 hrs/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

This course presents a basic introduction to the techniques used in developing Artificial Intelligent systems. It is a walkthrough to problem spaces and search algorithms, Knowledge representation, reasoning, logic programming and applications of Artificial Intelligence.

Course Prerequisite:
Students must have completed a computational statistics course.

Course Objectives:
1. To introduce students, solving a sequence of actions for an agent as a search problem.
2. To get familiarized with logical and probabilistic reasoning methods.
3. To introduce Classification and Regression.
4. To introduce forms of learning and demonstrate their working.

Course Outcomes:
At the end of the course, students will be able to
1. Formulate and solve a sequence of actions for an agent as a search problem.
2. Infer from represented knowledge using logical and probabilistic reasoning methods
3. Solve agent decision problems using probability theory
4. Comprehend forms of learning and demonstrate their working.

SECTION - I

Unit 1 – Overview **(07 Hrs)**
Foundations, scope, problems, and approaches of AI.
Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents

Unit 2 - Problem-solving through Search **(07 Hrs)**
Forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

Unit 3 - Knowledge Representation and Reasoning **(08 Hrs)**
Ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; first order logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

SECTION - II

Unit 4 - Representing and Reasoning with Uncertain Knowledge (07 Hrs)
Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, and sample applications.

Unit 5 - Decision-Making (07 Hrs)
Basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.

Unit 6 - Learning and Knowledge Acquisition (08 Hrs)
Forms of Learning: Supervised, Unsupervised, Semi-supervised. Statistical learning, Reinforcement Learning: Q-learning, sample applications.

Internal Continuous Assessment (ICA):
ICA should consist of a minimum of eight experiments based on the above syllabus

Text Book:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall
2. A First Course in Artificial Intelligence, Deepak Khemani, McGraw Hill Education (India)
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.

Reference Book:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw Hill

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

Final Year B.Tech. (Electronics & Telecommunication Engineering), Semester-VII

21ETU7HA1T – Artificial Intelligence Applications

Teaching Scheme:	Examination Scheme:
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Practical : 2 hrs/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

The purpose of this course is to provide the students with a comprehensive introduction to the recent developments in AI through the coverage of fundamental AI concepts, practical business applications and the hands-on experiences. Artificial Intelligence (AI) is behind your smart phone's intelligent personal assistant, driverless cars, robots, government fraud detection systems, and the image recognition algorithms of Facebook and Instagram, just to mention a few examples. This course introduces you to core techniques and applications of Artificial Intelligence

Course Prerequisite:
It is strongly recommended that you have had an introduction to data structures and algorithms, mathematical modeling and imperative programming.

Course Objectives:
1. To introduce AI's fundamental concepts and methods
2. To enable students to identify problems that are amenable to solution by AI methods to solve a given problem.
3. To enable students to formalize a given problem in the language/framework of different AI methods.
4. To evaluate different algorithms on a problem formalization.
5. To acquaint students for using modern AI tools

Course Outcomes:
At the end of the course, students will be able to-
1. Cognize AI's fundamental concepts and methods
2. Identify problems that are amenable to solution by AI methods to solve a given problem.
3. Formalize a given problem in the language/framework of different AI methods.
4. Evaluate different algorithms on a problem formalization.
5. Use modern AI tools

SECTION I

Unit-1 General Issues and Overview of AI **(07 Hrs)**

The AI problems, what is an AI technique, Characteristics of AI applications. Introduction to LISP programming: Syntax and numeric functions, Basic list manipulation functions, predicates and conditionals, input output and local variables, interaction and recursion, property lists and arrays.

Unit-2 Problem Solving, Search and Control Strategies **(08 Hrs)**

General problem solving, production systems, control strategies forward and backward chaining, exhaustive searches depth first breadth first search. Heuristic Search Techniques Hill climbing, branch and bound technique, best first search & A algorithm, AND / OR graphs, problem reduction & AO algorithm, constraint satisfaction problems.

Unit-3 Knowledge Representations **(07 Hrs)**

First order predicate calculus, skolemization, resolution principle & unification, interface mechanisms, horn's clauses, semantic networks, frame systems and value inheritance, scripts, conceptual dependency.

SECTION II

Unit-4 Natural Language processing **(08 Hrs)**

Parsing techniques, context free grammar, recursive transitions nets (RNT), augmented transition nets (ATN), case and logic grammars, symantic analysis. Game playing Minimax search procedure, alpha-beta cutoffs, additional refinements. Planning Overview an example domain, the block word, component of planning systems, goal stack planning, nonlinear planning.

Unit-5 Probabilistic Reasoning and Uncertainty **(07 Hrs)**

Probability theory, bayes theorem and bayesian networks, certainty factor, conflation of probability

Unit-6 Expert Systems **(07 Hrs)**

Introduction to expert system and application of expert systems, various expert system shells, vidwan framework, knowledge acquisition, case studies, MYCIN.

Internal Continuous Assessment:

ICA consists of minimum eight tutorials based upon above syllabus

Text books:

1. Elaine Rich and Kevin Knight "Artificial Intelligence" - Tata McGraw Hill.
2. Dan W. Patterson "Introduction to Artificial Intelligence and Expert Systems", Prentice India.
3. Nils J. Nilson "Principles of Artificial Intelligence", Narosa Publishing House.

Reference Books:

1. Clocksin & C.S. Melish "Programming in PROLOG", Narosa Publishing House.
2. M. Sasikumar, S. Ramani etc. "Rule based Expert System", Narosa Publishing House.
3. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007

4. Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007.
5. Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.
6. http://nptel.ac.in

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

Final Year B.Tech. (Electronics & Telecommunication Engineering), Semester VII

21ETU7HA2L – Mini Project

Teaching Scheme:	**Examination Scheme:**
Practical : 4 hrs/week, 2 credit	ICA : 50 Marks
	OE : 50 Marks

This course is introduced to enable students to apply the knowledge and skills gained through AI-ML honors courses to solve definitive engineering problems and problems associated with the society and stakeholders by analyzing the data and implementing various ML algorithms and AI techniques.

Course Prerequisite:
Students must have completed all the AI-ML honors courses till semester VI.

Course Objectives:
1. To make students apply the AI-ML tools to define an architecture for a problem.
2. To make students work in a team for planning and execution towards the solution of a given engineering problem.
3. To make students challenge themselves in identifying the stakeholders, end results, possible tools, timeline and life cycle policy for solving the defined problem.
4. To make them prepare a technical report based on the architecture, tools and the entire lifecycle of the defined problem and communicate it effectively to the stakeholders.

Course Outcomes:
At the end of this course, students will be able to -
1. Apply the AI-ML skills to define a rigid problem statement.
2. Analyze a given engineering problem to plan and execute in a team to acquire the desired goals.
3. Develop a solution to the proposed problem empirical to the cloud standards and stakeholders.
4. Prepare a technical report based on the proposed solution to a chosen problem.

Guidelines for project implementation:
1) Project group should be not more than 3 students per group.
2) Projects must be based on application of AI/ML.
3) Week 1 & 2: Formation of groups, searching of an application based on AI/ML.
4) Week 3 & 4: Finalization of Mini project & Distribution of work.
5) Week 5 & 6: Identifying appropriate tools and their availability for implementation.
6) Week 7 & 8: Architecting, development, testing and debugging
7) Week 9, 10 & 11: Development (in real world - optional) and Deployment of the project
8) Week 12: Demo, Group presentation & report submission

Internal Continuous Assessment (ICA):

1. Internal Continuous Assessment shall consist of the Literature Survey, Market survey, Basic project work implementation and applications of Mini project.
2. Assessment shall be based on Innovative Idea, Presentation skill, depth of understanding, Applications, Future Scope and Individual Contribution.
3. A certified copy of project report shall be required to be presented at the time of final submission empirical to the selected problem statement.

Resources:

1. OpenStack Docs: https://docs.openstack.org/install-guide/overview.html
2. Python 3.7: https://www.python.org/downloads
3. https://github.com/collections/machine-learning
4. http://old-www.cms.waikato.ac.nz/ml/weka/
5. https://github.com/microsoft/tensorwatch
6. https://colab.research.google.com/
7. https://dvc.org/
8. https://aws.amazon.com/sagemaker/
9. https://www.tensorflow.org/
10. https://scikit-learn.org/stable/
11. https://www.knime.com/
12. https://mahout.apache.org/
13. http://accord-framework.net/
14. https://keras.io/

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B.Tech. Electronics and Telecommunication Engineering

CHOICE BASED CREDIT SYSTEM (CBCS)

Structure and Syllabus for
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Artificial Intelligence and Machine Learning

S.Y. B. Tech. Electronics and Telecommunication Engineering W.E.F. 2023-24
T.Y. B. Tech. Electronics and Telecommunication Engineering W.E.F. 2024-25
Final Year B. Tech Electronics and Telecommunication Engineering W.E.F. 2025-26

Electronics and Telecommunication Engineering Department

Department Vision

To be a distinguished center for nurturing the holistic development of competent young engineers in the electronics and allied field.

Department Mission

1. To inculcate and stimulate Electronics & allied Engineering proficiency amongst students through quality education and innovative educational practices.
2. To create engineering professionals with social consciousness.
3. To foster technical skills of students through creativity and critical thinking.
4. To enhance soft skill set of students which is crucial for career success through effectual training.

Electronics and Telecommunication Engineering
Under Graduate Program
Program Educational Objectives (PEOs)

1. Graduates will exhibit strong fundamental knowledge and technical skills in Electronics and Telecommunication Engineering and allied fields.
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Program Outcomes (POs)

The program outcomes of B. Tech. E&TC Engineering Program are summarized as following:

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 modelling 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 lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Engineering graduate in Electronics and Telecommunication Engineering Programme will be able to do-

1. Graduates will be able to attain a solid foundation in Electronics and Telecommunication Engineering with an ability to function in multidisciplinary environment.
2. Graduates will be able to use techniques and skills to design, analyze, synthesize, and simulate Electronics and Telecommunication Engineering components and systems.
3. Graduate will be capable of developing programs in Assembly, High level and HDL languages using contemporary tools for software development.

Legends used–

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T	Tutorial Hours / week
P	Practical Hours / week
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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	2	E	T	U/P	2	H	A	1	T / L
Batch Entry Year		Program Code		U-Under Graduate, P-Post Graduate	Semester No. / Year 1/2/3/…8	Honors Code		Course Serial No. 1-9	T-Theory, L-Lab session A- Tutorial P-Programming/ Drawing / Design

Program Code	
ET	Electronics and Telecommunication Engineering
Honors Code	
HA	Honors in Artificial Intelligence and Machine Learning

Sample Course Code:

22ETU4HA1T	Computational Statistics

Walchand Institute of Technology, Solapur
Electronics and Telecommunication Engineering
Honors in Artificial Intelligence and Machine Learning

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

Semester- IV

Course Code	**Theory Course Name**	**Engagement Hours**			**Credits**	**FA**	**SA**		
		L	**T**	**P**		**ESE**	**ISE**	**ICA**	**Total**
22ETU4HA1T	Computational Statistics	3		-	3	60	40		100
22ETU4HA1A	Computational Statistics Tut		1		1			25	25
	Grand Total	**3**	**1**		**4**	**60**	**40**	**25**	**125**

Walchand Institute of Technology, Solapur
Electronics and Telecommunication Engineering
Honors in Artificial Intelligence and Machine Learning

Structure of T. Y. B. Tech. Electronics and Telecommunication Engineering
(W.E.F. 2024-2025)

Semester- V

Course Code	Theory Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
22ETU5HA1T	Machine Learning	3			3	60	40		100
	Laboratory:								
22ETU5HA1L	Machine Learning Lab			2	1			25	25
	Grand Total	**3**		**2**	**4**	**60**	**40**	**25**	**125**

Structure of T. Y. B. Tech. Electronics and Telecommunication Engineering.,
(W.E.F. 2024-2025)

Semester- VI

Course Code	Theory Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
22ETU6HA1T	Artificial Intelligence	3			3	60	40		100
	Laboratory:								
22ETU6HA1L	Artificial Intelligence Lab			2	1			25	25
	Grand Total	**3**		**2**	**4**	**60**	**40**	**25**	**125**

Walchand Institute of Technology, Solapur
Electronics and Telecommunication Engineering
Honors in Artificial Intelligence and Machine Learning

Structure of Final Year B. Tech. Electronics and Telecommunication Engineering
(W.E.F. 2025-2026)

Semester- VII

Course Code	Theory Course Name	Engagement Hours			Credits	FA	SA		
		L	T	P		ESE	ISE	ICA	Total
22ETU7HA1T	Artificial Intelligence Applications	3			3	60	40		100
	Laboratory:					**OE**			
22ETU7HA1L	Artificial Intelligence Applications Lab			2	1			25	25
22ETU7HA2L	Mini project			4	2	50		50	100
	Grand Total	**3**		**6**	**6**	**110**	**40**	**75**	**225**

Note: -These courses are to be completed by the student in addition to the courses of B. Tech Electronics & Telecommunication Engineering

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

S.Y.B.Tech. (Electronics & Telecommunication Engineering), Semester-IV

22ETU4HA1T – Computational Statistics

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Tutorial: 1 hr/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

The goal of this course is to provide students with an introduction to a variety of modern computational statistical techniques and the role of computation as a tool of discovery.

Course Prerequisite:
Students shall have knowledge of the programming language python, also some background in probability and statistical inference.

Course Objectives:
1. To make students learn efficient numerical methods for solving problems in statistical analysis.
2. To make students use computational statistics in applications like statistical machine learning.
3. To describe the Dimensionality reduction method.
4. To introduce the basics of Learning theory.

Course Outcomes:
At the end of the course, students will be able to-
1. Describe fundamental aspects of efficient numerical methods for statistical analysis
2. Explore modern computational statistical techniques
3. Describe the role of computation as a tool of discovery.
4. Apply statistical methods for Univariate, Bivariate, and Multivariate data

SECTION I

Unit 1: Matrix fundamentals **(07 Hrs)**
Systems of Linear Equations, Matrices, Solving Systems of Linear Equations, Vector Spaces, Linear Independence, Basis and Rank, Linear Mappings, Affine Spaces

Unit 2: Matrix decomposition **(07 Hrs)**
Determinant and Trace, Eigenvalues and Eigenvectors, Cholesky Decomposition, Eigen decomposition and Diagonalization, Singular Value Decomposition, Matrix Approximation

Unit 3: Probability Distributions **(08 Hrs)**
Construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, Bayes' Theorem, Statistics and Independence, Gaussian distribution, Conjugacy and the Exponential Family, Change of Variables/Inverse Transform

SECTION II

Unit 4: Descriptive statistics and analysis: (07 Hrs)
Scale Types, Descriptive Univariate Analysis, Univariate Statistics, Descriptive Bivariate Analysis, Multivariate Frequencies, Multivariate Statistics.

Unit 5: Linear Regression (07 Hrs)
Problem Formulation, Parameter Estimation, Bayesian Linear Regression, Maximum Likelihood as Orthogonal Projection

Unit 6: Dimensionality reduction (08 Hrs)
Problem Setting, Maximum Variance Perspective, Projection Perspective, Eigenvector Computation and Low-Rank Approximations, PCA in High Dimensions, Key Steps of PCA in Practice, Latent Variable Perspective

Internal Continuous Assessment:
ICA consists of a minimum of eight tutorials based upon the above syllabus.

Textbooks:

1. Peter Givens, G. H. and Hoeting, J. A. (2005) Computational Statistics, 2nd Edition, Wiley-Interscience
2. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong.
3. A General Introduction to Data Analytics, by Joao Moreira, Andre Carvalho, Tomas Horvath, Wiley Publication.

Reference Books:

1. Liu, J. (2001). Monte Carlo Strategies in Scientific Computing, Springer-Verlag.
2. Lange, K. (2002). Numerical Analysis for Statisticians, Springer-Verlag, 2nd Edition.
3. Hastie, T., Tibshirani, R. and Friedman, J. (2009). The Elements of Statistical Learning, 2nd Edition, Springer.
4. Goodfellow, I., Bengio, Y. and Courville, A. (2016). Deep Learning, MIT Press.

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

T.Y.B.Tech. (Electronics & Telecommunication Engineering), Semester-V

22ETU5HA1T – Machine Learning

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Practical : 2 hrs/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

This course introduces Machine Learning applications perspective. The course also introduces practical design aspects of Machine Learning Models.

Course Prerequisite:
Students shall have knowledge of programming languages and fundamentals of probability and Statistics.

Course Objectives:

1. To make student learn necessity and different aspects of Machine Learning.
2. To make student understand Machine Learning Models.
3. To make student understand Classification and Regression.
4. To introduce to student real world applications of Machine Learning.

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

1. Describe fundamental aspects of Machine Learning.
2. Distinguish between various characteristics of ML
3. Explore classification and regression algorithm
4. Design neural network for classification
5. Design and implement different Machine Learning models
6. Apply Machine learning techniques that enable to solve real world problems.

Course Prerequisite:
Student shall have knowledge of programming language like python / R, also fundamentals of probability and Statistics.

SECTION I

Unit 1:Introduction to Machine Learning **[08Hrs]**
Basics of Statistics, what is Machine learning? Examples of Machine Learning Problems, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, database and data processing for ML.

Unit 2: Theory of Machine Learning **[05Hrs]**
Definition of learning systems, Types: Supervised, Unsupervised, Semi Supervised, Reinforcement learning with examples. hypothesis space and inductive bias, evaluation, cross-validation, what is a feature? feature construction, feature extraction.

Unit 3: Supervised Learning **[08Hrs]**

Classification: Binary Classification- Assessing Classification performance.
Common classification algorithms: K Nearest Neighbor, Decision Tree, Random Forest model, Support vector machines. Probabilistic Models: Naïve Bayes Classifier.
Regression: Assessing performance of Regression- Error measures, Overfitting, underfitting, linear regression, logistic Regression. Multivariate Linear Regression.

SECTION II

Unit 4: Unsupervised Learning **[08Hrs]**

Unsupervised Vs supervised learning, Applications of unsupervised learning, Clustering, clustering as ML task, Different clustering techniques, partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN, Finding pattern using association rule, Association rule, apriori algorithm for association rule learning, Build the apriori principle rules.

Unit 5: Artificial Neural Networks **[08 Hrs]**

Introduction, Exploring Artificial Neuron, Types of activation functions, Early implementations of ANN, Architectures of Neural Network, Learning process in ANN, Backpropagation, Deep learning

Unit 6: Applications of Machine Learning **[05Hrs]**

Email Spam and Malware Filtering, Image recognition, Speech Recognition, Traffic Prediction, Self-driving Cars, Virtual Personal Assistant, Medical Diagnosis.

Internal Continuous Assessment (ICA):

ICA consists of minimum 8 practical based upon above curriculum.

Text books:

1. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rdEdition, 1997.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.
3. .Ethem Alpaydin, ”Introduction to Machine Learning”, MIT Press, Prentice Hall of India,3rd Edition2014.
4. Dutt, Chandramouli, Das, “Machine Learning” Pearson publication, Eighth Impression,2022.

Reference Books:

1. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar ” Foundations of Machine Learning”, MIT Press,2012.
2. Hastie, Tibshirani, Friedman: Introduction to Statistical Machine Learning with Applications in R, Springer, 2nd Edition-2012.
3. Kevin P. Murphy “Machine Learning: A Probabilistic Perspective”, The MIT Press, 2012
4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015.
5. Charu C. Aggarwal,“Data Classification Algorithms and Applications”, CRCPress,2014.
6. Charu C. Aggarwal, “DATA CLUSTERING Algorithms and Applications”, CRC Press,2014.
7. Machine Learning Mastery With Python 2016 by Jason Brownlee.

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

T.Y.B.Tech. (Electronics & Telecommunication Engineering), Semester-VI

22ETU6HA1T – Artificial Intelligence

Teaching Scheme:	Examination Scheme:
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Practical : 2 hrs/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

This course presents a basic introduction to the techniques used in developing Artificial Intelligent systems. It is a walkthrough to problem spaces and search algorithms, Knowledge representation, reasoning, logic programming and applications of Artificial Intelligence.

Course Prerequisite:
Students must have completed a computational statistics course.

Course Objectives:
1. To introduce students, solving a sequence of actions for an agent as a search problem.
2. To get familiarized with logical and probabilistic reasoning methods.
3. To introduce Classification and Regression.
4. To introduce forms of learning and demonstrate their working.

Course Outcomes:
At the end of the course, students will be able to
1. Formulate and solve a sequence of actions for an agent as a search problem.
2. Infer from represented knowledge using logical and probabilistic reasoning methods
3. Solve agent decision problems using probability theory
4. Comprehend forms of learning and demonstrate their working.

SECTION - I

Unit 1 – Overview **(07 Hrs)**
Foundations, scope, problems, and approaches of AI.
Intelligent agents: reactive, deliberative, goal-driven, utility-driven, and learning agents

Unit 2 - Problem-solving through Search **(07 Hrs)**
Forward and backward, state-space, blind, heuristic, problem-reduction, A, A*, AO*, minimax, constraint propagation, neural, stochastic, and evolutionary search algorithms, sample applications.

Unit 3 - Knowledge Representation and Reasoning **(08 Hrs)**
Ontologies, foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space; first order logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

SECTION - II

Unit 4 - Representing and Reasoning with Uncertain Knowledge (07 Hrs)
Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, and sample applications.

Unit 5 - Decision-Making (07 Hrs)
Basics of utility theory, decision theory, sequential decision problems, elementary game theory, sample applications.

Unit 6 - Learning and Knowledge Acquisition (08 Hrs)
Forms of Learning: Supervised, Unsupervised, Semi-supervised. Statistical learning, Reinforcement Learning: Q-learning, sample applications.

Internal Continuous Assessment (ICA):
ICA should consist of a minimum of eight experiments based on the above syllabus

Text Book:

1. Artificial Intelligence: A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall
2. A First Course in Artificial Intelligence, Deepak Khemani, McGraw Hill Education (India)
3. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.

Reference Book:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata McGraw Hill

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

Final Year B.Tech. (Electronics & Telecommunication Engineering), Semester-VII

22ETU7HA1T – Artificial Intelligence Applications

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE : 60 Marks
Practical : 2 hrs/week, 1 credit	ISE : 40 Marks
	ICA : 25 Marks

The purpose of this course is to provide the students with a comprehensive introduction to the recent developments in AI through the coverage of fundamental AI concepts, practical business applications and the hands-on experiences. Artificial Intelligence (AI) is behind your smart phone's intelligent personal assistant, driverless cars, robots, government fraud detection systems, and the image recognition algorithms of Facebook and Instagram, just to mention a few examples. This course introduces you to core techniques and applications of Artificial Intelligence

Course Prerequisite:

It is strongly recommended that you have had an introduction to data structures and algorithms, mathematical modeling and imperative programming.

Course Objectives:

1. To introduce AI's fundamental concepts and methods
2. To enable students to identify problems that are amenable to solution by AI methods to solve a given problem.
3. To enable students to formalize a given problem in the language/framework of different AI methods.
4. To evaluate different algorithms on a problem formalization.
5. To acquaint students for using modern AI tools

Course Outcomes:

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

1. Cognize AI's fundamental concepts and methods
2. Identify problems that are amenable to solution by AI methods to solve a given problem.
3. Formalize a given problem in the language/framework of different AI methods.
4. Evaluate different algorithms on a problem formalization.
5. Use modern AI tools

SECTION I

Unit-1 General Issues and Overview of AI (07 Hrs)

The AI problems, what is an AI technique, Characteristics of AI applications. Introduction to LISP programming: Syntax and numeric functions, Basic list manipulation functions, predicates and conditionals, input output and local variables, interaction and recursion, property lists and arrays.

Unit-2 Problem Solving, Search and Control Strategies (08 Hrs)

General problem solving, production systems, control strategies forward and backward chaining, exhaustive searches depth first breadth first search. Heuristic Search Techniques Hill climbing, branch and bound technique, best first search & A algorithm, AND / OR graphs, problem reduction & AO algorithm, constraint satisfaction problems.

Unit-3 Knowledge Representations (07 Hrs)

First order predicate calculus, skolemization, resolution principle & unification, interface mechanisms, horn's clauses, semantic networks, frame systems and value inheritance, scripts, conceptual dependency.

SECTION II

Unit-4 Natural Language processing (08 Hrs)

Parsing techniques, context free grammar, recursive transitions nets (RNT), augmented transition nets (ATN), case and logic grammars, symantic analysis. Game playing Minimax search procedure, alpha-beta cutoffs, additional refinements. Planning Overview an example domain, the block word, component of planning systems, goal stack planning, nonlinear planning.

Unit-5 Probabilistic Reasoning and Uncertainty (07 Hrs)

Probability theory, bayes theorem and bayesian networks, certainty factor, conflation of probability

Unit-6 Expert Systems (07 Hrs)

Introduction to expert system and application of expert systems, various expert system shells, vidwan framework, knowledge acquisition, case studies, MYCIN.

Internal Continuous Assessment:

ICA consists of minimum eight tutorials based upon above syllabus

Text books:

1. Elaine Rich and Kevin Knight “Artificial Intelligence” - Tata McGraw Hill.
2. Dan W. Patterson “Introduction to Artificial Intelligence and Expert Systems”, Prentice India.
3. Nils J. Nilson “Principles of Artificial Intelligence”, Narosa Publishing House.

Reference Books:

1. Clocksin & C.S. Melish “Programming in PROLOG”, Narosa Publishing House.
2. M. Sasikumar, S. Ramani etc. “Rule based Expert System”, Narosa Publishing House.
3. Peter Jackson, “Introduction to Expert Systems”, 3rd Edition, Pearson Education, 2007

4. Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2nd Edition, Pearson Education 2007.
5. Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.
6. http://nptel.ac.in

Walchand Institute of Technology, Solapur

Honors in Artificial Intelligence and Machine Learning

Final Year B.Tech. (Electronics & Telecommunication Engineering), Semester VII

22ETU7HA2L – Mini Project

Teaching Scheme:	**Examination Scheme:**
Practical : 4 hrs/week, 2 credit	ICA : 50 Marks
	OE : 50 Marks

This course is introduced to enable students to apply the knowledge and skills gained through AI-ML honors courses to solve definitive engineering problems and problems associated with the society and stakeholders by analyzing the data and implementing various ML algorithms and AI techniques.

Course Prerequisite:
Students must have completed all the AI-ML honors courses till semester VI.

Course Objectives:
1. To make students apply the AI-ML tools to define an architecture for a problem.
2. To make students work in a team for planning and execution towards the solution of a given engineering problem.
3. To make students challenge themselves in identifying the stakeholders, end results, possible tools, timeline and life cycle policy for solving the defined problem.
4. To make them prepare a technical report based on the architecture, tools and the entire lifecycle of the defined problem and communicate it effectively to the stakeholders.

Course Outcomes:
At the end of this course, students will be able to -
1. Apply the AI-ML skills to define a rigid problem statement.
2. Analyze a given engineering problem to plan and execute in a team to acquire the desired goals.
3. Develop a solution to the proposed problem empirical to the cloud standards and stakeholders.
4. Prepare a technical report based on the proposed solution to a chosen problem.

Guidelines for project implementation:
1) Project group should be not more than 3 students per group.
2) Projects must be based on application of AI/ML.
3) Week 1 & 2: Formation of groups, searching of an application based on AI/ML.
4) Week 3 & 4: Finalization of Mini project & Distribution of work.
5) Week 5 & 6: Identifying appropriate tools and their availability for implementation.
6) Week 7 & 8: Architecting, development, testing and debugging
7) Week 9, 10 & 11: Development (in real world - optional) and Deployment of the project
8) Week 12: Demo, Group presentation & report submission

Internal Continuous Assessment (ICA):

1. Internal Continuous Assessment shall consist of the Literature Survey, Market survey, Basic project work implementation and applications of Mini project.
2. Assessment shall be based on Innovative Idea, Presentation skill, depth of understanding, Applications, Future Scope and Individual Contribution.
3. A certified copy of project report shall be required to be presented at the time of final submission empirical to the selected problem statement.

Resources:

1. OpenStack Docs: https://docs.openstack.org/install-guide/overview.html
2. Python 3.7: https://www.python.org/downloads
3. https://github.com/collections/machine-learning
4. http://old-www.cms.waikato.ac.nz/ml/weka/
5. https://github.com/microsoft/tensorwatch
6. https://colab.research.google.com/
7. https://dvc.org/
8. https://aws.amazon.com/sagemaker/
9. https://www.tensorflow.org/
10. https://scikit-learn.org/stable/
11. https://www.knime.com/
12. https://mahout.apache.org/
13. http://accord-framework.net/
14. https://keras.io/