



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Minor/Hons. Program

Level: UG

Branch: Minor/Hons. -Artificial Intelligence & Machine Learning

Course / Subject Code : BE040AG011

Course / Subject Name : : Introduction to AI and Machine Learning

w. e. f. Academic Year:	AY 2025-26
Semester:	4 th
Category of the Course:	Core Courses

Prerequisite: Mathematics

Rationale:	With the increasing usage of Internet, the importance of Artificial Intelligence (AI) and Machine Learning (ML) can be seen in many areas which directly affect human life. Artificial Intelligence is the science and engineering which makes machines intelligent. A subset of AI, Machine Learning (ML) is the area of Computational Science that focuses on analyzing and interpreting structures and patterns in data to enable learning, reasoning and decision making. The AI and ML technologies bring more complex data analysis features to existing applications; therefore, students should learn various ML approaches to build new solutions for various real-life problems
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Course Outcome:

After Completion of the Course, the Student will be able to:

No	Course Outcomes
01	Summarize knowledge, logic fundamentals, and associate it with mathematical basics.
02	Examine and implement machine learning solutions to classification, regression
03	Evaluate and interpret the results of the different ML techniques.
04	Classify and analyze linear and logistic regression techniques.
05	Compare and design various machine learning algorithms in a range of real-world applications

Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/3 0	Assessment Pattern and Marks					Total Mark s
L	T	P	PBL*	TH		Theory		Tutorial / Practical			
						ESE I	PA (M)	PA/ (I)	PBL/ (I)	ESE (V)	
45	0	30	45	120	04	70	0	0	30	50	150



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Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.	12	20
2.	Idea of Machines learning from data, Classification of problem – Regression and Classification, Supervised and Unsupervised learning.	8	20
3.	Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice	10	20
4.	Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.	7	20
5.	Discussion on clustering algorithms and use-cases centered around clustering and classification.	5	20
Total			100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	25	20	10	10

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011.
2. Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.
3. Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.
4. Tom Mitchell, Machine Learning, McGraw Hill, 2017.
5. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.
6. T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.



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Suggested Course Practical List:

1. Implementation of logical rules in Python.
2. Using any data apply the concept of:
 - a. Linear regression
 - b. Gradient decent
 - c. Logistic regression
3. To add the missing value in any data set.
4. Perform and plot under fitting and overfitting in a data set
5. Implementation of clustering and classification algorithms

List of Laboratory/Learning Resources Required:

Suggested Project List:

Suggested Activities for Students: If any

List of Suggested Activities for Problem based Learning:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit=5hrs., Report preparation = 5hrs. Total = 10hrs.	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Technical Video based learning related to the subject	Duration of video = 5hrs. Report preparation = 5hrs. Total = 10hrs.	Report /presentation based on the video learning outcomes.
3.	Assignment writing. Numerical based assignment is preferable.	5 assignments of 4hrs. each. Total = 20hrs.	Based on the correctness of Submitted assignment.
4.	Problem solving/Coding using C, C++, Python, SCILAB, modeling and Analysis software or any other software	5 small coding-based assignment of 2hrs. each. Total = 10hrs.	Based on the coding solution submitted.
5.	Self-learning online course	Minimum duration of the course should be 10hrs.	Examination based assessment at the end of course. Based on the certificate produced.
6.	Identification and solution of Complex problem	Maximum 2 problems. Study of the problem and solution finding, Total = 10hrs.	Based on the depth of the solution submitted.



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7	Videos on Industrial safety/Disaster Management aspects based on subject	Duration of video = 5hrs. Report preparation = 5hrs. Total = 10hrs.	Based on quiz/report submitted
8	Technical paper reading and summarization of research papers based on relevant subject	5 research papers = 20 hrs.	Summarize research paper and evaluation critical parameters
9.	Poster/chart/power point preparation on technical topics	Duration = 6 hrs.	Based on poster/chart preparation and presentation skills
10	Working/non-working model on technical topics	Working = 12 hrs. Non- working = 8 hrs.	Based on inter department/external evaluation
11	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/sustainability/any other issue	Duration = 15 hrs. for Industrial exposure Problem identification and tentative solution = 10 hrs. Total = 20 hrs.	Based on evaluation of critical problems and solutions
12	Group Discussion on emerging/trending technical topics based on subject	Duration = Min. 1 hr. per subject. Max. 3 hrs. per subject	Based on performance in group discussion, technical depth, knowledge etc.
13.	Real world case studies-based learning	Duration of data collection/study = 5hrs. Report preparation = 5hrs. Total = 10hrs.	Based on in-depth study, technical depth, data collected, fact finding, etc.
14.	Application/Software	Duration = 10 hrs.	Depending on the complexity

Note:

- All the suggested activities should be related to the subject.
- The number of hours is suggestive. Faculty can subdivide the number of hours based on the activity. However, the total number of hours is fixed.
- The faculty can prepare rubrics for the evaluation.
- The subject teacher can add the relevant activities other than those listed above, with the consent of the head of the department and DQAC.
- All records related to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institutional level. These records should



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be made available to the university upon request.

- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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