Year: 2023
Semester: IV

1. **Name of the Faculty: Goutam Datta** **Course Code: CSAI2001**
2. **Course: Machine Learning** **L: 3**
3. **Program : B. Tech CS+AI&ML** **T: 0**
4. **Target : Level 2** **P: 0**
   C: 3

COURSE PLAN

Target	50% (marks)
Level-1	40% (population)
Level-2	50% (population)
Level-3	60% (population)

1. Method of Evaluation

UG	**PG**
Quizzes/Tests, Assignments (30%)	Quizzes/Tests, Assignments, seminar (50%)
Mid Examination (20%)	End semester (50%)
End examination (50%)	

*may be keep as per Program (UG/PG)

2. Passing Criteria

Scale	**PG**	**UG**
Out of 10point scale	SGPA – "6.00" in each semester CGPA – "6.00" Min. Individual Course Grade – "C" Course Grade Point – "4.0"	SGPA – "5.0" in each semester CGPA – "5.0" Min. Individual Course Grade – "C" Course Grade Point – "4.0"

*for PG, passing marks are 40/100 in a paper
*for UG, passing marks are 35/100 in a paper

3. Pedagogy

- Synchronous Mode using BB Collaborate aided with power point presentations.
- Asynchronous Mode using Recorded Lectures/Voice over Power Points.
- 1 Discussion will be covered every week on working/non-working day as per faculty/student convenience. Proper record will be maintained for it.
- Regular Communication for Tests/Quizzes/Assignments as well as discussions will be ensured by the faculty through email or Blackboard announcements.

4. Topics introduced for the first time in the program through this course: NA

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5. **References:**

Text Books	Web resources	Journals	Reference books
T1: IBM: Innovative Centre for Education Machine Learning			**R1:** "Data Mining Concepts and Techniques", Jiawei Han and Micheline Kamber Second Edition Elsevier Publications **R2:** H. Dunham, "Data Mining: Introductory and Advanced Topics" Pearson Education

Signature of HOD/Dean **Signature of Faculty**

Date: **Date:**

UPES

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GUIDELINES TO STUDY THE SUBJECT

Instructions to Students:

1. Go through the 'Syllabus' in the Black Board section of the web-site(https://learn.upes.ac.in) in order to find out the Reading List.
2. Get your schedule and try to pace your studies as close to the timeline as possible.
3. Get your on-line lecture notes (Content, videos) at Lecture Notes section. These are our lecture notes. Make sure you use them during this course.
4. check your blackboard regularly
5. go through study material
6. check mails and announcements on blackboard
7. keep updated with the posts, assignments and examinations which shall be conducted on the blackboard
8. Be regular, so that you do not suffer in any way
9. C**ell Phones and other Electronic Communication Devices:** Cell phones and other electronic communication devices (such as Blackberries/Laptops) are not permitted in classes during Tests or the Mid/Final Examination. Such devices MUST be turned off in the class room.
10. **E-Mail and online learning tool:** Each student in the class should have an e-mail id and a pass word to access the LMS system regularly. Regularly, important information – Date of conducting class tests, guest lectures, via online learning tool. The best way to arrange meetings with us or ask specific questions is by email and prior appointment. All the assignments/tests/quizzes and asynchronous lectures (Recorded Lectures or Voice over ppt) will be uploaded on online learning tool BlackBoard. Various research papers/reference material will be mailed/uploaded on online learning platform time to time.
11. **Attendance:** Students are required to have minimum attendance of 75% in each subject. Students with less than said percentage shall NOT be allowed to appear in the end semester examination.

This much should be enough to get you organized and on your way to having a great semester! If you need us for anything, send your feedback through e-mail gdatta@ddn.upes.ac.in. Please use an appropriate subject line to indicate your message details.

There will no doubt be many more activities in the coming weeks. So, to keep up to date with all the latest developments, please keep visiting this website regularly.

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RELATED OUTCOMES

1. The expected outcomes of the Program are:

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**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.
PO3	**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.
PO4	**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.
PO5	**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.
PO6	**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.
PO7	**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.
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and

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	write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**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.
PO12	**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.

2. The expected outcomes of the Specific Program are: (upto3)

PSO1	Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques
PSO2	Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms.
PSO3	Ability to create & develop most efficient solutions by applying machine learning with analytical emphasis on industrial and research problems.

3. **The expected outcomes of the Course are: (minimum 3 and maximum 6)**

CO 1	To know the range of machine learning algorithms along with their strengths and weaknesses.
CO 2	Discuss the machine learning concepts corresponding to different applications.
CO 3	Comprehend the contemporary techniques in machine learning.
CO 4	Analyze the concept of predictive analytics, classification, clustering and its usage.
CO 5	Discuss information retrieval systems.

4. Co-Relationship Matrix

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Indicate the relationships by1- Slight (low) 2- Moderate (Medium) 3-Substantial (high)

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Perform system and application programming using computer system concepts, concepts of Data Structures, algorithm development, problem solving and optimizing techniques	Apply software development and project management methodologies using concepts of front-end and back-end development and emerging technologies and platforms.	Ability to create & develop most efficient solutions by applying machine learning with analytical emphasis on industrial and research problems.
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
	Machine Learning	2	2	1										**2**	**1**	**2**

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

5. **Course outcomes assessment plan:**

components / Course Outcomes	Assignment	Test/Quiz	Mid Semester	End Semester	Any other
CO 1	✓	✓	✓	✓	☐
CO 2	✓	✓	✓	✓	☐
CO 3	✓	✓	✓	✓	☐
CO 4	✓	✓	☐	✓	☐
CO 5	✓	✓	☐	✓	☐

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OVERVIEW OF COURSE DELIVERY/BROAD PLAN OF COURSE COVERAGE

Course Activities:

S. No.	Description	Planned			Actual			Remarks
		From	To	No. of Ses	From	TO	No. of Ses	
1	Introduction to machine learning			4				
2	Simple Linear Regression			5				
3.	Multiple Regression and Model Building			7				
4.	Classification Algorithms			14				
5.	Clustering Algorithms			7				
6.	Information Retrieval							

Total No. of Instructional periods available for the course: Sessions

Signature of HOD/Dean

Date:

Signature of Faculty

Date:

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SESSION PLAN

UNIT-I

Introduction to machine learning (4 hrs)

Session Plan				Actual Delivery			
Lect.	**Date**	**Topics to be Covered**	**CO Mapped**	**Lect.**	**Date**	**Topics Covered**	**CO Achieved**
1		The Origins of Machine Learning, Uses and Abuses of Machine Learning, how do Machines Learn?	CO1				
2		Abstraction and Knowledge Representation, Generalization, Assessing the Success of Learning,	CO1				
3		Steps to Apply Machine Learning to Data, choosing a Machine Learning Algorithm - Thinking about the Input Data	CO1				
4		Thinking about Types of Machine Learning Algorithms, Matching Data to an Appropriate Algorithm	CO1				

Signature of faculty **Date**

SESSION PLAN

UNIT-II

Simple Linear Regression (5 hrs)

Session Plan				Actual Delivery			
Lect.	**Date**	**Topics to be Covered**	**CO Mapped**	**Lect.**	**Date**	**Topics Covered**	**CO Achieved**
7		Introduction to Simple Linear Regression, Simple Linear Regression Model Building,	CO2				
8		Estimation of Parameters Using Ordinary Least Squares, Interpretation of Simple Linear Regression Coefficients,	CO2				
9		Validation of Simple Linear Regression Model, Coefficient of Determination (R-squared) and Adjusted R-Squared,	CO2				

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10		Spurious Regression, Hypothesis Test for Regression Coefficients (t-Test),	CO2				
11		Test for Overall Model: Analysis of Variance (F-Test), Residual Analysis.	CO2				
		Test I					

Signature of faculty **Date**

SESSION PLAN

UNIT-III

Multiple Regression and Model Building (7 hrs)

Session Plan				Actual Delivery			
Lect.	**Date**	**Topics to be Covered**	**CO Mapped**	**Lect.**	**Date**	**Topics Covered**	**CO Achieved**
1		Introduction to basic statistical techniques	CO3				
2		Partial Correlation and Regression Model Building, Ordinary Least Squares Estimation for Multiple Linear Regression, Multiple Linear Regression Model Building	CO3				
3		Standardized Regression Coefficient, Regression Models with Categorical (i.e., Qualitative) Variables - Interpretation of Regression Coefficients of Categorical Variables, Interaction Variables in Regression Models, Validation of Multiple Regression Model	CO3				
4		Introduction to Market Basket Analysis, Apriori Algorithm	CO3				
5		FP Growth Algorithm	CO3				
6		Linear Regression Model	CO3				
7		Logistic Regression	CO3				

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C: 3

Signature of faculty **Date**

SESSION PLAN

UNIT-IV

Classification Algorithms (14 hrs)

Session Plan				Actual Delivery			
Lect.	**Date**	**Topics to be Covered**	**CO Mapped**	**Lect.**	**Date**	**Topics Covered**	**CO Achieved**
7		Introduction to Classification and applications	CO4				
8		k-Nearest Neighbor Algorithm	CO4				
9		Decision Trees Algorithms	CO4				
10		Decision Tree Algorithms	CO4				
11		Ensemble Methods: Bagging, Boosting and AdaBoost and XBoost, Random Forest	CO4				
12		Naive Bayesian Classifier	CO4				
14		Introduction to Neural Network	CO4				
15		Deep Neural Network	CO4				
16		Convolution Neural Network	CO4				
17		Other Advance Neural Networks (Fully Connected, RCNN, Google Net, ResNet)	CO4				
18		Support Vector Machine	CO4				
19		Support Vector Machine	CO4				
20		Classification Model Evaluation and Selection	CO4				
21		Misclassification Cost Adjustment to Reflect Real-World Concerns, Decision Cost/Benefit Analysis	CO4				

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C: 3

Signature of faculty **Date**

SESSION PLAN

UNIT-III

Clustering Algorithms (7 hrs)

Session Plan				Actual Delivery			
Lect.	Date	**Topics to be Covered**	**CO Mapped**	**Lect.**	**Date**	**Topics Covered**	**CO Achieved**
15		Introduction to Clustering, The Clustering Task and the Requirements for Cluster Analysis, Overview of Some Basic Clustering Methods	CO3				
16		Partitioning Methods: k-Means Clustering	CO3				
17		k-Medoids Clustering	CO3				
18		Hierarchical Methods: Agglomerate versus Divisive Hierarchical Clustering, Distance Measures	CO3				
19		Density-Based Clustering: DBSCAN - Density-Based Clustering Based on Connected Regions with High Density Measuring Clustering Goodness	CO3				
20		Real World Problems Analysis	CO3				
21		Real World Problems Analysis	CO3				
25		Quiz 1 & Assignment 1 Discussion	CO3				
26		***Test 2***	CO3				

Signature of faculty **Date:**

UPES

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C: 3

SESSION PLAN

UNIT-IV

Information Retrieval (8 hrs)

Session Plan				Actual Delivery			
Lect.	**Date**	**Topics to be Covered**	**CO Mapped**	**Lect.**	**Date**	**Topics Covered**	**CO Achieved**
27		Introduction to Information Retrieval	CO4				
28		Architecture and Models	CO4				
29		Similarity Metrics and Term Weighting	CO4				
30		Retrieval in Vector Space Model	CO4				
31		Constructing Inverted Index (Word Counting), Stop Word removal, Stemming	CO4				
32		Text Documents Clustering	CO4				
33		Text Representation	CO4				
34		Applications of Document Clustering, Evaluation of Text Clustering: Internal and External Measures	CO4				

Signature of faculty **Date:**