K L Deemed to be University
Department of Artificial Intelligence and Data Science -- KLVZA
Course Handout
2022-2023, Even Sem

Course Title	:Machine Learning
Course Code	:21AD2205
L-T-P-S Structure	: 3-0-0-2
Pre-requisite	:
Credits	: 3.5
Course Coordinator	:VIJAYALAKSHMI PONNUSWAMY
Team of Instructors	:
Teaching Associates	:

Syllabus : Basics: Introduction to machine learning - different forms of learning; Applications of Machine Learning. Regression Analysis: Linear regression, ridge regression, Lasso, Bayesian regression, regression with basis functions, Logistic regression, Multiple regression and its variants. Classification Methods: Classification and Regression Trees, Naïve Bayesian classifier, Linear Discriminant Analysis, Large margin classification, Kernel methods, Support Vector Machines, Perceptron, Multilayer Perceptron and Back propagation. Graphical Models: Bayesian Belief Networks, Markov Model, Hidden Markov models, Markov Network Reinforcement learning: Markov Decision process, Q-Learning Ensemble Methods: Voting, Boosting - Adaboost, Gradient Boosting; Bagging - Simple methods, Random Forest. Clustering: Partitional Clustering - k-means, k-medoids; Hierarchical Clustering - Agglomerative, Divisive, Distance measures; Density based clustering - DBScan; Spectral clustering Dimensionality Reduction: Wavelet Transform, Principal Component Analysis (PCA)

Text Books :1. Introduction to Machine Learning Edition 2, by Ethem Alpaydin 2. T. Hastie, R.Tibshirani, J. Friedman, "The Elements of Statistical Learning: Data Mining, Inference and Prediction", 2nd Edition, Springer Series in Statistics, 2009.

Reference Books :1. C. M. Bishop. "Pattern Recognition and Machine Learning," Springer, 2006. 2. J. Han and M. Kamber. "Data Mining: Tools and Techniques," 3rd Edition, Morgan Kaufmann Press, 2012. 3. K. R. Murphy. "Machine Learning - A Probabilistic Perspective", 1st Edition, The MIT Press, 2012. 4. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.

Web Links :1. https://www.coursera.org/specializations/machine-learning 2. https://www.coursera.org/learn/machine-learning 3. https://in.udacity.com/course/machine-learning-engineer-nanodegree-- nd009t 4. https://www.udemy.com/machinelearning/ 5. https://www.coursera.org/learn/machine-learning?cartId=34726539

MOOCS :1.https://onlinecourses.nptel.ac.in/noc16_cs03/preview 2.https://www.coursera.org/learn/machine-learning?cartId=34726539

Course Rationale : Once there is a perception that automation can replace humans. Now-a- days it has become reality. Machines are becoming more and more intelligent. Machine Learning is one such course which deals with making machines more powerful and intelligent. In this course, students can learn various machine learning algorithms, underlying concepts and their application to a real world problem. All these algorithms are powered by various statistical techniques. Students learn these probability and statistics methods that make machine learning algorithms robust in order to build automatic learning machine models. This course mainly focuses on the learning paradigms namely Decision tree, Bayes, Neural Networks and genetic algorithms. Overall this course gives a comprehensive insight to the student on the application of these algorithms on real time problems in order to construct an intelligent machine.

Course Objectives : The objective of the course is to make the students learn about how to build intelligent machines to solve a real world problem. The students will learn to analyse large datasets, build models that can make predictions from data, create systems that adapt and improve over time. The students will apply the skills to solve real world problems through implementation of machine learning algorithms. Machine

learning is attempted in a number of critical applications, such as medical, cybersecurity, natural language processing and expert systems. ML provides reasonable solutions in these domains. It is predicted that in future Machine Learning is going to become a globally recognized area and will be applied extensively in all the fields.

COURSE OUTCOMES (COs):

CO NO	Course Outcome (CO)	PO/PSO	Blooms Taxonomy Level (BTL)
CO1	Inculcate and impart core understanding of Machine learning basics and regression models	PO2,PO3	2
CO2	Quantitatively analyse the classification algorithms to provide solutions for realistic applications	PO3,PO2	3
CO3	Comprehend and solve real-world problems using unsupervised learning algorithms	PO4,PSO1	3
CO4	Apply and choose appropriate Reinforcement learning, Dimensionality reduction techniques and Ensemble methods to provide accurate solution to undeterministic problems.	PO4,PSO1	3
CO5	Deploy and develop Machine learning techniques in various real world applications using python and Tensor Flow	PO5,PSO1,PSO2	3

COURSE OUTCOME INDICATORS (COIs)::

Outcome No.	Highest BTL	COI-1	COI-2	COI-3
CO1	2	**Btl-1** List out applications of Machine Learning	**Btl-2** Understanding the concepts of machine learning and regression analysis	
CO2	3	**Btl-1** List out different supervised learning techniques	**Btl-2** Understanding classification and regression trees	**Btl-3** Apply classification algorithms for problem solving.
CO3	3	**Btl-1** List out different Unsupervised learning techniques	**Btl-2** Understanding Clustering algorithms.	**Btl-3** Apply Clustering algorithms for problem solving
CO4	3	**Btl-1** Recall the concept of Reinforcement learning	**Btl-2** Understanding the concepts of Reinforcement learning	**Btl-3** Apply Ensemble methods and Dimensionality reduction techniques
CO5	3			**Btl-3** Implement and enhancing machine learning algorithms in python, tensor-flow and provide solutions to real-world applications

PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES (POs/PSOs)

Po No.	Program Outcome
PO1	Engineering Knowledge:Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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PO2	Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences
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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
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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 for complex problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline.
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PO5	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.
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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.
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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
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PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
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PO9	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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PO10	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
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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.
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PO12	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.
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PSO1	An ability to design and develop Artificial Intelligence technology into innovative products for solving real world problems
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PSO2	An ability to design and develop Data Science methods for analyzing massive datasets to extract insights by applying AI as a tool.
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Lecture Course DELIVERY Plan:

Sess.No.	CO	COI	Topic	Book No[CH No] [Page No]	Teaching-Learning Methods	EvaluationComponents
1	CO1	COI-1	A brief on Handout, A brief introduction on ML	T1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
2	CO1	COI-1	Introduction to Machine Learning, Different forms of Machine Learning	T1-CH1 Page 1-6	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
3	CO1	COI-1	Applications of ML	T1-CH1-7-11	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
4	CO1	COI-1	Ridge Regression	T1-CH-4-Page 73 & T2-CH 3	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
5	CO1	COI-2	Lasso Regression	T1-CH4-page 74& T2-CH 3	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
6	CO1	COI-2	Bayesian Regression	T1-CH3-Page 43 & T3-CH-3	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
7	CO1	COI-	Regression with basis	T1-CH1-	Chalk,PPT,Talk	ALM,End Semester

Sess.No.	CO	COI	Topic	Book No[CH No] [Page No]	Teaching-Learning Methods	EvaluationComponents
		2	functions	Page 29 & T3-CH 3		Exam,Group Discussion,SEM-EXAM1
8	CO1	COI-2	Logistic Regression	T1-5-CH-1	Chalk,PPT,Talk	ALM,End Semester Exam,Home Assignment,SEM-EXAM1
9	CO1	COI-2	Multiple Regression and its variants	T1-CH 5 - Page 100 & T3-CH 3	Chalk,PPT,Talk	End Semester Exam,Home Assignment,SEM-EXAM1
10	CO2	COI-1	Classification and Regression Trees	T1-CH 9- Page 176 &T2-CH 9	Chalk,PPT,Talk	End Semester Exam,Home Assignment,SEM-EXAM1
11	CO2	COI-1	Naive Bayesian classifier	T1-CH-3Page 39& T5-CH 3	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
12	CO2	COI-1	Linear Discriminant Analysis	T1- CH 10 - Page 197 & T3-CH 4	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1
13	CO2	COI-2	Large margin Classification	T1-CH-10-Page 221 & T3-CH7	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
14	CO2	COI-2	Kernel Methods	T1-CH 10 - Page 223 & T3-CH 6	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
15	CO2	COI-2	Support Vector Machines	T1-CH 10 - Page 218 & T3- CH7	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1
16	CO2	COI-3	Perceptron	T1-CH 11 - Page 233	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
17	CO2	COI-3	Multilayer Perceptron	T1-CH 11 - Page 229	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
18	CO2	COI-3	Back-propagation	T1-CH 11 - Page 245	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
19	CO3	COI-1	Graphical Models: Basyesian Belief Networks	T1- CH 3 - Page 48 &T3-CH 8	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2

Sess.No.	CO	COI	Topic	Book No[CH No] [Page No]	Teaching-Learning Methods	EvaluationComponents
20	CO3	COI-1	Bayesian belief Networks	T1-CH 3-Page 48 & T3-CH 8	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
21	CO3	COI-1	Markov Model	T1-CH- 13 Page 48 & T3-CH- 8	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
22	CO3	COI-2	Hidden Markov Model	T1-CH 13-Page 309 & T5-CH 1	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1
23	CO3	COI-2	Markov Network	T1- CH 13 - Page 322 & T5-CH 1	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
24	CO3	COI-2	Reinforcement Learning: Markov Decision process	T1 - CH 16 - Page 373 & T6-CH 13	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
25	CO3	COI-2	Q Learning	T1-CH 16-Page-380 & T6-CH 13	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
26	CO3	COI-3	Ensemble Methods: Voting	T1 - CH 15 - Page 354	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
27	CO3	COI-3	Boosting - Adaboost	T1-Ch- 15 Page 363	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1
28	CO3	COI-3	Gradient Boosting	T1- CH- 15 Page 363	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
29	CO3	COI-3	Bagging - Simple methods	T1 - CH 15 - Page 360	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
30	CO3	COI-3	Random Forest	T1-CH-15 page 360	Chalk,PPT,Talk	End Semester Exam,Home Assignment,SEM-EXAM1
31	CO4	COI-1	Clustering: Partitional clustering - k-means	T1-CH 7-Page 135	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
32	CO4	COI-1	K-Medoids	T1-CH 7 - Page 135	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1
33	CO4	COI-2	Hierchical clustering - Agglomerative	T1-CH-7 page 146	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1

Sess.No.	CO	COI	Topic	Book No[CH No] [Page No]	Teaching-Learning Methods	EvaluationComponents
34	CO4	COI-2	Hierarchical clustering-Divisive	T1-CH 7-Page 146	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
35	CO4	COI-2	Distance measures	T1-CH 7-Page 134	Chalk,PPT,Talk	ALM,End Semester Exam,SEM-EXAM1
36	CO4	COI-2	DB Scan	T1-CH-7 page 134	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
37	CO4	COI-3	Spectral clustering	T1-CH-6 - Page 105	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM1
38	CO4	COI-3	Dimensionality Reduction: Wavelet transform	T1-CH 6 - Page 105	Chalk,PPT,Talk	End Semester Exam,SEM-EXAM2
39	CO4	COI-3	Principle Component Analysis	T1-CH-6-Page 108	Chalk,PPT,Talk	End Semester Exam,Home Assignment,SEM-EXAM1

Lecture Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 Briefing on ML Handout and Introduction to ML

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	A brief on ML-Handout	1	PPT	--- NOT APPLICABLE ---
20	Introduction to ML	1	Talk	--- NOT APPLICABLE ---
5	Summary and conclusion remarks	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 2

Session Outcome: 1 Enable the students to learn about the core concepts of ML and its types

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods

5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Concepts of ML	1	PPT	--- NOT APPLICABLE ---
20	Different Types of ML	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 3

Session Outcome: 1 Students are able to understand the Applications of ML

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Significance of ML Applications in scientific research	2	PPT	--- NOT APPLICABLE ---
20	Significance of ML Applications in real-world problems	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 4

Session Outcome: 1 Students are able to understand the core concepts of Ridge regression

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Concepts of Ridge regression	2	PPT	--- NOT APPLICABLE ---
20	Significance and Limitations of Ridge regression	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 5

Session Outcome: 1 Students are able to understand the core concepts of Lasso regression concepts

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Recap on regression types	1	PPT	--- NOT APPLICABLE ---
20	Lasso regression	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 6

Session Outcome: 1 Students are able to understand the core concepts of Bayesian regression

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Core concept of Bayesian Regression	2	PPT	--- NOT APPLICABLE ---
20	Limitations of Bayesian regression	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 7

Session Outcome: 1 Students are able to understand the core concepts of regression basis functions

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Concepts of regression with basis functions	2	PPT	Group Discussion
20	Significance and Limitations of Regularisation	2	PPT	--- NOT APPLICABLE ---

5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 8

Session Outcome: 1 Students are able understand the concepts of Logistic regression

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Concepts of Logistic Regression	2	PPT	Fish Bowl
20	Significance and Limitation of LR	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 9

Session Outcome: 1 Students are able to understand the multiple variants regression and

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Multiple Regression	2	PPT	--- NOT APPLICABLE ---
20	Variants of Multiple Regression	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 10

Session Outcome: 1 Students are able to understand the Regression tree concepts and classification models

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Classification	2	PPT	--- NOT APPLICABLE ---

20	Regression Trees	1	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 11

Session Outcome: 1 Students are able to understand the basic principles of Naive Bayesian classifier

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Basic principles of Naive Bayesian classifier	2	PPT	--- NOT APPLICABLE ---
20	Naive Bayesian classifier with proper Illustrations	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 12

Session Outcome: 1 Students are able to install the knowledge of LDA

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Significance of LDA	1	Talk	One minute paper
20	Principles of LDA	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 13

Session Outcome: 1 Students are able to understand the core principles of Margin classification

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE

20	Core principle and functioning of Large margin classification	2	PPT	--- NOT APPLICABLE ---
20	Limitations of Large Margin classification	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 14

Session Outcome: 1 Students are able to understand the core concepts of Kernel methods

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Principle & Methodology of Kernel methods	2	PPT	--- NOT APPLICABLE ---
20	Kernel methods - with proper illustration	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 15

Session Outcome: 1 Students are able to know the core principles of SVM

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Significance of SVM	2	Talk	Quiz/Test Questions
20	Principle of SVM and Limitations	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 16

Session Outcome: 1 Students are able to know the significance of Perceptrons

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	What is the need of Perceptrons?	1	Talk	--- NOT APPLICABLE ---
20	Principles of Perceptron with proper illustration	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 17

Session Outcome: 1 Students are able to know the concept of MLP

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Why MLP?	2	PPT	--- NOT APPLICABLE ---
20	Illustration of MLP and its Limitations	2	PPT	--- NOT APPLICABLE ---
5	Concluding Remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 18

Session Outcome: 1 Students are able to know the needs of BP

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Need for BP	2	PPT	--- NOT APPLICABLE ---
20	BP algorithm	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	2	Talk	--- NOT APPLICABLE

SESSION NUMBER : 19

Session Outcome: 1 Students are able to install the knowledge of BBF- Graphical models

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Introduction of Bayesian Belief Networks	2	PPT	--- NOT APPLICABLE ---
20	Illustration and Implementation of BBF	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 20

Session Outcome: 1 Students are able to understand the principles of Bayesian Belief networks

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Concepts of Belief Networks	2	PPT	--- NOT APPLICABLE ---
20	Significance of Bayesian belief networks in real-time Applications	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 21

Session Outcome: 1 Students are able to understand the significance of Markov model

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Principles of Markov model	2	Talk	--- NOT APPLICABLE ---

20	Significance of Markov model	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 22

Session Outcome: 1 Students are able to understand the importance of Hidden Markov models

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Concept of Hidden Markov model	2	PPT	Case Study
20	Illustrations of HMM	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 23

Session Outcome: 1 Students can understand the working of Markov network

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Markov Network - its significance	3	PPT	--- NOT APPLICABLE ---
20	Limitations of Markov network	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 24

Session Outcome: 1 Students are able to understand the significance of Markov decision models

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---

20	Introduction to Reinforcement Learning	2	PPT	--- NOT APPLICABLE ---
20	Markov Decision Process - Principles & its significance	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 25

Session Outcome: 1 Students are able to understand the Q Learning concepts

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Why Q Learning?	2	Talk	--- NOT APPLICABLE ---
20	Q Learning - Concepts & Limitations	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 26

Session Outcome: 1 Students are able to know the importance of Ensemble methods

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
20	What is Ensemble method? Its significance	2	PPT	--- NOT APPLICABLE ---
20	Voting- concepts and working principles	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 27

Session Outcome: 1 Students are able to understand the principles of Adaboost

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and transition activities	1	Talk	--- NOT APPLICABLE ---
20	Boosting: Adaboost - concepts	2	PPT	Brain storming session
20	Implementation of Adaboost	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 28

Session Outcome: 1 Students are able to understand the core principles of Gradient Boosting

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Gradient boosting: Concepts and its significance	2	Talk	--- NOT APPLICABLE ---
20	Gradient boosting: Implementation	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 29

Session Outcome: 1 Students are able to know the importance of Bagging methods

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Bagging - Principles	2	Talk	--- NOT APPLICABLE ---
20	Bagging- simple methods	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 30

Session Outcome: 1 Students are able to understand the concept of Random forest

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and transition activities	1	Talk	--- NOT APPLICABLE ---
20	Random forest: concept	2	PPT	--- NOT APPLICABLE ---
20	Random forest : Implementation	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 31

Session Outcome: 1 Students ar able to install knowledge in clustering

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Why clustering is important?	2	Talk	--- NOT APPLICABLE ---
20	Partitional clustering-k-means	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 32

Session Outcome: 1 Students are able to understand the core principles of K-Medoids

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Principles of K-Medoids	2	PPT	Role playing
20	Significance of k-Medoids & illustrations	3	PPT	--- NOT APPLICABLE ---

5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 33

Session Outcome: 1 Students are able to understand the core principles of Hierarchical clustering

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and transition activities	1	Talk	--- NOT APPLICABLE ---
20	Hierarchical clustering - Agglomerative	2	PPT	--- NOT APPLICABLE ---
20	Limitations of HC	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 34

Session Outcome: 1 Students are able to understand Divisive concepts

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
20	Significance of Divisive clustering	2	PPT	--- NOT APPLICABLE ---
20	Divisive clustering - concept & Illustration	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks * Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 35

Session Outcome: 1 Students are able to understand the concepts of distance measures

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Principles of Distance measures	3	PPT	Debate

20	Limitations od DM	2	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 36

Session Outcome: 1 Students are able to understand the concepts of DBScan

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Why density based clustering? & its importance	2	PPT	--- NOT APPLICABLE ---
20	DBScan concept and Illustrations & Implementation	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 37

Session Outcome: 1 Students are able to understand the concepts of Spectral clustering

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Spectral clustering: concepts and working principles	2	PPT	--- NOT APPLICABLE ---
20	Implementation of clustering algorithms (spectral)	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks and summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 38

Session Outcome: 1 Students are able to understand the concepts of Dimensionality Reduction

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods

5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
20	Dimensionality reduction: principles and significance	2	PPT	--- NOT APPLICABLE ---
20	Wavelet Transform	3	PPT	--- NOT APPLICABLE ---
5	Concluding remarks & Summary	1	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 39

Session Outcome: 1 Students are able to understand and implement PCA

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and transition activities	1	Talk	--- NOT APPLICABLE ---
20	PCA: Working principle	2	PPT	--- NOT APPLICABLE ---
20	Implementation of PCA	3	PPT	--- NOT APPLICABLE ---
5	Concluding Remarks and Summary	1	Talk	--- NOT APPLICABLE ---

Tutorial Course DELIVERY Plan: NO Delivery Plan Exists

Tutorial Session wise Teaching – Learning Plan

No Session Plans Exists

Practical Course DELIVERY Plan: NO Delivery Plan Exists

Practical Session wise Teaching – Learning Plan

No Session Plans Exists

Skilling Course DELIVERY Plan:

Skilling session no	Topics/Experiments	CO-Mapping
1	Manipulation operations using Numpy and Pandas	CO5
2	Build linear regression model for the given dataset using Python Libraries	CO5

Skilling session no	Topics/Experiments	CO-Mapping
3	Predict whether the person is willing to donate the blood or not based on the donor dataset using Decision tree classifier	CO5
4	Program on Multiple Linear Regression with scikit learn for house price prediction.	CO5
5	Predict the income class based on the Naïve Bayes classification using adult census data	CO5
6	Implementation of AND and OR logical gates using perceptron	CO5
7	Classification of Iris dataset using Multi-layer perceptron model	CO5
8	Apply K-means algorithm for clustering on IRIS dataset	CO5
9	Apply DBSCAN algorithm on weather dataset	CO5
10	Implement Agglomerative clustering algorithm on state wise pollution dataset.	CO5
11	Implement AdaBoost algorithm for classifying IRIS datat	CO5
12	Random Forest Ensemble	CO5

Skilling Session wise Teaching – Learning Plan

SESSION NUMBER : 1

Session Outcome: 1 Students are able to learn pandas and Numpy

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
45	Demonstrate basic data manipulation operations using Numpy and pandas	3	PPT	--- NOT APPLICABLE ---
50	Evaluation and Viva Voce	3	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 2

Session Outcome: 1 Students will learn how to build regression models using python libraries

Time(min)	Topic	BTL	Teaching-Learning	Active Learning

			Methods	Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
40	Build linear regression model for the given dataset using Python Libraries	3	PPT	--- NOT APPLICABLE ---
50	Evaluation and Viva-Voce	3	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 3

Session Outcome: 1 Students will be able to learn to apply Decision Trees and its applications

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
40	Predict whether the person is willing to donate the blood or not based on the donor data using Decision tree classifier	3	PPT	--- NOT APPLICABLE ---
50	Evaluation and Viva-Voce	3	Talk	--- NOT APPLICABLE ---

SESSION NUMBER : 4

Session Outcome: 1 Students will apply regression in house price prediction

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
50	Multiple Linear Regression with scikit learn for house price prediction	3	PPT	--- NOT APPLICABLE ---
45	Evaluation and Viva Voce	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 5

Session Outcome: 1 Apply Naïve Bayes classification using adult census data.

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---

60	Predict the income class based on the Naïve Bayes classification using adult census data.	3	PPT	--- NOT APPLICABLE ---
35	Evaluation & Viva-Voce	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 6

Session Outcome: 1 Implementing AND and OR logical gates using perceptron

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance	1	Talk	--- NOT APPLICABLE ---
60	Implementing AND and OR logical gates using perceptron	3	PPT	--- NOT APPLICABLE ---
35	Evaluation and Viva-Voce	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 7

Session Outcome: 1 Classification of Iris dataset using Multi-layer perceptron model

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
60	Classification of Iris dataset using Multi-layer perceptron model	3	PPT	--- NOT APPLICABLE ---
35	Evaluation & Viva-Voce	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 8

Session Outcome: 1 Apply K-means algorithm for clustering on IRIS dataset

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
60	Apply K-means algorithm for clustering on IRIS dataset	3	PPT	--- NOT APPLICABLE ---

35	Evaluation & Viva-Voce	3	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 9

Session Outcome: 1 Apply DBSCAN algorithm on weather dataset

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
60	Apply DBSCAN algorithm on weather dataset	3	PPT	--- NOT APPLICABLE ---
35	Evaluation and Viva-Voce	1	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 10

Session Outcome: 1 Implement Agglomerative clustering algorithm on state wise pollution dataset

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
60	Implement Agglomerative clustering algorithm on state wise pollution dataset	3	PPT	--- NOT APPLICABLE ---
35	Evaluation & Viva-voce	1	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 11

Session Outcome: 1 Implement AdaBoost algorithm for classifying IRIS data set

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance & Transition activities	1	Talk	--- NOT APPLICABLE ---
60	Implement AdaBoost algorithm for classifying IRIS data set	3	PPT	--- NOT APPLICABLE ---
35	Evaluation & Viva-Voce	1	LTC	--- NOT APPLICABLE ---

SESSION NUMBER : 12

Session Outcome: 1 Enable students to know about Random Forest Ensemble concepts

Time(min)	Topic	BTL	Teaching-Learning Methods	Active Learning Methods
5	Attendance and Transition activities	1	Talk	--- NOT APPLICABLE ---
60	Implement the concept of Random forest Ensemble	3	PPT	--- NOT APPLICABLE ---
35	Evaluation and Viva-voce	1	Talk	--- NOT APPLICABLE ---

WEEKLY HOMEWORK ASSIGNMENTS/ PROBLEM SETS/OPEN ENDEDED PROBLEM-SOLVING EXERCISES etc:

Week	Assignment Type	Assignment No	Topic	Details	co

COURSE TIME TABLE:

	Hour	1	2	3	4	5	6	7	8	9
Day	Component									
Mon	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--
Tue	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--
Wed	Theory	---	---	---	---	---	V-S3	---	V-S2	---
	Tutorial	---	---	---	---	---	--	---	--	---
	Lab	---	---	---	---	---	--	---	--	---
	Skilling	---	---	---	---	---	--	---	--	---

Thu	Theory	---	---	--	--	---	V-S3	---	---	V-S1
	Tutorial	---	---	--	--	---	--	---	---	--
	Lab	---	---	--	--	---	--	---	---	--
	Skilling	---	---	V-S2,V-S2,V-S2	V-S2,V-S2,V-S2	---	--	---	---	--
Fri	Theory	V-S2	---	---	---	---	V-S1	---	--	--
	Tutorial	--	---	---	---	---	--	---	--	--
	Lab	--	---	---	---	---	--	---	--	--
	Skilling	--	---	---	---	---	--	---	V-S1,V-S1,V-S1,V-S3,V-S3,V-S3	V-S1,V-S1,V-S1,V-S3,V-S3,V-S3
Sat	Theory	V-S1,V-S3	---	---	---	---	---	---	V-S2	---
	Tutorial	--	---	---	---	---	---	---	--	---
	Lab	--	---	---	---	---	---	---	--	---
	Skilling	--	---	---	---	---	---	---	--	---
Sun	Theory	--	--	--	--	--	--	--	--	--
	Tutorial	--	--	--	--	--	--	--	--	--
	Lab	--	--	--	--	--	--	--	--	--
	Skilling	--	--	--	--	--	--	--	--	--

REMEDIAL CLASSES:

Supplement course handout, which may perhaps include special lectures and discussions that would be planned, and schedule notified according

SELF-LEARNING:

Assignments to promote self-learning, survey of contents from multiple sources.

S.no	Topics	CO	ALM	References/MOOCS

DELIVERY DETAILS OF CONTENT BEYOND SYLLABUS:

Content beyond syllabus covered (if any) should be delivered to all students that would be planned, and schedule notified accordingly.

S.no	Advanced Topics, Additional Reading, Research papers and any	CO	ALM	References/MOOCS

EVALUATION PLAN:

Evaluation Type	Evaluation Component	Weightage/Marks		Assessment Dates	Duration (Hours)	CO1	CO2	CO3	CO4	CO5
End Semester Summative Evaluation Total= 40 %	End Semester Exam	Weightage	24		180	6	6	6	6	
		Max Marks	100			25	25	25	25	
	Skill Sem-End Exam	Weightage	16		120					16
		Max Marks	100							100
In Semester Summative Evaluation Total= 38 %	Semester in Exam-I	Weightage	15		90	7.5	7.5			
		Max Marks	50			25	25			
	Semester in Exam-II	Weightage	15		90			7.5	7.5	
		Max Marks	50					25	25	
	Skill In-Sem Exam	Weightage	8		90					8
		Max Marks	50							50
In Semester Formative Evaluation Total= 22 %	ALM	Weightage	8		60	2	2	2	2	
		Max Marks	40			10	10	10	10	
	Home Assignment and Textbook	Weightage	7		60	1.75	1.75	1.75	1.75	
		Max Marks	40			10	10	10	10	
	Skilling Continuous Evaluation	Weightage	7		100					7
		Max Marks	120							120

ATTENDANCE POLICY:

Every student is expected to be responsible for regularity of his/her attendance in class rooms and laboratories, to appear in scheduled tests and examinations and fulfill all other tasks assigned to him/her in every course
In every course, student has to maintain a minimum of 85% attendance to be eligible for appearing in Semester end examination of the course, for cases of medical issues and other unavoidable circumstances the students will be condoned if their attendance is between 75% to 85% in every course, subjected to submission of medical certificates, medical case file and other needful documental proof to the concerned departments

DETENTION POLICY :

In any course, a student has to maintain a minimum of 85% attendance and In-Semester Examinations to be eligible for appearing to the Semester End Examination, failing to fulfill these conditions will deem such student to have been detained in that course.

PLAGIARISM POLICY :

Supplement course handout, which may perhaps include special lectures and discussions

COURSE TEAM MEMBERS, CHAMBER CONSULTATION HOURS AND CHAMBER VENUE DETAILS:

Supplement course handout, which may perhaps include special lectures and discussions

Name of Faculty	Delivery Component of Faculty	Sections of Faculty	Chamber Consultation Day (s)	Chamber Consultation Timings for each day	Chamber Consultation Room No:	Signature of Course faculty:
Sajana Tiruveedhula	S	1-B	-	-	-	-

NICHENAMETLA RAJESH	S	3-B	-	-	-	-
Vivek Kumar	S	1-C	-	-	-	-
VIJAYALAKSHMI PONNUSWAMY	L	1-MA,2-MA	-	-	-	-
VIJAYALAKSHMI PONNUSWAMY	S	2-A,1-A	-	-	-	-
Ashwin M	L	3-MA	-	-	-	-
Ashwin M	S	2-B,3-A	-	-	-	-
SUNITHA PACHALA	S	2-C,3-C	-	-	-	-

GENERAL INSTRUCTIONS

Students should come prepared for classes and carry the text book(s) or material(s) as prescribed by the Course Faculty to the class.

NOTICES

Most of the notices are available on the LMS platform.

All notices will be communicated through the institution email.

All notices concerning the course will be displayed on the respective Notice Boards.

Signature of COURSE COORDINATOR

(VIJAYALAKSHMI PONNUSWAMY)

Signature of Department Prof. Incharge Academics & Vetting Team Member

Department Of AI&DS

HEAD OF DEPARTMENT:

Approval from: DEAN-ACADEMICS
(Sign with Office Seal) [object HTMLDivElement]