

Course Code	UDS21G01T	Course Name	ROLE OF MATHEMATICS IN AI	Course Category	G	Generic Elective Course	L	T	P	C
							4	0	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics and Statistics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):		The purpose of learning this course is to,			Learning			Program Learning Outcomes (PLO)														
CLR-1 :	Create an understanding on the use of Mathematical concepts applied in AI				1	2	3	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLR-2 :	Give exposure to Applications of Discrete/Applied/ Finite Mathematics in AI				Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)	Fundamental Knowledge	Application of Concepts	Link with Related	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	ICT Skills	Professional Behavior	Life Long Learning
CLR-3 :	Teach the Calculus and Probability and Statistics concepts used in AI							H	H	H	H	H	-	M	M	L	-	H	-	M	H	
CLR-4 :	Identify the application of Matrix and Matrix Algebra in AI							L	H	H	H	H	-	M	M	L	-	H	-	M	H	
CLR-5 :	Impart the knowledge on Graphs and Game theory concepts							L	H	H	H	H	-	M	M	L	-	H	-	M	H	
CLR-6 :	Apply Mathematics and Statistical concepts in AI							L	H	H	H	H	-	M	M	L	-	H	-	M	H	
Course Learning Outcomes (CLO):		At the end of this course, learners will be able to:																				
CLO-1 :	Understand the role of Mathematics in AI				2	85	80	H	H	H	H	H	H	-	M	M	L	-	H	-	M	H
CLO-2 :	Apply the Mathematical thinking in AI				3	85	80	L	H	H	H	H	H	-	M	M	L	-	H	-	M	H
CLO-3 :	Understand and apply the concepts in Calculus and Probability and Statistics in AI				3	85	80	L	H	H	H	H	H	-	M	M	L	-	H	-	M	H
CLO-4 :	Recognize the use of Matrix and Matrix Algebra				3	85	80	L	H	H	H	H	H	-	M	M	L	-	H	-	M	H
CLO-5 :	Use concepts in Graphs and Game theory in AI				3	85	80	L	H	H	H	H	H	-	M	M	L	-	H	-	M	H
CLO-6 :	Understand Mathematics and Statistical concepts used in AI				3	85	80	L	H	H	H	H	H	-	M	M	L	-	H	-	M	H

Note: All our curriculum, study materials, assignments, quizzes, lab works, and learning resources are personalized and dynamically generated using machine learning models based on the learner's learning ability. Users can review our learning curriculum only through our intelligent learning management platform (iLMSP), and our learning resources and lab infrastructures are available only in the digital form on our cloud infrastructures.

Duration (hour)		12	12	12	12	12
S-1	SLO-1	Unit 1: Mathematics in AI	Formulating Hypothesis Skills	Thinking from Perspectives	Introduction to Probability theory	Mathematics behind Fourier transform
	SLO-2	Role of Mathematics in AI	Comparison Classification Skills	Generalizing/Abstraction	Statistical data analysis	Discrete Fourier Transform
S-2	SLO-1	Fundamentals of Mathematics in AI	Identifying Variables Skills	Unit 6: Linear Algebra	Diagrammatic representation	Signal Generation and Phase Shift
	SLO-2	Introduction to Quadratic Equations and functions	Designing Experimental Skills	Overview of Linear Algebra	Sampling & its types	Transfer function for mathematics
S-3	SLO-1	Overview of Differential Calculus Foundations	Estimation and Approximation Skills	Linear Algebra for AI	Measures of Central Tendency	Unit 11: Graphs their Representation and terminologies

	SLO-2	Introduction to Differentiation and Derivatives	Reaching Conclusion and Interpretational Skills	Overview of vectors	Measures of Dispersion	Introduction to graph theory
S-4	SLO-1	Introduction to Vector and Vector Multiplications	Unit 4: Applications of Discrete/Applied/Finite Mathematics in AI	Overview of matrices	Correlation and covariance	Graphs – Terminology and Representation
	SLO-2	Introduction to Matrices	Infinite Series	Matrix Factorization	Different Types of Distributions	Graph, Vertices, and Edges
S-5	SLO-1	Sampling and Sampling Distributions	Linear Algebra and matrices	Single Value Decomposition	Unit 9: Matrix and Matrix Algebra	Classification of Graphs
	SLO-2	Probability Basics	Probability Distributions	Ordinary least Squares	Overview of Matrix and Matrix Algebra	Types of graphs
S-6	SLO-1	Unit 2: Why Mathematics is Required for an AI Implementation.	Predicate logic and Rule Engine	Linear least Squares	Order of matrix	Node, Degree of a Node
	SLO-2	Building Knowledge Based Expert Systems	Markov Chain and Markov Property	Overview of Tensors	Square matrix	Cyclic and Acyclic Graphs
S-7	SLO-1	Develop Problem Solving Skills	Curve fitting and Gradient Descent	Unit 7: Calculus	Diagonal matrix	Trees and Spanning Trees
	SLO-2	Generate AI Models	Levenberg Marquardt algorithm	Overview of Calculus	Triangular Matrix	Data Structures for representing Graphs
S-8	SLO-1	Interpret AI Models	Computational Linguistics	Calculus for AI	Upper Triangular Matrix	Unit 12: Role of Game Theory in AI
	SLO-2	Abstract Generation of Numerical Results	Multiplayer Perceptrons	Types of Calculus	Lower Triangular Matrix	Introduction to Game Theory
S-9	SLO-1	Conformance Evaluation	Unit 5: Overview of Mathematical Thinking	Integral Calculus	Scalar Matrix	Role of Game Theory in AI
	SLO-2	Integration in Design	Overview of Mathematical Thinking	Differential Calculus	Column Matrix	Introduction to Games
S-10	SLO-1	Formulate Numerical Models	Thinking like a mathematician	Optimization Techniques	Unit 10: Laplace Transforms	Type of Games
	SLO-2	Symbolic Processing	Effetual Thinking	Overview of Gradient Descent	Overview of Laplace Transform	Symmetric vs. Asymmetric Game
S-11	SLO-1	Unit 3: Mathematical Skills Matrix Required for an AI Implementation	Developing Mathematical Thinking	Convexity	Spectrum Analysis	Nash Equilibrium
	SLO-2	Problem Solving Skill	Addressing Misconceptions	Convergence	Fourier Series	Game theory Strategies
S-12	SLO-1	Knowledge and Reasoning Skill	Focussing on Structure of Mathematics	Unit 8: Probability and Statistics	Fourier Transformation	A Game Playing Process
	SLO-2	Inferential Skills	Developing Multiple Models/Strategies	Introduction to Statistics	Fourier Transformation in Spectrum Analysis	Playing a game on complete and an Incomplete Information?

Learning Resources	https://deepsphereai.litmos.com/	1. Introduction to Linear Algebra, Gilbert Strang, Fifth Edition (2016) 2. Linear Algebra and Optimization for Machine Learning, Aggarwal, Charu, 2020 3. Introduction to Graph Theory Fourth edition Robin J. Wilson, Addison Wesley, 4. Game Theory & Optimal Decisions. Accessed at: http://euler.fd.cvut.cz/predmety/game_theory/
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Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	30%	-	30%	-	30%	-	30%	-	30%	-
	Understand										
Level 2	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
	Analyze										
Level 3	Evaluate	30%	-	30%	-	30%	-	30%	-	30%	-
	Create										
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
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