

TEACHING PLAN (TP)

Academic Year: 2025-2026 (EVEN)

Date: 15/12/2025

Institute Code & Name: 0078 - K. K. Wagh Polytechnic, Nashik

Semester: Four

Programme & Code: Artificial Intelligence & Machine Learning (AN)

Course Index: 404

Course and code: Mathematics For Machine Learning (MML)

Course Code : 314320

Scheme: K

Allocated Hrs: 45

Class: SYAN

Name of Faculty: Mr.V.N.Bachhav

COURSE LEVEL LEARNING OUTCOMES (COS)

- CO1 - Use partial differentiation concept to obtain optimal solution.
- CO2 - Implement matrix concept to solve real life problems.
- CO3 - Build programs to implement basic operations based on vectors and tensors.
- CO4 - Evaluate numerical differentiation and integration functions.
- CO5 - Apply the linear programming problem concept to obtain optimal solution.

TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category	Learning Scheme				P a p e r D u r a t i o n	Assessment Scheme												
				Actual Contact Hrs/Week			C r e d i t s		Theory				Based on LL & TSL Practical								
				CL	TL	LL			SLH	NLH	FA-TH	SA-TH	Total	FA-PR	SA-PR	SLA					
				M a x	M a x	M a x			M a x	M a x	M a x	M a x	M a x	M a x	M a x	M a x					
314320	MATHEMATICS FOR MACHINE LEARNING	MML	AEC	4	-	2	-	6	3	3	30	70	100	40	25	10	25 @	10	-	-	150

Total IKS Hrs for Sem.: 0 Hrs

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @\\$ Internal Online Examination

SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO- 1	PSO- 2
CO1	2	2	2	1	1	-	1		
CO2	2	2	2	1	1	-	1		
CO3	2	2	2	1	1	-	2		
CO4	2	2	2	1	1	-	1		
CO5	2	3	3	1	1	-	1		

Legends:- High:03, Medium:02,Low:01, No Mapping: -

PSO 1: Apply fundamental concepts of Computer Engineering and Artificial Intelligence and machine learning to solve technical problems.

PSO2: Implement the domain knowledge to achieve successful career as an engineering professional.

Course Outcomes (COs) and Theory Learning Outcomes (TLOs)

By learning course Mathematics For Machine Learning (MML), Second Year students will be able to:

CO No.	TLO No.	Course Outcomes (COs) and Theory Learning Outcomes (TLOs)
CO404.1		Use partial differentiation concept to obtain optimal solution. 1.1 Calculate partial derivative of first order, second order and mixed order. 1.2 Verify Euler's theorem for the homogeneous function. 1.3 Calculate maximum and minimum value of the function. 1.4 Find maximum and minimum value of the function subject to the given condition using Lagrange's undetermined multipliers.
CO404.2		Implement matrix concept to solve real life problems.
	2.1	Reduce the matrix to echelon form and normal form.
	2.2	Find the inverse of matrix by elementary transformation.
	2.3	Calculate the rank of matrix using determinant of order 2 and 3.
	2.4	Calculate the rank of matrix by reducing matrix to echelon form of order 2 and 3.
	2.5	Calculate the rank of matrix by reducing matrix to normal form of order 2 and 3.
	2.6	Check the consistency of non-homogenous system of linear equation using rank of matrix.
	2.7	Check the consistency of homogenous system of linear equation using rank of matrix.
	2.8	Find solution of non-homogeneous system of linear equations.
	2.9	Find solution of homogenous system of linear equations.
	2.10	Find eigen-values and eigen-vectors for the given matrix of order 2.
CO404.3		Build programs to implement basic operations based on vectors and tensors.
	3.1	Calculate the magnitude of given vector and unit vector perpendicular to given vector.
	3.2	Calculate direction ratio and direction cosines of a vector.
	3.3	Find scalar(dot) product of two vectors.
	3.4	Find angle between two vectors using scalar(dot) product.
	3.5	Find projection of one vector on another vector.
	3.6	Find vector(cross) product of two vectors.
	3.7	Find angle between two vectors using vector(cross) product.
	3.8	Find scalar triple product of the vectors.
	3.9	Define different types of tensors.
CO404.4		Evaluate numerical differentiation and integration functions.
	4.1	Find first order derivative using forward and backward interpolation.
	4.2	Evaluate numerical integration using Trapezoidal rule.
	4.3	Evaluate numerical integration using Simpson's one third rule.
	4.4	Evaluate numerical integration using Simpson's three eight rule.
CO404.5		Apply the linear programming problem concept to obtain optimal solution.
	5.1	Formulate given problem in Linear Programming Problems.
	5.2	Find optimal solution of Linear Programming Problems using graphical (corner point) method.
	5.3	Find optimal solution of Linear Programming Problems using simplex method.

Maharashtra State Board of Technical Education, Mumbai

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Institute Code: 0078

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Semester: Four [AN-4K]

Name of Faculty: Mr.V.N.Bachhav

Chap No. (Alloted Hrs.)	CO	TLO	Unit Name and Learning Content Title/ Details	No. of Lecture	Plan (From-To)	Actual Execution (From-To)	Teaching method/ Media	Remark
01 (10)	CO-1	I	Partial Differentiation	10				
		TLO-1.1	1.1 Introduction to Derivative	01	18/12/25 To 18/12/25		Chalk & Black Board, ppt., Video, LMS.	Ex.
		TLO-1.1	1.2 Partial derivative (Two variables): Introduction, Partial derivative of first order, second order and mixed order	04	19/12/25 To 27/12/25			
		TLO-1.2	1.3 Homogeneous Function	01	01/01/26 To 01/01/26			
		TLO-1.2	1.4 Euler's theorem on homogeneous function (Two variables)	01	02/01/26 To 02/01/26			
		TLO-1.3	1.5 Maxima and minima of function (Two variables)	01	03/01/26 To 08/01/26			
02 (18)	CO-2	II	Matrices	18				
		TLO-2.1	2.1 Review of types of matrices and algebra of matrices	01	09/01/26 To 09/01/26		Chalk & Black Board, ppt., Video, LMS.	Ex.
		TLO-2.1	2.2 Elementary row and column transformation of matrices	01	10/01/26 To 10/01/26			
		TLO-2.1	2.3 Conversion of matrix to echelon and normal form	01	15/01/26 To 15/01/26			
		TLO-2.2	2.4 Inverse of matrix using elementary transformation	01	16/01/26 To 16/01/26			
		TLO-2.3	2.5 Rank of matrix using determinant of order two & three, Rank of matrix by reducing matrix to echelon and normal form	04	16/01/26 To 15/01/26			
		TLO-2.4	2.6 Non-Homogeneous and Homogeneous system of linear equations	02	16/01/26 To 22/01/26			
		TLO-2.7	2.7 Consistency of system of linear equations using rank of matrices	01	23/01/26 To 23/01/26			
		TLO-2.8	2.8 Non-Homogeneous system of linear equation: Unique solution, Infinite number of solutions	02	24/01/26 To 24/01/26			
		TLO-2.9	2.9 Homogeneous system of linear equation: Unique or trivial solution, Infinite number of non-trivial solutions	02	29/01/26 To 30/01/26			
		TLO-2.10	2.10 Eigen values and Eigen-vector: Basic Definition, Characteristic Polynomial, Characteristic Equation, Eigen-value and Eigen- vector of a matrix of order 2	03	31/01/26 To 06/02/26			

		III	Vectors and Tensors	14				
03 (14)	CO-3	TLO-3.1	3.1 Introduction, Definition of scalar and vector quantity, Representation of vector, Magnitude of vector, Component of vector, Direction ratio, Direction cosines	02	07/02/26		Chalk & Black Board, ppt., Video, LMS.	Ex.
		TLO-3.1	3.2 Types of vectors: Zero vector, Unit vector, Position vector, Equal vector, Negative vector. Parallel vector, Co-initial vector, Collinear vector		12/02/26			
		TLO-3.2	3.3 Algebra of vectors: Addition of vectors, Triangle law of vectors addition, Parallelogram law of vectors addition, Subtraction of vectors, Multiplication of vectors by scalar		13/02/26			
		TLO-3.3	3.4 Product of two vectors: Scalar (dot) product of two vectors, Projection of one vector on another vector, Angle between two vectors using scalar(dot) product, Properties of scalar(dot) product		14/02/26			
		TLO-3.4			20/02/26			
		TLO-3.5			21/02/26			
		TLO-3.6			26/02/26			
		TLO-3.7			To 28/02/26			
		TLO-3.8	3.6 Scalar triple product of vectors		05/03/26			
		TLO-3.9	3.7 Tensor: Definition of tensors, Types of tensors, Rank of tensors, Algebra of tensors		To 12/03/26			
04 (10)	CO-4	IV	Numerical Differentiation and Integration	10			Chalk & Black Board, ppt., Video, LMS.	Ex.
		TLO-4.1	4.1 Introduction to numerical differentiation and integration	02	14/03/26			
		TLO-4.2	4.2 Derivative using forward and backward interpolation		To 17/03/26			
		TLO-4.3	4.3 Numerical integration using Trapezoidal rule	02	18/03/26			
		TLO-4.3	4.4 Numerical integration using Simpson's one third rule		To 19/03/26			
		TLO-4.4	4.5 Numerical integration using Simpson's three eight rule	02	20/03/26			
					To 21/03/26			
05 (08)	CO-5	TLO-5.1	5.1 Introduction, Basic terms in Linear Programming Problems	01	25/03/26		Chalk & Black Board, ppt., Video, LMS.	Ex.
		TLO-5.2	5.2 Mathematical formulation of Linear Programming Problems		To 26/03/26			
		TLO-5.3	5.3 Method of solving Linear Programming Problems (Two equations in two variables): Graphical (corner point) method, Simplex method		27/03/26			

ASSESSMENT METHODOLOGIES/TOOLS

A. Formative assessment (Assessment for Learning) (FA-TH)

- Tests

B. Summative Assessment (Assessment of Learning) (SA-TH)

- End Term Exam

SUGGESTED LEARNING MATERIALS / BOOKS

Sr. no	Author	Title	Publisher with ISBN Number
01	H. K. Dass, Er.Rajnish Verma	Higher Engineering Mathematics	S. Chand Technical, ISBN: 9788121938907
02	K.Nageswara Rao, Shaikh Akbar	Python Programming	Scitech Publication(India) Pvt. Ltd. ISBN:9789385983450
03	Grewal B. S.	Higher Engineering Mathematics	Tata McGraw Hill Education, New Delhi, ISBN : 9789386173522
04	A. C. Shrivastava, P. K. Shrivastava	Engineering Mathematics	PHI Learning, New Delhi, ISBN:9788120342934
05	Mark Lutz	Learning Python	O'Reilly Publication ISBN-13: 9780672329784

LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://atozmath.com/default.aspx	Online Learning Initiative for Mathematics Problems with Solutions
2	https://www.w3schools.com/ai/ai_mathematics.asp	Machine Learning Mathematics
3	https://docs.python.org/3/tutorial/index.html	The Python Tutorial
4	https://www.geeksforgeeks.org/machine-learning-mathematics/	Machine Learning Mathematics
5	https://onlinecourses.nptel.ac.in/noc21_ma38/preview	NPTEL Course
6	https://www.purplemath.com/index.htm	Foundational Mathematics to improve learning
7	https://mathworld.wolfram.com/	Extensive mathematical resource with detailed explanations
8	https://www.khanacademy.org/math	Mathematical concepts through video lectures

Mr.V.N.Bachhav
(Name & Signature of staff)

Prof.A.D.Watpade
(Name & Signature of HOD)

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