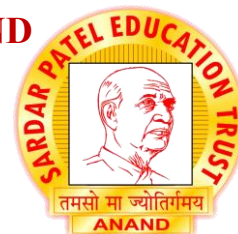




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Revised Syllabus as per NEP 2020 with effect from the Academic Year 2026-2027

Master of Science (Data Science)

Semester – I

Course Code	PGN1CMDS05	Title of the Course	Applied Mathematics
Total Credits	04	Hours per Week	04 Hours / Week

Course Learning Outcomes (CLOs)

CLO 1	Apply matrix operations, determine rank, and solve systems of linear equations relevant to linear algebra applications in data science.
CLO 2	Utilize concepts of ordinary differentiation to model and analyse trends, rates of change, and optimize one-dimensional functions in data analysis.
CLO 3	Calculate and interpret partial derivatives for multivariable functions, and apply them to data optimization and sensitivity analysis problems.
CLO 4	Formulate linear programming problems and solve them using graphical and simplex methods to support decision-making in data-driven environments.

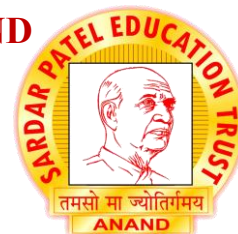
Course Content

Unit No.	Description	Weightage (%)
1.	Matrices Algebra: - Matrices and Basic Operations, Special structures Matrices and Basic Operations. Interpretation of matrices as linear mappings and some examples. - Rank of a matrix, Echelon form, consistency of linear System of equations, Linear dependence of vectors, Eigen values, Eigenvectors. - Square Matrices, Determinants, Properties of determinants, singular and non-singular matrices, examples, finding an inverse matrix.	25%
2.	Ordinary Differentiation - Definition of ordinary differentiation - Derivatives of explicit, composite functions, Derivatives of exponential and arithmetic functions, working rules of differentiation (without proof) - Higher order derivatives, maxima and minima of a polynomial function.	25%
3.	Partial Differentiation and Its Applications - Functions of two or more variables, Partial derivatives, Higher order partial derivatives, - Differentiation of implicit functions • Maxima and minima of functions of two variables.	25%



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4.	Linear Programming Problem (LPP): • Meaning and Mathematical form of LPP • Assumptions, limitations and uses of LPP • Definitions: Objective functions, Constrains, Solution, Feasible Solution, Optimum Feasible solution • Optimum Feasible Solution of LPP by Graphical Method • Optimum Feasible Solution of LPP by simplex method.	25%
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Teaching – Learning Methodology

Material for this course will be presented using multiple teaching approach: lecture and discussion, exploration and inquiry, cooperative group work, demonstrations, and presentations

Examination Evaluation Pattern

Sr. No.	Particulars	Weightage (%)
01	Continuous and Comprehensive Evaluation (CCE) (Formative Assessment)	50%
02	Semester End Evaluation (SEE) (Summative Assessment)	50%
	TOTAL	100%

Specifications for CCE and SEE

Sr. No.	Details of the Evaluation Pattern		Marks
01	Continuous and Comprehensive Evaluation (CCE) (Formative Assessment)		
	A	Assignments	10
	B	Multiple Choice Questions	05
	C	Attendance	05
	D	Written Examination (01 Hour)	30
	(Formative Assessment) (A + B + C + D)		50 Marks
02	Semester End Evaluation (SEE) (Summative Assessment)		
	E	Written Examination (02 Hours)	50 Marks
	TOTAL(For 04 Credit Courses)		100 Marks

Rubrics – Based Assessment for Assignments (10 Marks)

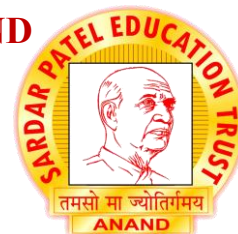
Excellent	09 – 10 Marks	Demonstrates correct mathematical/computational logic, accurate calculations or program execution, well-structured solutions, excellent conceptual understanding of Matrices (Algebra), Ordinary Differentiation, Data Manipulation with Pandas, and LPP, proper use of relevant formulas, functions, libraries, and optimization methods.
Good	07 – 08 Marks	Minor computational, syntax, or logical errors. Good conceptual understanding of the topics. Solutions are mostly correct with



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		appropriate use of mathematical methods, Pandas operations, and optimization techniques.
Average	05 – 06 Marks	Basic understanding of concepts. Some logical, calculation, or syntax errors. Partially correct solutions with limited application of matrix operations, differentiation rules, Pandas functions, or LPP formulation.
Basic	03 – 04 Marks	Limited conceptual understanding. Noticeable errors in calculations, coding, or problem formulation. Solutions are incomplete or partially working with inadequate use of mathematical methods or Pandas library.
Poor	01 – 02 Marks	Inadequate understanding, incorrect logic, major syntax errors, program does not execute properly
Below Poor	Zero Marks / NA	Irrelevant answer or not attempted

Note:

- Assignments may be taken in forms of written project, computerized and online suggested courses / certificates as per the decision made by the respective faculties of the courses.

Rubrics – Based Assessment for Multiple Choice Questions (05 Marks)

05 Multiple Choice Questions – 01 Mark Each (05 Marks)

Excellent	01 Mark	The chosen option is correct, no errors in response
Below Poor	Zero Marks / NA	Chosen option is incorrect, completely irrelevant, multiple options chosen / Not Attempted

Rubrics – Based Assessment for Attendance (05 Marks)

As per the Rules and Regulations provided by the Academic Section of Sardar Patel University, Vallabh Vidyanagar, for the students studying in all departments and colleges.

Reference No.: E – 3 / 3127; dated: 07-03-2024.

<https://www.spuvvn.edu/orbit-cdn/uploads/circulars/Circular-NEP-InternalExamMarks-March-April24.pdf>

Excellent	05 Marks	More than 90% (Minimum 54 Hours for 04 Credits Courses)
Good	04 Marks	80% - 89% (48 to 53 Hours for 04 Credit Courses)
Average	03 Marks	70% - 79% (42 to 47 Hours for 04 Credit Courses)
Poor	Zero / NA	Less than 70% (Less than 42 Hours) (NOT ELIGIBLE TO APPEAR FOR EXAM)

Note:

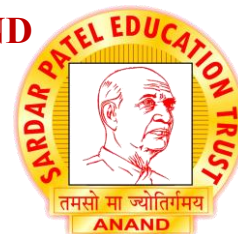
- Students with below 70% of attendance must submit their written application to their respective class coordinators with genuine reasons and evidence (in case of working or medical emergencies). Students must **not** pursue dual degree programmes that clash with the college's timings.



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Rubrics – Based Assessment for Mid-Semester Examination (30 Marks)		
Any Two Unit or 50% of The Syllabus - 15 Marks Each Question		
Excellent	13 – 15 Marks	Accurate, error-free, logically presented, timely submission
Good	10 – 12 Marks	Minor errors and good conceptual clarity
Average	07 – 09 Marks	Basic understanding or partially correct
Basic	04 – 06 Marks	Limited clarity, noticeable mistakes, incomplete content
Poor	01 – 03 Marks	Inadequate conceptual clarity, incorrect content
Below Poor	Zero Marks / NA	Content is irrelevant / Not Attempted / Not Submitted
Note: Written Examination questions will be based on various levels of Revised Bloom's Taxonomy.		

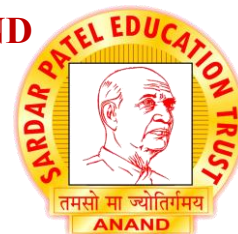
Rubrics – Based Evaluation Pattern for End-Semester Examination (50 Marks)		
06 Multiple Choice Questions – 01 Mark Each (06 Marks)		
Excellent	01 Mark	The chosen option is correct, no errors in response
Below Poor	Zero Marks / NA	Chosen option is incorrect, completely irrelevant, multiple options chosen / Not Attempted
Short Question (12 Marks) – 6 Question from all Units		
Excellent	02 Marks	Demonstrates accurate understanding of concepts related to questions. Provides correct calculations, appropriate formulas, and clear explanations with complete answers.
Good	01 Mark	Shows partial understanding of concepts with some correct steps or explanations. Minor errors or incomplete answers may be present.
Poor	00 Mark	Incorrect, irrelevant, or no response provided.
UNIT I - 08 Marks Each Question		
Excellent	06 – 08 Marks	Correctly applies matrix concepts including matrix operations (addition, subtraction, multiplication), transpose, determinant, inverse, rank, and solving systems of linear equations. Demonstrates strong conceptual understanding, accurate calculations, and well-presented solutions.
Good	04 – 06 Marks	Demonstrates good understanding of matrix operations and related concepts with only minor computational or logical



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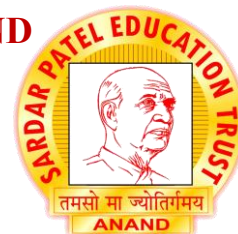
		errors. Most solutions are correct and clearly explained.
Average	03 – 04 Marks	Shows moderate understanding of matrix concepts. Can perform basic matrix operations but makes some calculation or procedural errors. Solutions may lack completeness or accuracy.
Basic	02 – 03 Marks	Demonstrates basic awareness of matrices and their operations but struggles to apply concepts correctly. Solutions are incomplete or contain several errors.
Poor	01 – 02 Marks	Shows minimal understanding of matrix concepts. Frequently applies incorrect methods or calculations, resulting in largely incorrect solutions.
Below Poor	Zero Marks / NA	No attempt or completely irrelevant response.
UNIT II - 08 Marks Each Question		
Excellent	06 – 08 Marks	Correctly applies the concepts of Ordinary Differentiation, including differentiation rules, implicit differentiation, higher-order derivatives, and applications such as maxima and minima. Demonstrates strong conceptual understanding, accurate calculations, and well-presented solutions.
Good	04 – 06 Marks	Understands the principles of ordinary differentiation with only minor calculation or procedural errors. Most derivative calculations and applications are correct and logically presented.
Average	03 – 04 Marks	Shows moderate understanding of differentiation concepts and rules but lacks completeness or accuracy in solving problems. Makes occasional errors in applying differentiation techniques.
Basic	02 – 03 Marks	Demonstrates basic awareness of differentiation concepts but struggles to correctly apply differentiation rules and solve problems. Solutions are incomplete or contain several errors.
Poor	01 – 02 Marks	Shows minimal understanding of matrix concepts. Frequently applies incorrect methods or calculations, resulting in largely incorrect solutions.
Below Poor	Zero Marks / NA	No attempt or completely irrelevant response.



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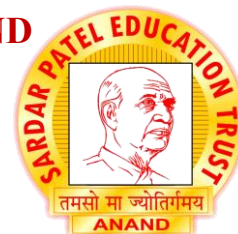
UNIT III - 08 Marks Each Question		
Excellent	06 – 08 Marks	Correctly applies concepts of partial differentiation, including first- and higher-order partial derivatives, chain rule, total differentiation, Euler's theorem, maxima and minima of functions of two variables, and real-life applications. Demonstrates strong conceptual understanding, logical reasoning, accurate calculations, and complete solutions.
Good	04 – 06 Marks	Understands the fundamentals of partial differentiation and applies most techniques correctly with minor computational or procedural errors. Solutions are generally logical and mostly accurate.
Average	03 – 04 Marks	Shows moderate understanding of partial differentiation concepts, including basic derivative calculations. Attempts application problems but lacks completeness, accuracy, or correct interpretation in some parts.
Basic	02 – 03 Marks	Demonstrates basic awareness of partial derivatives and related concepts but struggles with higher-order derivatives, applications, or optimization problems. Frequent errors affect the correctness of solutions.
Poor	01 – 02 Marks	Shows minimal understanding of partial differentiation. Most calculations are incorrect or incomplete, with little evidence of applying appropriate methods.
Below Poor	Zero Marks / NA	No attempt or completely irrelevant response.
UNIT IV - 08 Marks Each Question		
Excellent	06 – 08 Marks	Correctly formulates and solves LPPs with accurate interpretation of optimal solutions.
Good	04 – 06 Marks	Solves most LPPs correctly with minor errors in formulation or graphical method.
Average	03 – 04 Marks	Demonstrates basic formulation and solution skills but with noticeable errors.
Basic	02 – 03 Marks	Understands basic LPP concepts but struggles to formulate and solve problems.
Poor	01 – 02 Marks	Shows minimal understanding and provides incorrect or incomplete solutions.
Below Poor	Zero Marks / NA	No attempt or completely irrelevant response.
Note:		
• Multiple Choice Questions of 10 Marks will be based on various levels of Revised Bloom's		



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Taxonomy.

- Written Examination questions will be based on various levels of Revised Bloom's Taxonomy.

PLO – CLO Mapping								
Applied Mathematics								
	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8
CLO 1	3	2	1	1	0	0	0	2
CLO 2	3	3	2	2	1	0	0	2
CLO 3	3	3	3	2	2	1	0	2
CLO 4	3	3	3	3	3	1	1	3

Note:
High: **03**; Moderate: **02**; Low: **01**; No Mapping: **00**

Suggested References and E-Resources for Further Reading	
Sastry, S.S (2014) Engineering Mathematics", Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi	
Gilbert Strang, Linear Algebra and its Applications. Thomson /Brooks Cole.	
Wylie, R.C. and Barre, L.C (2012): Advanced Engineering Mathematics —Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi	
B.S. Grewal (2017): Higher Engineering Mathematics, Khanna Publishers, 44th Edition,	
Erwin Kreyszig (2010): Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons,	
Sharma, J. K.(2006): Quantitative Techniques for Management Decisions, Macmillan	
H A Taha (2007): Operations Research: An Introduction, Pearson/ Prentice Hall	
