Department	International College of Liberal Arts		
Semester	Fall 2023	Year Offered (Odd/Even/Every Year)	Every Year
Course Number	DATA250		
Course Title	Mathematics for Data Science		
Prerequisites	DATA150 Introduction to Python Programming AND QREA102 College Algebra AND QREA/PSCI/ECON203 Statistics		
Course Instructor	PARIDA Abhishek	Year Available (Grade Level)	2
Subject Area	Data Science	Number of Credits	3
Class Style	Lecture	Class Methods	Face to face

(NOTE 1) Class Methods are subject to change

(NOTE 2) Depending on the class size and the capacity of the facility, we may not be able to accommodate all students who wish to register for the course"

Course Description	This course introduces the students to several foundational and abstract Mathematical notions to grasp the core concepts in Data Science, presented later. It includes an introduction to Linear Algebra, Calculus, Probability theory, and Statistics.
Class plan based on course evaluation from previous academic year	None
Course related to the instructor's practical experience (Summary of experience)	None
Learning Goals	The course focuses on learning the required Mathematical concepts through Python's implementation. Topics covered are essential and geared towards understanding and endeavoring Machine Learning topics. Students would develop the skills needed to master mathematics for Data Science and Artificial Intelligence.

iCLA Diploma Policy	DP1／DP2

iCLA Diploma Policy

(DP1) To Value Knowledge — Having high oral and written communication skills to be able to both comprehend and transfer knowledge

(DP2) To Be Able to Adapt to a Changing World — Having critical, creative, problem-solving, intercultural skills, global and independent mindset to adopt to a changing world

(DP3) To Believe in Collaboration — Having a disposition to work effectively and inclusively in teams

(DP4) To Act from a Sense of Personal and Social Responsibility — Having good ethical and moral values to make positive impacts in the world

Active Learning Methods	The best way to correspond during the course is through the UNIPA system or direct emails. Please check the UNIPA account regularly for updates related to classes. To have a better grade, be regular in the study, active and attentive in class, do a revision of classwork regularly, and participate in-class quizzes. Students are advised to take handwritten notes; this will drastically increase their ability to retain the information. Further, they are expected to practice regularly.
Use of ICT in Class	None
Use of ICT outside Class	None

Expected study hours outside class	One to two hours of study is required before the class preparation, and an equal amount of practice is needed after each lecture.
Feedback Methods	There will be written remarks on the assignments. And after every quiz, a model answer will be discussed or circulated among the students to aid their understanding.

Grading Criteria		
Grading Methods	Grading Weights	Grading Content
Assignments	40%	
Quizes	60%	

Required Textbook(s)	Marc Peter Deisenroth et. al.- Mathematics for Machine Learning Hyun-Seok Son- Linear Algebra Coding with Python: Python's application for linear algebra Amit Saha- Doing Math with Python: Use Programming to Explore Algebra, Statistics, Calculus, and More! Peter Farrell et al.- The Statistics and Calculus with Python Workshop: A comprehensive introduction to mathematics in Python for artificial intelligence applications (Refer to the URLs)
Other Reading Materials/URL	https://mml-book.github.io/book/mml-book.pdf https://vdoc.pub/download/linear-algebra-coding-with-python-pythons-application-for-linear-algebra-489ktonuodl0 https://oiipdf.com/doing-math-with-python
Plagiarism Policy	Plagiarism is the dishonest presentation of others' work as if it were one's own. Duplicate submission is also treated as plagiarism. Depending on the nature of plagiarism, one may fail the assignment or the course. The repeated act of plagiarism will be reported to the University, which may apply additional penalties.
Other Additional Notes	None

(NOTE 3) Class schedule is subject to change

Class Schedule	
Class Number	Content
Class 1	Module 1: Vectors and Matrices Introduction to the course. Linear Algebra with Python: Vectors: Algebraic and geometric interpretations; Vector addition and subtraction, Vector-scalar multiplication
Class 2	Vector-vector multiplication: the dot product; Properties of the dot product - associative, distributive, commutative
Class 3	Dot product geometry: sign and orthogonality; length of vector; Vector cross product

Class 4	Implementations in Numpy
Class 5	Application of Matrices in Machine Learning; Matrix addition and subtraction, Matrix-scalar multiplication
Class 6	Matrix-matrix multiplication; Transpose, Diagonal, and Trace
Class 7	Determinant, Inverse, Matrix space; Solving systems of Linear equations
Class 8	Least squares for model fitting
Class 9	Practice exercises
Class 10	Practice exercises
Class 11	Eigenvalue decomposition
Class 12	Practice exercises
Class 13	Singular value decomposition
Class 14	Practice exercises
Class 15	Module 2: Calculus with Python Introduction to Sympy; Limit of a function; Derivatives of a polynomial and trigonometric function; Graphing a function and tangent lines; Find critical points
Class 16	Implementations in Sympy (continued)
Class 17	Local minima using gradient descent
Class 18	Indefinite integrals; Area under the curve, the area between two curves

Class 19	Practice exercises
Class 20	Practice exercises
Class 21	Module 3: Applied Probability with Python Applied Probability with Python: Set operations, Power sets, laws of set algebra, cardinality, Venn Diagram
Class 22	Combinatorics: Permutation and combination
Class 23	Sum and Product rule of counting; Permutation and Combination
Class 24	Binomial theorem; Probability density and histograms, Bernoulli Trails
Class 25	Probability Distributions: Binomial, Poisson
Class 26	Practice exercises
Class 27	Gaussian, Cumulative distribution
Class 28	Practice exercises
Class 29	Conditional Probability, Bayes theorem (Extra)
Class 30	Practice exercises