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| Department | International College of Liberal Arts |

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| Semester | Spring 2025 | Year Offered (Odd/Even/Every Year) | Every Year |

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| Course Number | DATA250 |

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| Course Title | Mathematics for Data Science |

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| Prerequisites | DATA150 Introduction to Python Programming  AND  QREA102 College Algebra  AND  QREA/PSCI/ECON203 Statistics |

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| Course Instructor | PARIDA Abhishek | Year Available (Grade Level) | 2 |

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| Subject Area | Data Science | Number of Credits | 3 |

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| Class Style | Lecture | Language of instruction | English |

(NOTE 1) 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

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| 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 and Calculus. |
| Class plan based on course evaluation from previous academic year | N/A |
| Course related to the instructor's practical experience (Summary of experience) | N/A |
| 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 |
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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

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| Active Learning Methods | Problem-Based Learning | | | |
| More details/supplemental information on Active Learning Methods | N/A | | | |
| Use of ICT | The course will take place in the Data Science Lab, which is equipped with the Anaconda distribution of Python and other relevant packages pre-installed. However, for homework assignments, students must use their own laptops and install the Anaconda distribution of Python along with the required packages. | | | |
| Contents of class preparation and review | Students are advised to take handwritten notes; this will drastically increase their ability to retain the information. Further, they are expected to practice regularly. One to two hours of study is required before the class preparation, and an equal amount of practice is needed after each lecture. | Hours expected to be spent preparing for class (hours per week) | 3 hours | Hours expected to be spent on class review (hours per week) | 3 hours |
| Feedback Methods | The best way to correspond during the course is 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 the class, do a revision of classwork regularly, and participate in-class quizzes. | | | |

| Grading Criteria | | |
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| Grading Methods | Grading Weights | Grading Content |
| Understanding of Concepts | 40% | In-class discussion, Homework Assignments, Class Quizes, Final Exam |
| Code Functionality | 30% | Homework Assignments, Class Quizes |
| Timeliness | 30% | Homework Assignments |

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| Required Textbook(s) | Marc Peter Deisenroth et. al.- Mathematics for Machine Learning<br>Hyun-Seok Son- Linear Algebra Coding with Python: Python's application for linear algebra<br>Amit Saha- Doing Math with Python: Use Programming to Explore Algebra, Statistics, Calculus, and More!<br>Peter Farrell et al.- The Statistics and Calculus with Python Workshop: A comprehensive introduction to mathematics in Python for artificial intelligence applications |
| Other Reading Materials/URL | N/A |
| 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 (Outline crucial policies and info not mentioned above) | N/A |
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(NOTE 2) Class schedule is subject to change

| Class Schedule | |
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| Class Number | Content |
| Class 1 | Module 1: Linear Algebra<br>Lecture 1 - Introduction to the course - Linear Algebra and its application; Calculus and its application; Introduction to vectors |
| Class 2 | Lecture 2 - Python Implementation of Vectors |
| Class 3 | Lecture 3 - Complex vectors; Vector inequalities |
| Class 4 | Lecture 4 - Types of vector multiplications; Matrix terminologies |
| Class 5 | Lecture 5 - Python implementation of matrix, Rotation matrix |
| Class 6 | Lecture 6 - Solving Linear Equations, Types of solutions |
| Class 7 | Lecture 7 - Quiz 1 |
| Class 8 | Lecture 8 - Linear independence, Matrix Rank, Determinants, Inverse |
| Class 9 | Lecture 9 - Null Space of a Matrix; introduction to sympy |
| Class 10 | Lecture 10 - Practice Exercises |
| Class 11 | Lecture 11 - Eigenvalue equation and diagonalization |

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| Class 12 | Lecture 12 – Practice Exercises |
| Class 13 | Lecture 13 – QR decomposition |
| Class 14 | Lecture 14 – Singular Value Decomposition |
| Class 15 | Lecture 15 – Quiz 2 |
| Class 16 | Lecture 16 – Application of Singular Value Decomposition |
| Class 17 | Module 2: Calculus with Python<br>Lecture 17 – Limit of a function; Derivatives of a polynomial and trigonometric function; Graphing a function and tangent lines |
| Class 18 | Lecture 18 – Practice Exercises |
| Class 19 | Lecture 19 – Application of Derivatives – Maxima and minima |
| Class 20 | Lecture 20 – Practice Exercises |
| Class 21 | Lecture 21 – Taylor series expansion, Types of Derivatives |
| Class 22 | Lecture 22 – Quiz 3 |
| Class 23 | Lecture 23 – Least square method, Gradient Descent Algorithm |
| Class 24 | Lecture 24 – Least square method, Gradient Descent Algorithm |
| Class 25 | Lecture 25 – Optimization - Linear Programming and Lagrange Multiplier |

| Class 26 | Lecture 26 — Optimization - Linear Programming and Lagrange Multiplier |
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| Class 27 | Lecture 27 — Quiz 4<br><br>5 / 5 |
| Class 28 | Lecture 28 — Review to quiz solution |
| Class 29 | Lecture 29 — Selected Applications |
| Class 30 | Lecture 30 — Selected Applications |