UNIVERSITY of NICOSIA

Course Syllabus

Course Code	Course Title	ECTS Credits
MATH-281	Linear Algebra II	6
Prerequisites	**Department**	**Semester**
MATH-280, MATH-190	Computer Science	Fall/Spring
Type of Course	**Field**	**Language of Instruction**
Elective	Mathematics	English
Level of Course	**Lecturer(s)**	**Year of Study**
1st Cycle	Dr. George Chailos	2nd
Mode of Delivery	**Work Placement**	**Corequisites**
Face to Face	N/A	None

Course Objectives:

The main objectives of the course are to:

- Remind students of the fundamental theory of finite dimensional vector spaces and matrix eigenvalues and eigenvectors .
- Extend the fundamental theory of Matrices to the complex domain and cover Hermitian, Normal and Unitary Matrices.
- Further develop eigenvalues and eigenvectors and Matrix diagonalization.
- Introduce applications such matrix exponentials.
- Present the Cayley-Hamilton theorem.
- Develop the theory of finite-dimensional inner product spaces.
- Provide students with the necessary skills to construct orthonormal bases and orthogonal complements.
- Introduce QR-decomposition and the method of least squares.

Learning Outcomes:

After completion of the course students are expected to be able to:

1. Identify and use Hermitian, Normal and Unitary Matrices.
2. Diagonalize square matrices and use the decomposition to find matrix powers.
3. Apply the Cayley-Hamilton theorem to compute the exponential of a matrix.
4. Compute the Jordan canonical form.
5. Calculate the norm of a vector and the distance between two vectors

6. Apply the Gram-Schmidt orthonormalization process to construct orthonormal bases of vector spaces; identify orthogonal complements.
7. Compute the QR factorization of a square matrix.
8. Utilize the Least Squares method to solve linear systems of equations.

Course Content:

1. Review of fundamental Linear Algebra concepts
    - Review of vector spaces.
    - Review of eigenvalues and eigenvectors.
2. Matrices with complex entries
    - Introduction to complex numbers and their arithmetic
    - Hermitian, normal and unitary matrices
    - Complex eigenvalues and eigenvectors
    - The Cayley-Hamilton theorem
3. Applications of eigenvalues and eigenvectors
    - Matrix diagonalization
    - Matrix powers
    - The exponential of a matrix
    - Jordan Canonical form
4. Inner-product Spaces
    - Inner product, vector norm and distance
    - Coordinates and change of base
    - Orthogonal and orthonormal bases and Gram-Schmidt orthonormalization
    - Orthogonal subspaces and direct sums
    - Orthogonal Projections
    - Orthogonal Matrices and the QR-decomposition
    - Least squares solutions of linear systems

Learning Activities and Teaching Methods:

Lectures, Exercises, Assignments and Tests.

Assessment Methods:

Mid-Term Exam; Final Exam; Class Participation.

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Elementary Linear Algebra with Applications.	H. Anton and C. Rorres	Wiley (11h Edt.)	2015	978-1-118-67745-2

Recommended Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
Elementary Linear Algebra	B. Kolman and D. Hill	Pearson 9th Edt	2017	978-0134718538