Course Syllabus

1. Course number and name: 020ALBNI3 Bilinear Algebra and Geometry

2. Credits and contact hours: 6 ECTS credits, 3x1:15 course hours

3. Instructors names: Jad Dakroub

4. Text book : Mathématiques tout-en-un, C. Deschamps, DUNOD 2016

5. Specific course information

    a. brief description of the content of the course (catalog description) Diagonalization and trigonalization of a matrix, Inner product spaces, Inner product, orthogonal vectors, orthogonal projection, Gram-Schmidt orthonormalization, Isometry in Euclidian spaces of dimension 2 and 3, Parametric curves

    b. prerequisites or co-requisites: Linear Algebra

    c. Required

6. Specific goals for the course
    a. specific outcomes of instruction:

        - Compute the characteristic polynomial of a square matrix and find the eigenvalues and the corresponding eigenvectors.
        - Determine whether a given square matrix is diagonalizable/ trigonalizable and if so, find a diagonal/ triangular similar matrix.
        - Identify inner products and calculate the inner product of two vectors.
        - Understand the concept of orthogonal projection and how to explicitly calculate the projection of one vector onto another one.
        - Use the Gram-Schmidt process to convert a given basis for a vector space to an orthonormal basis.
        - Recognize an orthogonal matrix and a Euclidian isometry.
        - Differentiate isometries in dimension two and three.
        - Sketch a parametric curve given parametric equations.

    b. KPIs addressed by the course.

KPI	a1
Covered	x
Assessed	x
Give Feedback	x

7. Brief list of topics to be covered and approximate lecture hours :

- Review of Linear Algebra (3 Lectures)
- Characteristic polynomial of a square matrix, Cayley-Hamilton theorem, eigenvalues and eigenvectors, diagonalization (7 Lectures)
- Minimal polynomial of a linear operator (2 Lectures)
- Generalized eigenspaces and trigonalization of a square matrix (5 Lectures)
- Inner product and associated norm (2 Lectures)
- Orthogonal vectors and spaces, Euclidian spaces, orthonormal basis (4 Lectures)
- Orthogonal projection, Gram-Schmidt orthonormalization process (6 Lectures)
- Euclidian isometry, orthogonal matrix, Symmetric endomorphism (4 Lectures)
- Orthogonal group, isometry in dimension 2 and 3 (5 Lectures)
- Infinity branches, singular, non-singular and double points, asymptotes and tangent of a parametric curve (4 Lectures)