Course Syllabus

1. Course number and name: 020AL1CI2 Algebra 1.
2. Credits and contact hours : 8 ECTS credits, 4x1:15 course hours
3. Instructor's or course coordinator's name : Fares Maalouf
4. Text book: Xavier OUDOT: Maths MP/MP*. Vuibert.
5. Specific course information
    i. Catalog description: Algebraic structures, vector spaces, linear span, linear subspaces, affine spaces, bases, sums of subspaces, linear forms, finite dimensional spaces, matrices, linear maps and their matrix representation, rank of a matrix, symmetric groups, determinants, Euclidian spaces.
    ii. Prerequisites: None
    iii. Required : Yes
6. Specific goals for the course
    a. Specific outcomes of instruction
        - Identify linear problems, and represent them with vector spaces and linear maps.
        - Define the notion of dimension.
        - Manipulate matrices and linear systems.
        - Represent linear maps with matrices.
        - Identify the solutions of a linear system of equations.
        - Identify alternating multilinear forms, and compute determinants.
        - Orthonormalize a basis in a Euclidian space.
        - Classify isometries in the Euclidian oriented plane.

    b. KPIs addressed by the course.

RAP (KPI)	a1
Covered	x
Assessed	x
Give Feedback	x

7. Topics and approximate lecture hours :

- Algebraic structures: groups, rings, fields. (4 Lectures)
- Vector spaces, linear subspaces, linear span. (3 Lectures)
- Direct sums of linear subspaces. (2 Lectures)
- Linear maps, kernel and image, projections, symmetries and homotheties. (4 Lectures)
- Linear independence, bases. (2 Lectures)
- Finite dimensional vector spaces, dimension, dimension theorems for vector spaces. (4 Lectures)
- Rank of a family of vectors, linear maps in finite dimension, rank-nullity theorem, hyperplanes. (4 Lectures)
- Matrices: basic properties, algebraic operations. (5 Lectures)
- Matrix equivalence, matrix similarity. (3 Lectures)
- Echelon form for linear systems of equations. (3 Lectures)
- Symmetric group, permutations, cycles signatures. (2 Lectures)
- Alternating multilinear forms, determinants. (4 Lectures)
- Methods for computing determinants, Cramer formulas. (3 Lectures)
- Euclidian spaces, inner product, Cauchy-Schwartz inequality. (3 Lectures)
- Orthogonality, orthonormal bases, Gram-Schmidt process. (3 Lectures)
- Isometries in Euclidean spaces, orthogonal matrices. (3 Lectures)
- Supplementary exercices. (4 Lectures)