Algebra 3

1. **Course number and name:** 020AL3CI4 Algebra 3

2. **Credits and contact hours:** 4 ECTS credits, 2x1:15 contact hours

3. **Name(s) of instructor(s) or course coordinator(s):** Fares Maalouf

4. **Instructional materials:**
   a. **Text book:** C. Cochet & X. OUDOT, Maths MP/MP* Vuibert 2022
   b. **Other supplemental materials:** Notes on certain topics from internet sites.

5. **Specific course information**
   a. **Catalog description:**
      Algebra 3 is an advanced course, divided into two main parts. The first part focuses on inner product spaces, exploring concepts such as inner products, orthogonal vectors, orthonormal bases, and isometry in 2 and 3-dimensional Euclidean spaces. This section also delves into the study of symmetric endomorphisms and orthogonal matrices. The second part of the course introduces probability theory, including probability spaces, discrete random variables, probability distributions, and the law of large numbers. Building on the foundations of Algebra 2, this course provides students with a comprehensive understanding of these mathematical disciplines.

   b. **Prerequisites:** 020AL2CI3 Algebra 2

   c. **Required/Selected Elective/Open Elective:** Required

6. **Educational objectives for the course**
   a. **Specific outcomes of instruction:**
      - Identify, manipulate inner products
      - Characterize orthogonal vectors and orthonormal basis
      - Study and classify isometric applications.
      - Study symmetric endomorphisms.
      - Compute probabilities

   b. **PIs addressed by the course:**

PI	1.1
Covered	x
Assessed	x

7. **Brief list of topics to be covered**
   - Inner products and Inner spaces, Euclidian spaces, orthogonal vectors, Bessel inequality (2 lectures)
   - Total sequences, orthogonal projections , orthogonal polynomials (2 lectures)

- Isometries in Euclidean spaces, classification of isometries in 2 or 3 dimensional spaces (4 lectures)
- Orthogonal matrices (3 lectures)
- Symmetric application and their matrices (3 lectures)
- Probability spaces, countability, Conditional probability, independence (7 lectures)
- Discrete random variables, probability distributions, generating functions, law of large numbers (7 lectures)