

## **COURSE SYLLABUS FORM**

**American University of Beirut  
Faculty of Arts and Sciences  
Department: Mathematics**

**Course Number and Title: Math 344, Commutative algebra .**

### **1. Course Learning Outcomes**

Thoroughly understand basic concepts and proof techniques in commutative algebra, and be able to use them fluently.

Have a geometric viewpoint on the subject as preparation for a future topics course on elliptic curves or algebraic geometry.

Be able to do nontrivial algebraic computations on explicit examples involving rings of polynomials and their ideals.

Develop a concrete feeling for the algebraic background needed for further study of number theory, algebraic geometry, or algebraic groups.

### **2. Resources Available to Students**

Required textbook: Introduction to Commutative Algebra, by Atiyah and MacDonald.

Recommended references (available at Jafet library):

- Introduction to Commutative Algebra and Algebraic Geometry, by Kunz.
- Commutative Algebra, by Zariski and Samuel.
- Commutative Algebra with a View towards Algebraic Geometry, by Eisenbud.
- Undergraduate Commutative Algebra, by Reid.
- Undergraduate Algebraic Geometry, by Reid.
- Invitation to Algebraic Geometry, by Smith, Kahanpaa, Kekalainen, and Traves.

### **3. Grading Criteria**

Weekly problem sets (50%), midterm (20%), final (30%).

### **4. Schedule**

Depending on student background, I plan to cover the following topics:

- Brief review of rings, modules, exact sequences, tensor products (1 week)
- Prime ideals and localization (2 weeks)
- Noetherian rings and modules; a brief account of primary decomposition (2 weeks)
- Integral dependence (1 week)
- Polynomial rings, affine algebras, and affine varieties including Hilbert Nullstellensatz (2 1/2 weeks)
- Dedekind domains and algebraic curves; ramification, completion, and prime decomposition in extensions (3 weeks)
- Dimension of rings and of varieties (2 1/2 weeks).

**5. Course Policy (if any)**

The prerequisites for this course are Math 242 and Math 341, or their equivalent. Students who have taken only one of these courses may ask the instructor for permission to enroll in Math 344. The decision will be based on the rest of the student's mathematical background.