COURSE SYLLABUS FORM

American University of Beirut
Faculty of Arts and Sciences
Department Mathematics

Course Number and Title: Math 341, Modules and Rings I

1. Course Learning Outcomes

- Relate unique factorization domains, Principal ideal domains, and Euclidean domains
- Construct the ring of quotients of an arbitrary commutative ring
- Define free modules
- Classify free modules over a ring
- Explain the notion of a ring having the invariant dimension property
- Relate projective and free modules
- Explain how every module over a ring R is the homomorphic image of a projective R-module
- Give examples of injective modules
- Explain how every unitary module over a ring R with identity can be embedded in an injective R-module
- Define tensor product
- Describe the structure of finitely generated modules over a principal ideal domain

2. Resources Available to Students

Textbook**:** Algebra by Thomas Hungerford, Graduate texts in Mathematics, Springer

References: 1. Rings and Categories of Modules , by Anderson/Fuller.
2.A First Course in Noncommutative Rings.By T.Y.Lam

3. Grading Criteria

Mid-term , 30 %
Final exam, 50 %
Homework assignments, 20%

4. Schedule

Week 1 & 2
Topics: Rings and homomorphisms, Ideals, Factorization in commutative rings, Rings of quotients

Week 3 & 4
Topics: Polynomial rings, Modules and submodules

Week 5 & 6
Topics: Homomorphisms and exact sequences, Direct sums and products of modules

Week 7 & 8
Topics: Free modules and vector spaces

Week 9 & 10
Topics: Projective and injective modules

Week 11 & 12
Topics: Noetherian and Artinian rings and modules

Week 13 & 14
Topics: Tensor products, Modules over a principal ideal domain