Dilla University

College of Natural and Computational Science

Department of Mathematics

Course Title: Commutative Algebra   Course Code: Math 711

Pre-requisite: Math 612   Course hrs: 3   Credit hr: 3hrs   Tutorial: 2hrs

Aims of the course: The aim of this course is to introduce students the basic properties of commutative rings and module over these rings.

Course Description: The course covers Flatness; Localizations: associated Prime ideals and Primary Decompositions: Graded Rings: Completion: Dimension Theory; Normal Rings and Regular Rings.

Course Objectives: On completion of the course successful students will be able to:
- ☛ familiarize the concept of commutative rings
- ☛ understand definition of categories and factors
- ☛ identify the different types of factors
- ☛ see the relation between factors
- ☛ comprehend the idea of localization
- ☛ comprehend the concept of fitting invariants
- ☛ understand the concept of primary decompositions of ideals
- ☛ understand the concept of associated primes
- ☛ grasp the concept of dimension theory of Noetherian rings

Chapter 1: Rings
  1.1 Ring elements
  1.2 Ring homomorphisms and ideals
  1.3 Ring properties
  1.4 Domains

Chapter 2: Modules
  2.1 Module homomorphisms
  2.2 Module properties

Chapter 3: Exact Sequences
  3.1 Split exact sequences and projectivity

3.2 Free resolutions
3.3 Sylvester rings

Chapter 4: Catagories
4. 1 Functors and functional morphisms

Chapter 5: Special Functors

5.1 The covariant Hom-functor
5.2 The contravariant Hom-functor
5.3 The tensor product
5.4 Relation between Hom and tensor product

Chapter 6: Localization

6.1 Local rings
6.2 Modules of fractions
6.3 Local properties
6.4 Geometric interpretation of localization

Chapter 7: Fitting Invariants

7.1 Determinant ideals
7.2 Fitting ideals
7.3 The rank of a matrix
7.4 Euler characterization

Chapter 8: Dimension Theory
8.1 Height and prime divisors of ideals
8.2 Geometric interpretation of prime decomposition
8.3 Primary decomposition
8.4 Associated primes
8.5 The zero divisors of a ring
8.6 Modules of Finite length
8.7 Krull's principal ideal theorem
8.8 Dimension theory of Noetherian rings

Mode of Assessment:

o   Assignment: 20%

o   Mid exam: 30%

o   Final exam: 50%

Text book: M.Atiyah, I. G. Macdonald, Introduction to Commutative Algebra, Perseus Books 1999**.**

Rereferences

1. M.Atiyah, I. G. Macdonald, Introduction to Commutative Algebra, Perseus Books 1999.
2.   D. Eisenbud, Commutative Algebra with a View Toward Algebraic Geometry, Springer 2007.
3.   G. -M. Greuel G. Pfister, A Singular Introduction to Commutative Algebra, Springer 2007.

4.   E. Kunz, Introduction to Commutative Algebra and Algebraic Geometry, Birkhöuser 1985.
5. T.Y. Lam, Lectures on Modules and Rings, Springer 1998 .
6. D.G. Northcott, Finite Free Resolutions, Cambridge University press 2004.