Dilla University

College of Natural and Computational Science

Department of Mathematics

Course Title: Algebra II Course Code: Math 612 Prerequisite courses: Math 601

Credit hr: 3hrs Course hrs: 3

AIMS OF THE COURSE: This course is a continuation of the course Math 601 and aims in giving a more thorough development of the topics of Abstract Algebra courses, fields, field extensions and Galois theory.

Course Description: The course covers the theory of modules, fields and their extension, ruler and compass constructions, Galois Theory, the fundamental theorem of Galois Theory, and applications of Galois Theory.

Course Objectives: On completion of the course successful students will be able to:

- Comprehend definitions and properties of modules
- acquire the appropriate skills and knowledge on free, projective and injective modules
- comprehend finite extension field as a vector space over its subfield
- understand the concept of algebraic and transcendental numbers and its relation to the zeros irreducible polynomials over the rational numbers
- Comprehend Galois Theory and the construction with ruler and compass.

Chapter 1: **MODULE THEORY**

1.1 Definitions and examples
1.2 Category of modules and module homomorphisms
1.3 Submodules
1.4 Factor modules
1.5 Isomorphism theorems
1.6 Direct product and sum of modules, exact sequences
1.7 Free modules
1.8 Projective modules
1.9 Injective modules

1.10 Hom and duality

1.11 The tensor product

Chapter 2: **FIELD EXTENSIONS**

2.1 Basic definitions and examples

2.2 Basic properties

2.3 Simple and algebraic extensions

2.4 Finitely generated extensions

2.5 Splitting fields

2.6 Algebraically closed fields

2.7 Separable extensions

2.8 Characteristic of a field, finite fields

2.9 Roots of unity

2.10 Ruler and compass constructions

Chapter 3: **GALOIS THEORY**

3.1 Galois groups

3.2 Normality and separability

3.3 Galois group of a polynomial

3.4 Solvability by radicals

3.5 The fundamental theorem of Galois theory

3.6 Applications of Galois Theory

Mode of Assessment:

- Assignment: 20%
- Mid exam: 30%
- Final exam: 50%

Text book: Hungerford, T.H.: Algebra, Springer-Verlag, 1974.

References:

- Lang, S.: Algebra, Addison-Wesley, 1970.
- Goldstein. L.J: Abstract Algebra: A First Course, Prentice-Hall Inc., 1973.