Tennessee Technological University
Mathematics Department

MATH 4010-4020/5010-5020: Modern Algebra I-II

I.   COURSE DESCRIPTION FROM CATALOG: Lec. 3-3. Cr. 3-3.
Groups and subgroups including cyclic, abelian, finite; permutation groups, group homomorphisms, cosets and Lagrange's Theorem, normal subgroups and factor groups. Rings including integral domains, unique factorization domains and Euclidean domains, ideals and factor rings, ring homomorphisms, fields and their extensions, geometric constructions.

II.   PREREQUISITE(S):
MATH 4010/5010: C or better in MATH 2010 <u>and</u> C or better in MATH 3400.
MATH 4020/5020: C or better in MATH 4010/5010.

III.   COURSE OBJECTIVE(S):
To enable the student to obtain a broad overview of the most common algebraic systems and to begin attaining a working knowledge of groups, rings, fields, and integral domains.

IV.   STUDENT LEARNING OUTCOMES:
MATH 4010/5010:
Upon successful completion of the course students will understand the standard axioms of a group and be able to use these axioms to prove simple results about groups; develop a working knowledge of important types of groups including Abelian group, cyclic group, permutation group, factor group, and direct product, along with a working knowledge of important concepts related to groups, including order, homomorphism, isomorphism, subgroup, and normal subgroup; and be familiar with important theorems, including Lagrange's Theorem, Cayley's Theorem, and the First Isomorphism Theorem for Groups, and be able to apply these theorems to prove simple results about groups.

MATH 4020/5020:
Upon successful completion of the course students will understand the standard axioms of a ring and be able to use these axioms to prove simple results about rings; develop a working knowledge of important types of rings, including integral domain, field, factor ring, polynomial ring, and direct product, along with a working knowledge of important concepts related to rings, including order, characteristic, irreducible factorization, homomorphism, isomorphism, subring, ideal, prime ideal, and maximal ideal; be familiar with important theorems, including the First Isomorphism Theorem for Rings and Kronecker's Theorem, and be able to apply these theorems to prove simple results about rings.

V.   TOPICS TO BE COVERED:
MATH 4010/5010:
- Basic properties of special groups: abelian, cyclic, dihedral, direct product, factor, permutation

- Major results: fundamental theorem of cyclic groups, Lagrange's theorem, Cayley's theorem, first isomorphism theorem for groups
- Subgroup tests and normal subgroups
- Properties of group homomorphisms and isomorphisms
- Fundamental theorem of finite abelian groups (optional)

MATH 4020/5020:
- Basic properties of special rings: commutative, direct product, factor, field, integral domain, polynomial, quotient field
- Subrings and ideals, including prime ideal and maximal ideal
- Factorization topics, including prime element, irreducible element, unique factorization domain, principal ideal domain, and Euclidean domain
- Properties of ring homomorphisms and isomorphisms
- Properties of field extensions
- Geometric constructions (optional)

VI. **ADDITIONAL INFORMATION:**
Graduate credit is earned on the basis of additional work required by the instructor [per 2005-2006 TTU Graduate Bulletin], page 38.

VII. **POSSIBLE TEXTS AND REFERENCES:**
Abstract Algebra, 3rd ed., Beachy and Blair
Contemporary Abstract Algebra, 10th ed., Gallian
Modern Algebra: An Introduction, 4th ed., Durbin
Schaum's Outline of Modern Abstract Algebra, Ayers

VIII. **ANY TECHNOLOGY THAT MAY BE USED:**
Maple

IX. **STUDENT ACADEMIC MISCONDUCT POLICY:**
Maintaining high standards of academic integrity in every class at Tennessee Tech is critical to the reputation of Tennessee Tech, its students, alumni, and the employers of Tennessee Tech graduates. The Student Academic Misconduct Policy describes the definitions of academic misconduct and policies and procedures for addressing Academic Misconduct at Tennessee Tech. For details, view the Tennessee Tech's Policy 217 – Student Academic Misconduct at Policy Central.

X. **DISABILITY ACCOMMODATION:**
Students with a disability requiring accommodations should contact the Office of Disability Services (ODS). An Accommodation Request (AR) should be completed as soon as possible, preferably by the end of the first week of the course. The ODS is located in the Roaden University Center, Room 112; phone 372-6119. For details, view the Tennessee Tech's Policy 340 – Services for Students with Disabilities at Policy Central.