Kotebe University of Education
College of Natural and Computational Sciences

Course title: Fundamental Concepts of Algebra
Course code: Math 2011
Credit hrs: 3
ECTS: 5
Contact hrs: 3
Tutorial hrs: 2
Year: II Semester: I
Prerequisite: Math1011

Aims

This course intends to introduce the students to the basic notions of formal logics from the perspectives of truth, proof, and arguments. It presents the notion of sets and algebraic structures which lay foundations for subsequent mathematics courses.

Course Description:

The course mainly covers, relations, classification of sets, cardinal numbers, groups, rings, and the system of integers.

Course objectives:

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

- understand the notion of relations, equivalence of sets and cardinal numbers,
- understand the properties of binary operations and algebraic structures,
- understand the basic properties of groups,
- grasp the concept of group and ring homomorphism and use them to prove homomorphism of groups and rings respectively,
- understand the axiomatic approach of the construction of integers,
- apply the principle of mathematical induction to prove statements involving integers.

Course Contents

1. Set theory (12 hrs)
   - 1.1 Review of sets and set operations, ordered pairs, relations and functions
   - 1.2 Order and equivalence relation
   - 1.3 Classification of sets
   - 1.4 Cardinal numbers
2. Groups (15 hrs)
   - 2.1 Binary operations, algebraic structures
   - 2.2 Identity element and inverses
   - 2.3 Morphisms
   - 2.4 Definition and examples of groups
   - 2.5 Subgroups, cosets, and Lagrange's theorem
   - 2.6 Normal subgroups and quotient groups
   - 2.7 Homomorphisms

3. Rings (12 hrs)
    3.1 Definition of rings and examples
    3.2 Subrings and characteristic of a ring
    3.3 Ideals and quotient rings
    3.4 Homomorphism of rings
    3.5 Integral domains and the field of quotients
    3.6 Polynomial rings
    3.7 Prime fields
4. The system of integers (9 hrs)
    4.1 Properties of addition and multiplication
    4.2 Order axioms of the system of integers
    4.3 Well-ordering axioms
    4.4 Mathematical induction
    4.5 Characterization of the system of integers

Teaching-Learning Strategy/Methods:

Active learning strategy

- Modified lecture, Inductive and deductive approach, Heuristic approach, and Assignment method.

Assessment Strategy/Methods:

- Assignments: 20%
- Tests: 30%
- Semester Examination: 50%

Course Policy:

A student has to

- Attend at least 85% of the classes
- Take all continuous assessments
- Take final examination
- Respect all rules and regulations of the University

References

[1] Demissu Gemeda and Seid Mohammed (2008). *Fundamental Concepts of Algebra.* Department of Mathematics, AAU.

[2] Bhattachara, P. B. (1995). *Basic abstract algebra.* 2 nd ed, Cambridge University press.

[3] Dummit, D. S. and Foote, R. M. (2004). *Abstract algebra.* 3 rd ed, John Wiley and Sons.

[4] Ehrlich, G. (2011). *Fundamental concepts of abstract algebra.* Courier Corporation.

[5] Fraleigh, J. B. (2003). *A first course in abstract algebra.* Pearson Education India.

[6] Gerald, J. J. (1989). *Introduction to modern algebra (revised).* 4th ed, University Book Stall, Reading.