Approval: 8th Senate Meeting

Course Name: Abstract Algebra

Course Number: MA549

Credit: 3-0-0-3

Students intended for: UG 3rd and 4th year students/PG

Prerequisites: None

Elective or Core: Elective

Semester: Odd

Course Preamble: This one semester course is designed to provide a first exposure of the concepts of abstract algebra to students of engineering as well as to show them some practical applications of these concepts. Such a course would teach students the basic objects of algebra, providing plentiful examples and enough theory to allow interested students to transition easily to more advanced abstract algebra.

Course objective: This course aims to provide a first approach to the subject of abstract algebra, which is one of the basic pillars of modern mathematics. The focus of the course will be the study of certain structures called groups, rings, fields and some related structures and to introduce some cryptographic applications. Abstract algebra gives to student a good mathematical maturity and enables to build mathematical thinking and skill. Upon completion of this course, the student will understand and be able to apply the fundamental principles of abstract algebra.

Course Contents:

[21 Lectures]

Binary operation, and its properties, Definition of a group, Examples and basic properties. Subgroups, Coset of a subgroup, Lagrange's theorem. Cyclic groups, Order of a group. Normal subgroups, Quotient group. Homomorphisms, Kernel Image of a homomorphism, Isomorphism theorems. Permutation groups, Cayley's theorems. Direct product of groups. Structure of finite abelian groups. Applications, Private and public key cryptography, some nontrivial examples

[21 Lectures]

Rings: definition, Examples and basic properties. Zero divisors, Integral domains, Fields, Characteristic of a ring, Quotient field of an integral domain. Subrings, Ideals, Quotient rings, Isomorphism theorems. Ring of polynomials. Prime, Irreducible elements and their properties, UFD, PID and Euclidean domains. Prime ideal, Maximal ideals. Extension fields, Algebraic extensions, Finite fields.

Text books:

1. Joseph Gallian**,** *Contemporary Abstract Algebra*, 7th ed. (Brooks Cole, 2009).
2. J. B. Fraleigh, *A first Course in Abstract Algebra*, Narosa Publishing House, 2003.

Reference Books:

1. I. N. Herstein, *Topics in Algebra,* Wiley Eastern Ltd., New Delhi, 1975.
2. Klima, Sigmon and Stitzinger**,** *Applications of Abstract Algebra with Maple and Matlab ,* Second Edition, 2006.