

**Form (H)**  
**Short course description**

Course title: Rings and Fields	Course number and code: Math 441
Previous course requirement: MATH 343	Language of the course: Arabic or English
Course level: 7th level (fourth year)	Effective hours: 4 (3+2+0)

Course description

Rings, group of units and group of automorphisms of a ring. Ideals and factor rings. Principal ring. Prime and maximal ideals. Field of quotients of an integral domain. Characteristic of a ring. Direct sum of rings. Modules. Euclidean rings. Ring of polynomials. Roots of polynomials over a field. Field extensions. Finite and simple extensions of fields. Algebraic closure of a field. Splitting fields. Finite fields.

Course objectives

- 1-Well scientific knowledge of the theory of rings which is an important algebraic structure in mathematics ( specifically in algebra)
- 2- deep study of some interesting rings as Euclidean rings and a ring of polynomials over a field which is very useful in the study of finite fields and field extensions.
- 3-These concepts have very important applications in Galois theory and especially for the course Math 442 (Applications of Algebra).

Learning outcomes (understanding, knowledge, and intellectual and scientific skills)

After studying this course, the student is expected to be able to:

- 1- The students acquire basic concepts of a Ring as an algebraic structure like the definitions of a Ring, its Ideals, the factor ring, the automorphisms of a ring, principal ring, prime and maximal ideals, the field of quotients of an integral domain, characteristic of a ring and direct sum of rings.
- 2- Study the modules as another algebraic structure. Deep study of some important rings and field extensions which essentially arise from ideas of Galois Theory.
- 3- the students study the notion of finite fields which has a useful application in coding theory.

Textbook adopted and supporting references

Title of the book	Author's name	Publisher's name	Date of publication
1-Theory of Rings and Field Extensions	Y. Alkhamees	King Saud University	1426 H
2- Rings Modules and Linear Algebra.	Hartley, B. and Hawkes, T. O.	London, New York: Champion and Hall, 1991.	1991
3- Topics in Algebra.	Herstein, I. N.	New York: John Wiley and sons	1977
4- Introduction to Algebra	Kochendoreffer, R.	The Netherland: Wolters-Noordhoff	1972