

**SECOND SEMESTER 2021-22**

# Course Handout Part II

Date:15.01.2022

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

*Course No.* : **MATH F314**

## Course Title : **Algebra II**

## Instructor-in-Charge : **Pratyusha Chattopadhyay**

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**Scope and Objective of the Course:** Basic Field Theory, Vector Spaces, and Linear Algebra are the fundamental building blocks of abstract algebra. Knowledge of this course will help a student to pursue courses on advanced algebra.

The objective of this course is to introduce basics of modules, field extensions, vector spaces, and linear transformations. In this course one will learn about definitions of modules, basic facts about modules, vector spaces & dual vector spaces, definitions and examples of fields, field extension, degree of extension, algebraic element, splitting field, normal extensions, Galois extension & Galois group, linear transformations, characteristic roots & characteristic polynomials, and certain canonical forms of transformations.

**Text Book:**

1. I. N. Herstein, Topics in Algebra, 2nd Edition, John Wiley.

**Reference Books:**

1. Dummit & Foote, Abstract Algebra, 3rd Edition, Wiley.
2. I.B.S. Passi, Field Theory, Alpha Science International Limited.
3. P.M. Cohn, Basic Algebra, Springer, 1st Edition.
4. K.M.Hoffman & R. Kunze, Linear Algebra, Pearson, 2nd Edition.

**Course Plan:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Lecture No.** | **Learning objectives** | **Topics to be covered** | **Chapter in the Text Book** |
| 1-5 | Vector spaces and dual spaces | Basics of vector spaces and dual spaces | 4.1 – 4.3 |
| 6-8 | Modules | Basics of modules | 4.5 |
| 9-13 | Extension of fields | Field extension, algebraic element, and transcendental element | 5.1, 5.2 |
| 14-19 | Root of a polynomial | Definition of root, multiplicity of roots, splitting field, and simple extension | 5.3, 5.5 |
| 20-25 | Galois Theory | Galois extension and Galois groups | 5.6 |
| 26-28 | Algebra of Linear Transformations | Algebra of linear transformations and related results | 6.1 |
| 29-31 | Characteristic Roots | Characteristic roots, characteristic vectors, and related results | 6.2 |
| 32 | Matrices | Matrices of linear transformations | 6.3 |
| 33-35 | Canonical Forms: Triangular | Similar transformations, invariant subspaces, and triangular forms | 6.4 |
| 36-37 | Canonical Forms: Nilpotent | Nilpotent transformation, index of nilpotence, and related results | 6.5 |
| 38-40 | Canonical Forms: Jordan | Decomposition of a vector space and Jordan canonical form | 6.6 |

**Evaluation Scheme:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Component** | **Duration** | **Weightage (%)** | **Date & Time** | **Nature of Component** |
| Assignment-1 |  | 15 | Will be announced\* | Open book |
| Mid-semester Exam | 90mins | 30 | 12/03 3.30pm to5.00pm | Closed book |
| Assignment-2 |  | 15 | Will be announced\* | Open book |
| Comprehensive | 120 mins | 40 | 12/05 AN | Closed book |

\*Exact date and duration will be notified later

Total marks is 100

**Chamber Consultation Hour:** To be announced by the Instructor.

**Notices:** The notices concerning this course will be announced on the CMS Notice Board only.

**Make-up Policy:** Make-up for tests will be given only for genuine cases and prior permission has to be obtained from Instructor In-charge.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and any type of academic dishonesty is not acceptable.

**INSTRUCTOR-IN-CHARGE (MATH F314)**