

**University of Kerala**  
**Complementary Course in Mathematics**  
**for First Degree Programme in Chemistry**

**Semester IV**  
**Mathematics-IV**  
**(Abstract algebra, Linear transformations, Coordinate systems)**

CODE: MM 1431.2

Instructional hours per week: 5  
No. of Credits: 4

Module 1: Abstract algebra

- Groups—definition and examples, elementary properties, finite groups and subgroups, cyclic groups, elementary properties, symmetry of plane figures
- Rings and fields—definition and examples,
- Vector spaces, definition and examples, elementary properties, linear dependence and independence, basis and dimension.

Module 2: Linear Transformations

- Linear transformations from  $\mathbb{R}^n$  into  $\mathbb{R}^m$ . Matrix of a linear transformation relative to a given pair of bases and linear transformation defined by a matrix. Characterisation of linear transformations from  $\mathbb{R}^n$  into  $\mathbb{R}^m$ .
- Linear transformations from  $\mathbb{R}^n$  into  $\mathbb{R}^n$  and matrix of such transformations. Matrix representation of simple transformations such as rotation, reflection, projection etc. on the plane. Relation between matrices of a given transformation relative to two different bases. Method of choosing a suitable basis in which the matrix of a given transformation has the particularly simple form of a diagonal matrix.

Module 3: Co-ordinate systems

- Spherical co-ordinates, polar co-ordinates, cylindrical co-ordinates, relation to cartesian co-ordinates, application of integration, integration in spherical co-ordinates.

Text for Module 1: J B Fraleigh, *A First Course in Abstract Algebra*, Narosa Publications

Text for Module 2: David C. Lay, *Linear Algebra*, Thompson Publications, 2007

Text for Modules 3: Howard Anton, et al, *Calculus*. Seventh Edition, John Wiley

REFERENCES:

1. James Stewart, *Essential Calculus*, Thompson Publications, 2007.
2. Thomas and Finney, *Calculus and Analytic Geometry*, Ninth Edition, Addison-Wesley.

3. Kreyzig, *Advanced Engineering Mathematics*, 8<sup>th</sup> edition, John Wiley.
4. Peter V. O' Neil, *Advanced Engineering Mathematics*, Thompson Publications, 2007
5. Michael D. Greenberg, *Advanced Engineering Mathematics*, Pearson Education, 2002.

DISTRIBUTION OF INSTRUCTIONAL HOURS:

Module 1: 30 hours; Module 2: 30 hours; Module 3: 30 hours