23MA804 Advanced Ring Theory 3 1 0 4

Course Outcomes (CO's):

CO1: To familiarize with the fundamental concepts of categories of modules.

CO2: To learn some techniques to decompose the rings and modules.

CO3: To study the socle and the radical of rings and modules.

CO4: To learn the various functors and its role between categories of modules.

Syllabus:

Unit 1: Rings, Modules and Homomorphisms

Review of Rings and their Homomorphisms - Modules and Submodules - Homomorphisms of Modules - Categories of Modules - Endomorphism Rings.

Unit 2: Direct Sums and Products

Direct Summands - Direct Sums and Products of Modules - Decomposition of Rings - Generating and Cogenerating.

Unit 3: Finiteness Conditions for Modules

Semi-simple Modules - The Socle and the Radical - Finitely Generated and Finitely Cogenerated Modules, Chain Conditions - Modules with Composition Series - In-decomposable Decompositions of Modules.

Unit 4: Classical Ring-Structure Theorems

Semi-simple Rings - The Density Theorem - The Radical of a Ring- Local Rings and Artinian Rings.

Unit 5: Functors Between Module Categories

The Hom Functors and Exactness- Projectivity and Injectivity - Projective Modules and Generators - Injective Modules and Co-generators - The Tensor Functors and Flat Modules - Natural Transformations.

References:

1. F. W. Anderson, and K. R. Fuller, Rings and Categories of Modules (2^{nd} Ed.), Springer-Verlag-New York, 1992.
2. T. Y. Lam, Lectures on Modules and Rings, Springer-Verlag-New York, 1999.
3. M. E. Keating, First Course in Module, Imperial Press, 1998.