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 (2nd Ed.),