

Semester	JAN 2022
Open to semester	22
Course code	MT6264
Course title	Algebra I
Credits	/4
Course Coordinator & participating faculty (if any)	Anupam Kumar Singh
Nature of Course	Lectures and Tutorials
Pre-requisites	Undergraduate Algebra
Objectives (goals, type of students for whom useful, outcome etc)	To learn basic algebra
Course contents (details of topics /sections with no. of lectures for each)	<p>Groups: Examples, category of groups, Action of a group on a set. Subgroups, isomorphism theorems. Group actions: Permutation representations, action on itself by left multiplication, action on itself by conjugation. Automorphisms of groups and statement of Sylow theorem Automorphisms: Inner automorphisms, automorphism groups of some finite groups: dihedral, quaternions, cyclic. Statement of Sylow's theorem, Direct and Semidirect products. Simple groups, composition series, Jordan-Hölder Series, An is simple.</p> <p>Category Theory Objects, morphisms, functors.</p> <p>Free groups: words, construction, and uniqueness. Universal property, adjointness with forgetful functor. Finitely generated and finitely presented groups. Rings</p> <p>Definitions (review): integral domains, euclidean domains, pid, ufd, fields. Examples: Polynomials rings, Matrix rings, group rings. Ideals and Quotient rings, prime and maximal ideals. Chinese Remainder Theorem. Nilradical and Jacobson radical.</p>

	<p>Modules Definition, Z-modules, $F[x]$-modules. Direct sums and free modules - construction and universal property.</p> <p>Bilinear Forms: Symmetric forms. Orthogonal bases, ordered fields, Gram Schmidt, Sylvester's theorem. Eigen vectors of linear maps, Spectral theorem (Hermitian, Unitary, Symmetric case). Structure theorem for alternating forms.</p> <p>Tensors: Tensor products of modules. Examples. Universal property, Adjointness with Hom. Tensor product of homomorphisms, associativity, symmetry, tensor product of algebras. Symmetric and Exterior algebras Linear functions on tensor products of vector spaces, determinants. Symmetric algebras, universal properties, alternating algebras, universal properties, symmetric and alternating tensors.</p> <p>Modules over a PID and Canonical forms Structure of finitely generated modules over a PID. Canonical forms. Rational Canonical Form. Jordan Canonical Form.</p>
Evaluation /assessment	<p>End-Sem Examination-40% Mid-Sem Examination-30% Others-30% %</p>
Suggested readings (with full list of authors, publisher, year, edn etc.)	<p>Dummit & Foote: Abstract Algebra. Hungerford: Algebra. Herstein: Abstract Algebra. Artin: Algebra. Lang: Algebra. Bourbaki: Algebra. Alperin & Bell: Groups and Representations. Atiyah & MacDonal: Introduction to Commutative Algebra. Bourbaki: Commutative Algebra. Weibel: Introduction to Homological Algebra. Jacobson: Basic Algebra I & II.</p>