Semester	AUG 2022
Open to semester	22
Course code	**MT5214**
Course title	**Algebra - II**
Credits	/4
Course Coordinator & participating faculty (if any)	Rabeya Basu
Nature of Course	Lectures
Pre-requisites	PhD Course Algebra I
Objectives (goals, type of students for whom useful, outcome etc)	This course is the second of two courses that together provide a foundation in abstract algebra for PhD Students. It will cover the theory of commutative algebra, homological algebra and advanced field theory. This material is ideal for a student wanting to specialising in algebra or any subject with a strong algebraic flavor.
Course contents (details of topics /sections with no. of lectures for each)	A. Commutative Algebra : (i) Localization : Examples and Universal Property. (ii) Integral Extensions : Integral Elements, Integral Extensions, Integral Closure, Going-up Theorem. Going-Down Theorem (only Statement). (iii) Finiteness Conditions: Modules of Finite Lengths, Notherian and Artinian Rings and Modules.The Hilbert Basis theorem. (vi) DVR, Dedekind Domain B. Homological Tools : (i) Algebra: Definition and Examples. Algebra Homomorphism. (ii) Tensor Product of Modules: Base Change, Basic Properties and Universal Property. (iii) Direct and Inverse Limits. (iv) Tensor Algebra, Symmetric and Exterior algebras: Universal Property. (v) Category and Functors : Definition, Examples and Universal Property. (vi) Exact Functors. The Functor Hom. (vii) Projective, Injective and Flat Modules. (viii) Ext and Tor Functors : Properties and Computation for

	few Examples. C. Galois Theory: (i) Separable and Normal extensions, Finite Fields, (ii) Galois Extensions : Examples and Applications. (iii) Algebraic and Transcendental extensions, (iv) Solvable and Radical Extensions. (v) Fundamental theorem of Galois Theory. (iv) Galois' theorem, Infinite Galois Groups, Hilbert 90.
Evaluation /assessment	End-Sem Examination-50% Mid-Sem Examination-30% Others-20%%
Suggested readings (with full list of authors, publisher, year, edn etc.)	Dummit & Foote: Abstract Algebra. Herstein: Abstract Algebra. Lang: Algebra. Atiyah & MacDonald: Introduction to Commutative Algebra. Balwant Singh: Commutative Algebra N.S. Gopala Krishnan: Commutative Algebra. Weibel: Introduction to Homological Algebra.