

MATH 555 COMMUTATIVE ALGEBRA

1. DESCRIPTION

Basics of rings and ideals. Rings of fractions, integral dependence, valuation rings, discrete valuation rings, Dedekind domains, fractional ideals. Topologies and completions, filtrations, graded rings and modules. Dimension theory.

2. TEXTBOOK

M. F. Atiyah & I. G. Macdonald, INTRODUCTION TO COMMUTATIVE ALGEBRA, Addison-Wesley, 1969. Paperback edition, Perseus Publishing, December 1994.

3. SYLLABUS

WEEK	MATERIAL
1	1. RINGS & IDEALS. Exercises & problems.
2	2. RINGS AND MODULES OF FRACTIONS. Exercises & problems.
3	3. INTEGRAL DEPENDENCE AND VALUATIONS. Integral dependence. Cohen-Seidenberg [going-up & going-down] theorems.
4	Valuation rings. Hilbert's Nullstellensatz.
5	Noether's normalization lemma. Exercises & problems.
6	4. NOETHERIAN RINGS. ARTINIAN RINGS. Exercises & problems.
7	5. DISCRETE VALUATION RINGS AND DEDEKIND DOMAINS. Discrete valuation rings. Dedekind domains
8	Structure theorems [via fractional ideals]. Exercises & problems.
9	6. COMPLETIONS. Topologies & Completions.
10	Graded rings and modules.
11	The associated graded ring. Exercises & problems.
12	7. DIMENSION THEORY. Hilbert functions
13	Dimension theorem for Noetherian local rings.
14	Regular local rings. Local dimension theorem for irreducible affine varieties.
15	Exercises & problems.

4. GRADING POLICY

Take-home Exam 1	Chapters 1-3	120
Take-home Exam 2	Chapters 4-7	180
Research Project	-	100