

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	RINGS & IDEALS. Prime and maximal ideals. Nilradical and Jacobson radical. Operations on ideals.
2	Extension and contraction.
3	MODULES. Nakayama's Lemma. Exact sequences.
4	Tensor products of modules. Exactness.
5	RINGS AND MODULES OF FRACTIONS. Local properties. Extension & contraction in rings of fractions
6	INTEGRAL DEPENDENCE AND VALUATIONS. Integral dependence. Going-up and going-down theorems.
7	Valuation rings. Hilbert's Nullstellensatz.
8	CHAIN CONDITIONS.
9	NOETHERIAN RINGS.
10	ARTINIAN RINGS.
11	DISCRETE VALUATION RINGS.
12	DEDEKIND DOMAINS.
13-14	TOPOLOGIES & COMPLETIONS.
14-15	DIMENSION THEORY.

4. GRADING POLICY

Take-home Exam 1	100
Take-home Exam 2	100
Project (Oral + Written)	50