

## MATH 596 - 101

### 2. TEXTBOOK

Irena Swanson and Craig Huneke, INTEGRAL CLOSURE OF IDEALS, RINGS, AND MODULES, LMS Lecture Series, Vol. 336, Cambridge University Press, New York, 2006.

### 3. SYLLABUS

WEEK	MATERIAL
1	<b>1. What is integral closure of ideals:</b> Basic properties; Integral closure via reductions; Integral closure of an ideal
2	Monomial ideals; Dedekind-Mertens formula
3	<b>2. Integral closure of rings:</b> Lying-over, incomparability, going-up, and going-down; Integral closure and grading
4	<b>3. Separability:</b> Algebraic separability; General separability; Relative algebraic closure
5	<b>4. Noetherian rings:</b> Principal ideals; Normalization theorems; Complete rings; Jacobian ideals
6	Serre's conditions; Affine and $\mathbb{Z}$ -algebras; Absolute integral closure; Absolute integral closure
7	Finite lying-over and height; Dimension one; Krull domains
8	<b>5. Rees algebras:</b> Rees algebras constructions; Integral closure of Rees algebras; Integral closure of powers of an ideal
9	Powers and formal equidimensionality; Defining equations of Rees algebras; Blowing up
10	<b>6. Valuations:</b> Valuations and the integral closure of ideals <b>7. Derivations:</b> Analytic approach
11	<b>8. Reductions:</b> Basic properties and examples; Connections with Rees algebras; Minimal reductions; Reducing to infinite residue fields
12	Superficial elements; Superficial sequences and reductions; Non-local rings
13-14	<b>12. The conductor:</b> The Lipman-Sathaye theorem <b>13. The Briancon-Skoda Theorem:</b> Tight closure; Briancon-Skoda via tight closure
14-15	The Lipman-Sathaye; General version

### 4. GRADING POLICY

Presentations	100
Seminars	100
Take-home Exam (20 Problems)	200