

## MATH 603A (Toric Varieties) Spring 2021 Syllabus

**Instructor:** Alexander Borisov

**Office hours:** On Zoom, TBA

**Email:** borisov@math.binghamton.edu

**Classes meet:** MWF 2:20-3:20, online

### Some Useful Texts

**Available Online** (click on the titles):

Jean-Paul Brasselet. Introduction to Toric Varieties

V.I. Danilov. The Geometry of Toric Varieties

Geert Popma. Toric Geometry. An introduction to toric varieties with an outlook towards toric singularity theory

**Printed** (optional):

Tadao Oda. Convex Bodies and Algebraic Geometry. An Introduction to the Theory of Toric Varieties. ISBN 978-3-642-72549-4

J.W.S. Cassels. An Introduction to the Geometry of Numbers. ISBN 978-3-540-61788-4

### Main Topics to be Covered

Projective spaces

Algebraic varieties, as glued from spectra of algebras

Lattices in  $\mathbb{R}^n$

Convex bodies and convex cones; duality

Construction of toric varieties from rational polyhedral fans

Basic algebraic geometry of curves: divisors, canonical class, Riemann-Roch Theorem, Hurwitz formula

Basic algebraic geometry of surfaces: divisors, canonical class, adjunction, intersection form, blow-up of a point construction

Singularities, Weil and Cartier divisors

Toric aspects of Minimal Model Program

Geometry of Numbers and applications: Minkowski Theorems, successive minima, duality, Lawrence Theorem

Classification results for lattice-free convex lattice polytopes in low dimensions

Connection to the Nyman-Beurling-Báez-Duarte Criterion for the Riemann Hypothesis

### Assignments and Grades

The officially registered students will have their course grade determined by attendance, participation, two or three written assignments, and one or two oral examinations (on Zoom, at a mutually convenient time outside of class). The details will be announced later.