

# Positive Characteristic Methods in Commutative Algebra

Department of Mathematics, Indian Institute of Technology Bombay

19-30 June 2017

---

## Overview

This course is organized in several modules that should be taken together. The topics in Module A will expose the participants to basic techniques from the theory of Cohen-Macaulay, Gorenstein and regular local rings. Module B will introduce classical invariant theory of finite groups including theorems of Hilbert, Noether, Molien, Hochster-Eagon and K.-I. Watanabe. This will be complemented by the lectures in Module C which will develop invariant theory of reductive groups and related results about rational singularities.

Module D, offered in the second half of the course, will introduce positive characteristic techniques in commutative algebra. The highlights are: proofs of the ADG conjectures on magic squares, the Briançon-Skoda Theorem in complex analytic geometry, the Hochster-Roberts Theorem regarding the Cohen-Macaulay property of rings of invariants of linearly reductive groups, and uniform bounds on symbolic powers of ideals that have recently attracted a lot of attention. These apparently disconnected topics are indeed connected when one approaches them from the viewpoint of tight closure theory.

<b>Modules</b>	<b>A: Basic commutative algebra : June 19-24</b> <b>B: Invariant theory of finite groups : June 19-24</b> <b>C: Invariant theory of reductive groups : June 19-24</b> <b>D: Commutative algebra in positive characteristic : June 25-30</b> Number of participants for the course will be limited to fifty
<b>You Should Attend If...</b>	<ul style="list-style-type: none"><li>• you are a research scholar, post doctoral fellow or a faculty member with background in basic commutative algebra and algebraic geometry taught at Master's degree level.</li><li>• you are a college teacher pursuing research in commutative algebra or algebraic geometry.</li></ul>
<b>Fees</b>	The participation fees for taking the course is as follows: <b>Participants from abroad : US \$500</b> <b>Academic Institutions: Rs. 10,000</b> The above fee include all instructional material, meals, computer use for tutorials and assignments, free Internet facility. The participants will be provided with accommodation on payment basis.

## The Faculty



**Prof. Hariharan Ananthnarayan** is a faculty member at IIT Bombay. His research interests include Gorenstein rings, free resolutions and Boij-Soderberg theory of free resolutions.



**Prof. Rajendra Gurjar** is a visiting professor at IIT Bombay. His research interests include invariant theory of reductive groups, algebraic surfaces,  $\mathbb{Q}$ -homology planes, affine geometry, fundamental groups of surfaces and singularity theory.



**Prof. Anurag Singh** is a faculty member in the University of Utah, USA. His research interests include local cohomology modules, rational singularities, symbolic powers of ideals,  $F$ -rational and  $F$ -regular rings, tight closure of ideals and  $D$ -modules.



**Prof. Manoj Kummini** is a faculty member at the Chennai Mathematical Institute, Chennai. His research interests include local cohomology, normal Hilbert-Samuel polynomials, Schubert varieties, free resolutions, Boij-Soderberg theory and graph theory.



**Prof. J. K. Verma** is a faculty member at IIT Bombay. His research interests include local cohomology of Rees algebras, Hilbert-Samuel polynomials, fiber cones of ideals, mixed multiplicities and mixed volumes.

## Course

## Co-ordinators

**Prof. Manoj Kummini**  
Chennai Mathematical Institute  
Phone: +91-44-6748 0943  
E-mail: mkummini@cmi.ac.in

**Prof. Jugal K Verma**  
Indian Institute of Technology Bombay  
Phone: +91-22-2576-7478  
email: jkv@math.iitb.ac.in

.....