Polynomials, Inequalities and Related Topics

MATH 6290

Time and Place: T Th 12:30-1:45 p.m. in MSCS 428
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Textbook: Q. I. Rahman and G. Schmeisser, Analytic Theory of Polynomials: Critical Points, Zeros and Extremal Properties, Oxford University Press, 2002.

Polynomials are of importance in almost every area of mathematics, so that you may find (perhaps with a surprise) that some parts of this course are related to your interests. We shall highlight a number of open problems and attractive directions of research.

Most of the of material is rather elementary, and only requires general knowledge of analysis at the level of Advanced Calculus and Elementary Complex Variables. Real Analysis and Complex Analysis courses will definitely suffice as prerequisites.

Each student will work on a project related to the course, and prepare a presentation.

Brief contents

1. General properties of polynomials, connections between their zeros and coefficients.
2. Classical polynomial inequalities, e.g., inequalities of Markov and Bernstein for the derivative.
3. Extremal problems for polynomials, e.g., problems on minimizing various norms that lead to Chebyshev polynomials and orthogonal polynomials.
4. Location of the critical points of polynomials.
5. Applications in Analysis, Number Theory and beyond.

Additional references:
1. P. B. Borwein and T. Erdelyi, Polynomials and Polynomial Inequalities, Springer, 1995.
2. G. V. Milovanovic, D. S. Mitrinovic, Th. M. Rassias, Topics in Polynomials: Extremal Problems, Inequalities, Zeros, World Scientific, 1994.
3. V. V. Prasolov, Polynomials, Springer, 2004.
4. T. Sheil-Small, Complex Polynomials, Cambridge University Press, 2002.
5. G. H. Hardy, J. E. Littlewood, G. Polya, Inequalities, Cambridge University Press, 1988.
6. D. S. Mitrinovic, P. M. Vasic, Analytic Inequalities, Springer, 1970.