# ANALYTIC THEORY OF POLYNOMIALS

Course Code: **MM24405DCE** Total Credits: **04**
Semester: **MA/M.Sc. 4th Semester** Total Marks: **100**
Continuous Assessment: **Marks 20,** Theory: **Marks 80** Time Duration: **2½ hrs**

**Course objectives:** To expose the student toward the study of polynomials, their extremal problems, zeros, critical points and their location.

**Course Outcomes**: This course shall help the students in finding roots of complex polynomial equations, including the Fundamental Theorem of Algebra and the location of roots in the complex plane.

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**UNIT -I**

Introduction, the fundamental theorem of algebra (revisited), symmetric polynomials, the continuity theorem, orthogonal polynomials, general properties, the classical orthogonal polynomials, tools from matrix analysis.

**UNIT -II**

Critical points in terms of zeros, fundamental results and critical points, convex hulls and Gauss-Lucas theorem, some applications of Gauss-Lucas theorem, extensions of Gauss-Lucas theorem, average distance from a line or a point, real polynomials and Jenson's theorem, extensions of Jenson's theorem.

**UNIT -III**

Derivative estimates on the unit interval, inequalities of S. Bernstein and A. Markov, extensions of higher order derivatives, two other extensions, dependence of the bounds on the zeros, some special classes, Bernstein Theorem on unit disk and its generalization, $L^p$ analog of Bernstein's inequality.

**UNIT -IV**

Coefficient estimates, polynomials on the unit circles, coefficients of real trigonometric polynomials, polynomials on the unit interval. (Scope of above syllabus as given in the book "Analytic Theory of Polynomials" by Rahman and Schmeisser).

**Recommended Books:**


1. Q. I. Rahman and G.Schmeisser, Analytic Theory of Polynomials, Claredon Press, 2002.
2. Morris Marden, Geometry of Polynomials, AMS, 2nd Edition, 1949.
3. G. V. Milovanovic, D.S.Mitrinovic and Th. M. Rassias, Topics in Polynomials, Extremal Properties, Problems, Inequalities, Zeroes, World Scientific Publishers, 1994.
4. G. Polya and G. Szego, Problems and Theorems in Analysis, Springer Verlag New York Heidelberg Berlin, 1998th Edition, 1997.