MATHEMATICS 3161
ORDINARY DIFFERENTIAL EQUATIONS II

The elementary functions—polynomials, exponentials, logarithmic functions, trigonometric and inverse trigonometric functions—have graphs that consist of no more than a handful of curves in the plane. It is surprising that so much mathematics can be done with these functions and algebraic combinations of them. Because the solutions of most differential equations cannot be expressed by elementary functions, their solution in terms of infinite series is necessary. One part of this course deals with infinite series solutions of differential equations. Particularly important differential equations such as Bessel's equation are studied in some detail.

Systems of linear first order differential equations can often be solved by eigenvalue methods, and are useful for modelling a variety of real systems as compartmental models. Also, numerical methods for integrating differential equations are studied, to discover how approximate solutions for differential equations are computed. Finally, the important theory of existence and uniqueness of solutions is investigated, so that we can confidently answer such questions as "Under what conditions does a differential equation problem have exactly one solution?"

Text. One possibility is *Elementary Differential Equations and Boundary Value Problems* by Boyce and DiPrima. Lately, *Elementary Differential Equations with Boundary Value Problems* by William F. Trench has been made available, without charge, on line at:

http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH_DIFF_EQNS_II.PDF

Marks. Usually 50% is assigned to a comprehensive final examination, 35% to a one-hour midterm test, and 15% to assignments.

Calendar description. 3161 Ordinary Differential Equations II examines power series solutions, method of Frobenius, Bessel functions, Legendre polynomials and others from classical Physics, systems of linear first order equations, fundamental matrix solution, numerical methods for initial value problems, existence and uniqueness of solutions.
Prerequisites: Mathematics 2260 (or 3260) and 3202.

Offered. Fall