SYLLABUS
MASTER'S/PHD QUALIFYING EXAM

ORDINARY DIFFERENTIAL EQUATIONS

Topics: May 1996

1. Elementary solution techniques (e.g. Math 316).

2. Existence, uniqueness, and continuation of solutions and continuity with respect to parameters.

3. Linear systems with constant and periodic coefficients.

4. Basic ideas of stability theory including the theory of almost linear systems and the theory of Liapunov functions.

5. Two-dimensional system. Phase plane portraits. Energy method; Poincare-Bendixon theory.

6. Regular perturbation theory and 1st order averaging theory.

References:

1. V. Arnold, *Ordinary Differential Equations.*"

2. W.E. Boyce and R.C. DiPrima, *Elementary Differential Equations.*"

3. F. Brauer and J. Noel, "*Qualitative Theory of Ordinary Differential Equations.*"

4. E. Coddington and N. Levinson, *Theory of Ordinary Differential Equations.*"

5. J. Hale, "*Ordinary Differential Equations.*"

6. M. Hirsch and S. Smale, "*Differential Equations, Dynamical Systems, and Linear Algebra.*"

7. W. Hurewicz, "*Lectures on Ordinary Differential Equations.*"

8. D. Jordan and P. Smith, "*Nonlinear Ordinary Differential Equations.*"

9. L. Perko, "*Differential Equations and Dynamical Systems.*"

10. F. Verhulst, "*Nonlinear Differential Equations and Dynamical Systems.*"

Please refer questions concerning this syllabus to ellison@math

Masters-Ph.D. Qualifying Exam
Partial Differential Equations Syllabus

Topics:

1. Derivation of elementary P.D.E.s from physical problems: heat, wave and Laplace's equation. Elementary solution techniques for P.D.E.s. Method of separation of variables and transform methods. Fourier series and integrals. Physical applications.

2. First order quasilinear and nonlinear P.D.E.'s. The method of characteristics.

3. Hyperbolic equations. The wave equation in 1-D and Multi-D. D'Alembert's solution. Solution of Mixed initial-boundary problems. The method of reflection. Propagation of singularities. The energy principle.

4. Elliptic equations. Laplace and Poisson equations. Fundamental solutions and Green's funcitons. The Dirichlet and Neumann problems. Elementary properties of harmonic functions. Maximum principle. Potential theory. Variational formulations.

5. Parabolic equations. The heat equation. Fundamental solution. Solution of initial value problem. Solution of mixed initial-boundary value problems. The method of reflection. Duhamel's principle. Elementary properties of solutions of the heat equation. Maximum principles.

References:

1. Carrier, G. and Pearson, C., *Partial Differential Equations, Theory and Technique.*
2. Chester, C., *Techniques in Partial Differential Equations.*
3. Colton, E, *Partial Differential Equations.*
4. Courant, R. and Hilbert, D., *Methods of Mathematical Physics.*
5. Garabedian, P., *Partial Differential Equations.*
6. John, F., *Partial Differential Equations.*
7. Zachmanoglou, E. and Thoe, D., *Introduction to Partial Differential Equations with Applications.*
8. Zauderer, E., *Partial Differential Equations of Applied Mathematics.*
9. Copson, E.T., *Partial Differential Equations.*
10. Epstein, B., *Partial Differential Equations.*
11. Lax, P.D., *Hyperbolic Systems of Conservation Laws and the Mathematical Theory of Shock Waves.*
12. Pinsky, M.A., *Partial Differential Equations and Boundary-Value Problems with Applications.*
13. Petrovsky, I., *Lectures on Partial Differential Equations.*
14. Sneddon, I.N., *Elements of Partial Differential Equations.*
15. Street, R.L., *Analysis and Solution of Partial Differential Equations.*
16. Tikhonov, A. and Samarski, A.A., *Equations of Mathematical Physics.*