

SYLLABUS FOR MASTER'S COMPREHENSIVE EXAMINATION
PARTIAL DIFFERENTIAL EQUATIONS

Department of Mathematics and Statistics
California State University, Long Beach

Topics

1. First-order equations (Cauchy problem for quasi-linear and fully non-linear equations; Formation of singularities, weak solution, application to traffic flow; Constant-coefficient first-order hyperbolic systems).
2. General techniques and principles for second-order equations (Canonical forms; Separation of variables; Fourier series, sine series, and cosine series; Eigenfunction expansion; Duhamel's principle).
3. The Laplace equation (Mean Value Theorem and Maximum Principle; Fundamental solution, Green's function, Poisson kernel; Method of images (or reflections); Eigenvalues and eigenfunctions of the Laplacian.)
4. The wave equation (d'Alembert's formula; Reflections; Two-dimensional and three-dimensional wave equation; Conservation of energy).
5. The heat equation (Weak maximum principle; Properties of the heat kernel; Properties of the solution to the pure initial value problem).

References

1. *An Introduction to Partial Differential Equations*, Yehuda Pinchover and Jacob Rubinstein, Cambridge University Press, 2005.
2. *Partial Differential Equations*, 2nd Ed., Robert McOwen, Prentice Hall, 2002.
3. *Partial Differential Equations: An Introduction*, 2nd ed., Walter Strauss, Wiley, 2007.
4. *Applied Partial Differential Equations*, 4th Ed., Richard Haberman, Prentice Hall, 2003.

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