MATH 207A - Ordinary Differential Equations

Syllabus for Math 207A

Textbooks: Brauer and Nohel, The Qualitative Theory of Ordinary Differential Equations.

The outline specifies 24 standard 50 minute periods of lectures, leaving the additional class periods for examinations, reviews, and extra time for difficult topics.

Existence and uniqueness of solutions (2 weeks).
Brauer and Nohel, Sections 1.4 - 1.7, 3.1 - 3.5.
Motivation, Gronwall's inequality, existence and uniqueness theorems for solutions, continuation of solutions, continuous and smooth dependence on initial conditions and parameters.

Stability properties (2 weeks).
Brauer and Nohel, Sections 4.1 - 4.7.
The stability concept and its meaning for linear and almost linear systems; conditional stability; asymptotic
equivalence; stability of periodic solutions.

Lyapunov's Theorems and Methods (2 weeks).
Brauer and Nohel, Sections 5.1 - 5.6.
Statements and proofs of Lyapunov's Theorems; invariant sets and stability; asymptotic stability; nonautonomous systems.

Some applications (2 weeks).
Brauer and Nohel; Sections 6.1 - 6.6.
Undamped oscillations; pendulum problems; the Lienard Equation; the Regulator Problem and the stability of its solutions.

MATH 207B - Partial Differential Equations I

Syllabus for Math 207B

Textbook: Evans, Partial Differential Equations (Second Edition).

The outline specifies 24 standard 50 minute periods of lectures, leaving the additional class periods for examinations, reviews, and extra time for difficult topics.

Basic concepts (1 week).
Evans, Sections 1.1 - 1.4.
Definitions and terminology, types of partial differential equations and approaches to solving them.

Equations with explicit solutions (3 weeks).
Evans, Sections 2.1 - 2.4.
The Transport, Heat, Laplace and Wave Equations; initial value problems; nonhomogeneous equations; descriptions of solutions; fundamental solutions; Green's functions; mean value formulas; energy methods.

Nonlinear first order equations (3 weeks).
Evans, Sections 3.1 - 3.4.
Complete integrals; envelopes; the method of characteristics; Hamilton-Jacobi equations; conservation laws; weak solutions and uniqueness.

Techniques for solving important examples (2 weeks).
Evans, Sections 4.1 - 4.4, 4.6.
Separation of variables; similarity solutions; integral transforms; reductions to linear equations; power series.

MATH 207C - Partial Differential Equations II

Syllabus for Math 207C

Textbook: Evans, Partial Differential Equations (Second Edition).

The outline specifies 24 standard 50 minute periods of lectures, leaving the additional class periods for examinations, reviews, and extra time for difficult topics.

Asymptotic properties of solutions (1/2 week).
Evans, Section 4.5.
Singular perturbations; Laplace's method; examples from physics.

Sobolev spaces (2 1/2 weeks).
Evans, Sections 5.1 - 5.9.
Definitions and basic properties; approximation theorems; extensions and traces; Sobolev inequalities; the Compactness Theorem; formal applications.

Second order elliptic equations (2 1/2 weeks).
Evans, Sections 6.1 - 6.5.
Weak solutions; energy estimates; the Fredholm A1temative; regularity; maximum principles; eigenvalues and eigenfunctions.

Linear evolution equations (2 1/2 weeks).
Evans, Sections 7.1 - 7.4
Second order hyperbolic and parabolic equations; first order hyperbolic systems; existence and regularity theorems; maximum principles and propagation of disturbances; semigroup methods and their applications.