DEPARTMENT OF MATHEMATICS
SYLLABUS

Course # & Name: Mathematics 118A

Recommended Text(s) & Price: "Introduction to Partial Differential Equations, 1st Edition" by Walter Strauss. ($50.00)

Prepared by: Spitzer/Shkoller UPC Approval Date: March 2003

Lecture(s)	Sections	Comments/Topics
1	1.1-1.4 & 1.6	Introduction. Standard examples of PDEs. Derivation of transport, wave and diffusion equation from simple physical principles. First order equations: coordinate method and geometric method of characteristics. Second order equation. Initial and boundary conditions.
2	2.1-2.5	Wave and Diffusion equation on the whole real line The wave equation: Coordinate method and geometric method. Causality and energy. The Maximum Principle for the diffusion equation, Uniqueness and Stability of solutions. Derivation of the Solution of the diffusion equation.

		Comparison of wave and diffusion equation.
3	3.1-3.3	Reflections and Sources Diffusion on the half-line with Dirichlet and Neumann boundary conditions. Method of reflection. Method of reflection on a finite interval with outlook to chapter 4. Inhomogeneous diffusion equation on the whole real line.
4	4.1-4.2	Boundary Problems Wave and diffusion equation on a finite interval with Dirichlet boundary conditions. Wave and diffusion equation on a finite interval with Neumann and periodic boundary conditions. Sketch discussion on Robin boundary conditions.
5	5.1-5.4	Fourier Series Fourier-sine, Fourier-cosine and full Fourier series, complex and real version. Orthogonally and Completeness of Fourier series, convergence theorems.

Additional Notes:

Recommendation: Use matlab, mathematica or maple for demonstration in class early on, and frequently. In 118C (se chp 8), it should be required for students to adapt or write some simple codes.

DEPARTMENT OF MATHEMATICS
SYLLABUS

Course # & Name: Mathematics 118 B

Recommended Text(s) & Price: "Introduction to Partial Differential Equations, 1st Edition" by Walter Strauss. ($50.00)

Prepared by: Spitzer/Shkoller UPC Approval Date: March 2003

Lecture(s)	Sections	Comments/Topics
1	6.1-6.4	Second order Linear Differential equations in 2D and 3D. Harmonic Functions Laplace equation; examples, Maximum Principle, Uniqueness of solutions, and Symmetries. Extension to elliptic differential equations. Laplace equation on Rectangles and Cubes. Poisson's Formula, Mean Value Property, and Maximum Principle. Laplace equation on Circles, Wedges, and Annuli.
2	7.1-7.4	Green's Identities and Green's Functions Green's First Identity, Maximum Principle, Dirichlet's Principle. Green's Second Identity. Green's Functions in general.

		Green's Function for Half-Space and Sphere.
3	9.1-9.4	Diffusion and Wave Equation in unrestricted 2D and 3D. Energy and Causality. Kirchhoff's Formula in 3D, and the solution in 2D. Inhomogeneous wave equation in 3D. Diffusion equation in 2D and 3D.
4	10.1-10.3	Boundary Problems in 2D and 3D. Separation of Variables, revisited. Vibrations of a Drumhead, Bressel functions (see also 10.5) Sketch of 3D Wave Equation in a ball.
5	11.1 & 11.6	General Eigenvalue Problems: An Introduction Minimum Principle Asymptotics of Eigenvalue

Additional Notes:

Recommendation: use matlab, mathematica or maple for demonstration in class early on, and frequently.

DEPARTMENT OF MATHEMATICS
SYLLABUS

Course # & Name: Mathematics 118C

Recommended Text(s) & Price: "Introduction to Partial Differential Equations, 1st Edition" by Walter Strauss. ($50.00)

Prepared by: Spitzer/Shkoller UPC Approval Date: March 2003

Lecture(s)	Sections	Comments/Topics
1	11.1-11.4 & 11.6	General Eigenvalue Problems. Minimum Principle. Minimax and Maxmin Principle. Completeness of Eigenfunctions. Extension to Symmetric Differential Operators. Asymptotics of Eigenvalues, Neumann-Dirichlet bracketing
2	8.1-8.4 (8.5 optional)	Computation of Solutions Finite Difference Method. Diffusion Equation. Wave Equation. Laplace Equation. Finite Element Method (optional)
3	12.1-12.3 & 12.5 plus Asymptotics, Stationary Phase Method (not in the textbook)	Distributions and Fourier Transform Distributions.

		Green's functions, revisited. Fourier Transform, revisited. Laplace Transform Techniques Asymptotics, Stationary Phase Method (not in textbook)
4	14.1-14.3	Non-linear PDEs Burgers' equation, shock waves, RH formula, entropy condition. KdV equation, inverse scattering method, KP equation. Calculus of variations.

Additional Notes:

Recommendation: Use matlab, mathematica, or maple for demonstration in class early on, and frequently.

In 118C (see chp 8), it should be required for students to adapt or write some simple codes.