

Department of Mathematics - North Dakota State University  
MATH 785 Partial Differential Equations II - Spring 2008, 3 credits  
Instructor: Marian Bocea

## COURSE SCHEDULE

### **WEEK 1 (January 7-11, 2008)**

Introduction to the theory of distributions

### **WEEK 2 (January 14-18, 2008)**

Distributions (continued)

Review of Sobolev spaces

### **WEEK 3 (January 21-25, 2008)**

**No Class on Monday, January 21 - Holiday: Martin Luther King, Jr. Day**

Sobolev spaces (continued)

### **WEEK 4 (January 28-February 1, 2008)**

Second order elliptic equations: definitions and motivation

Lax-Milgram theorem and energy estimates

### **WEEK 5 (February 4-8, 2008)**

Existence of weak solutions

Regularity of weak solutions

### **WEEK 6 (February 11-15, 2008)**

Interior regularity

Regularity up to the boundary

### **WEEK 7 (February 18-22, 2008)**

**No Class on Monday, February 18 - Holiday: Presidents Day**

The weak maximum principle

Hopf's strong maximum principle

### **WEEK 8 (February 25-29, 2008)**

Harnack's inequality

Eigenvalues of symmetric elliptic operators

Variational characterization of the first eigenvalue (Rayleigh's formula)

### **WEEK 9 (March 3-7, 2008)**

**No Classes: SPRING BREAK**

**WEEK 10 (March 10-14, 2008)**

Connections with the Calculus of Variations

**WEEK 11 (March 17-21, 2008)**

Calculus of Variations (continued)

**No Class on Friday, March 21 - Holiday: Good Friday**

**WEEK 12 (March 24-28, 2008)**

**No Class on Monday, March 24 - Holiday: Easter Monday**

Critical Point Theory: Mountain Pass Theorem

Applications to semilinear elliptic PDEs

**WEEK 13 (March 31- April 4, 2008)**

Nonvariational techniques: Fixed point methods

The method of subsolutions and supersolutions

**WEEK 14 (April 7-11, 2008)**

Nonexistence results: Derrick-Pohozaev identity

Gradient flows: an introduction

**WEEK 15 (April 14-18, 2007)**

Viscosity solutions for Hamilton-Jacobi equations

Uniqueness of viscosity solutions

**WEEK 16 (April 21-25, 2008)**

The infinity Laplace equation: derivation and significance

Infinity harmonic maps

**WEEK 17 (April 28-May 2, 2008)**

The infinity Laplace equation and minimal Lipschitz extensions

**Last Day of Classes: Friday, May 2**