

Theory of Partial Differential Equations

Course literature

Robert C. McOwen, *Partial Differential Equations - Methods and Applications*, Prentice Hall.

Course web page: <http://www.math.uu.se/staff/pages/?uname=ostensson>

Here you can find information about the course, e.g. materials handed out in class.

Teaching

Teaching consists of 15 lectures. These lectures will mainly be devoted to the basic theory. You are strongly advised to solve additional problems on your own.

The course material is shown under the heading "Sections in book" in the lecture plan below. I will certainly not have time to cover everything in class, during which I can only hope to explain basic ideas and the most fundamental results. You are expected to study the rest on your own.

Preliminary lecture plan

Lecture	Contents	Sections in book
1	Quasilinear first order equations. The method of characteristics.	1.1
2	General nonlinear first order equations.	1.3
3	Higher order equations.	2.1–2.2
4	The wave equation.	3.1–3.2
5	More about the wave equation.	3.2–3.4
6	The Laplace, Poisson and heat equations.	4.1, 4.4, 5.1
7	Weak derivatives and Sobolev spaces.	2.3, 6.1
8	Theory of distributions.	2.3
9	More about the Laplace, Poisson and heat equations. Fundamental solutions and Green's functions.	4.2, 5.2–5.3
10	Applications of Functional Analysis to elliptic PDE. Poincaré's inequality. The Riesz representation theorem. The Lax-Milgram theorem. Existence of weak solutions.	6.2
11	Sobolev inequalities and imbedding theorems.	6.4–6.5
12	More about Sobolev inequalities and imbedding theorems.	6.4–6.5
13	Variational methods.	7.1–7.2
14	Project presentations.	
15	Project presentations.	

Examination

The course finishes on the 21st of October with a written exam. Maximum score: 40 points. A total score of 18 is needed for the grade 3, 25 for the grade 4, and 32 for the grade 5.

In addition to passing the exam the student is required to give a 30 minute project presentation. Project suggestions will be given in class.

Uppsala, 29th of August 2010.

Jörgen Östensson