



## DEPARTMENT OF MATHEMATICAL SCIENCES

### **MMG800 Partial Differential Equations, 7.5 higher education credits**

Partiella differentialekvationer, 7,5 högskolepoäng

*First Cycle*

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#### **Confirmation**

This course syllabus was confirmed by Department of Mathematical Sciences on 2017-06-22 to be valid from 2017-07-01, autumn semester of 2017.

*Field of education:* Science 100%

*Department:* Department of Mathematical Sciences

#### **Position in the educational system**

The course can be part of the following programme: 1) Bachelor's Programme in Mathematics (N1MAT)

*Main field of studies*

Mathematics

*Specialization*

G2F, First Cycle, has at least 60 credits in first-cycle course/s as entry requirements

#### **Entry requirements**

General entry requirements and the equivalent of 60 credits in mathematics and the course MMG710 Fourier Analysis.

#### **Learning outcomes**

On successful completion of the course the student will be able to:

- analyze existence, uniqueness, and stability of problems with initial or boundary conditions,
- construct and analyze finite element solutions with respect to stability and convergence,
- use polynomial interpolation and quadrature rules,
- use methods of variation (choice of analytic/approximate function spaces and bases),

- determine stiffness, mass, and convection matrices for FEM approximations in polygonal domains,
- make computer implementations of solution algorithms,
- compare analytical, approximate, and implemented solutions.

### **Course content**

Classification of basic differential equations in technology and physics. Variational methods. Existence and regularity of solutions of linear partial differential equations of elliptic, parabolic, and hyperbolic type by using the Riesz representation theorem and Lax-Milgram theory. Studies of dynamical systems. Introduction to interpolation, quadrature rules, and the finite element method. Convergence analysis: a priori and a posteriori error estimates and adaptive error control. Stability estimates. Application to problems in strength of materials, heat conduction, fluid mechanics, electromagnetism, acoustics, quantum mechanics, etc.

### **Form of teaching**

The course will be taught in English unless everyone involved speaks Swedish.

### **Assessment**

The examination consists of two obligatory assignments and a written examination.

If a student, who has failed the same examined component twice, wishes to change examiner before the next examination, a written application shall be sent to the department responsible for the course and shall be granted unless there are special reasons to the contrary (Chapter 6, Section 22 of Higher Education Ordinance).

### **Grades**

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).

### **Course evaluation**

The course is evaluated with an anonymous questionnaire and/or a discussion with the student representatives. The results of and possible changes to the course will be shared with students who participated in the evaluation and students who are starting the course.

### **Additional information**

For a list of course literature, see:

<https://www.chalmers.se/sv/institutioner/math/utbildning/grundutbildning-goteborgs-universitet/kurslitteratur/Sidor/Kurslitteratur-i-matematik.aspx>

The syllabus for MMG800 was originally established to take effect from 2007-07-01, when it replaced MAN660, and was revised 2010-07-01.