Study program : Mathematics

Type and level of studies: Master academic studies

Course unit: Numerical analysis 1

Teacher in charge : Marija Stanic

Language of instruction (*English or other foreign language*) English

ECTS: 10

Prerequisites: Numerical Mathematics

Semester*(Winter Semester or Summer Semester)* Winter

Course unit objective

Knowledge and understanding of the problems of the best approximation in a different normed spaces, the theory of orthogonal polynomials and methods for numerical integrationas well as of numerical methods of linear algebra.

Learning outcomes of Course unit

The student has acquired the necessary theoretical knowledge for understanding of problems relating to the theory of orthogonal polynomials, the problem of the best approximation, numerical integration and numerical methods of linear algebra. The student has gained the knowledge necessary for the programming of numerical methods.

Course unit contents

Theoretical classes

Orthogonal polynomials. Moment functional and orthogonality. General properties of orthogonal polynomials. Construction of orthogonal polynomials. Classical orthogonal polynomials and their properties. Discrete orthogonal polynomials.

Approximations of functions. Types of approximating functions. Criteria for approximation. The best approximations in different normed spaces.

Quadrature rules. Quadrature rules of interpolatory type. Gaussian type quadrature rules. Methods for error estimates in quadrature rules. Convergence of quadrature processes.

Numerical methods of linear algebra. Matrix computations. Direct and indirect methods for solving systems of linear equations and for the inversion of matrices. Error analysis and ill-conditioned systems. The eigenvaue problems.

Practical classes

Application of the acquired theoretical knowledge in solving problems. Programming numerical methods in Mathematica.

Literature

1. G. Mastroianni, **G.V. Milovanović:** *Interpolation Processes - Basic Theory and Applications*, Springer Monographs in Mathematics, Springer – Verlag, Berlin – Heidelberg, 2008

2. W. Gautschi, *Orthogonal Polynomials - Computation and Approximation*, Oxford University Press, 2004.
3. R. A. DeVore, G.G. Lorentz, *Constructive Approximation*, Springer, 1993.
4. L.N. Trefethen, D. Bau, III, *Numerical Linear Algebra*, Siam, 1997.

Number of active teaching hours				**Other classes**
Lectures:	Practice:	Other forms of classes: *mentoring system* 2	Independent work: 6	

Teaching methods

Examination methods (maximum 100 points)

Exam prerequisites	**No. of points:**	**Final exam**	**No. of points:**
Student's activity during lectures		oral examination	*50*
practical classes/tests	**30**	written examination	
Seminars/homework	**20**	.....	
Project			
Other			

Grading system		
Grade	**No. of points**	**Description**
10	**91-100**	Excellent
9	**81-90**	Exceptionally good
8	**71-80**	Very good
7	**61-70**	Good
6	**51-60**	Passing
5	**0-50**	Failing

(Table 5.2) Course unit description