Course: Numerical integration

Course instructors: Marija Stanić

Course type: elective

Credit points ECTS: 12

Prerequisites: -

Course objectives:
Thorough knowledge and understanding of quadrature and cubature processes. Enabling students to solve problems in this area with the use of scientific procedures and methods. Ability to follow modern achievements in the field of numerical integration and its application.

Learning outcomes:
The student has acquired the necessary theoretical knowledge for a systematic understanding of issues related to the theory of quadrature and cubature formulas, its application in other branches of mathematics, technology, and science. The student has mastered the skills and methods of research in this area.

Course description (outline):
Theoretical classes
Quadrature formulas of interpolation type. Methods for estimating the remainder. Romberg integration. Gaussian quadrature formulas. Modifications of Gaussian formulas. Radau and Lobatto type formulas. Cronrod's scheme. The existence of formulas. Gauss-Turán quadratures and generalizations. Convergence of quadrature processes. Quadrature formulas with quasi degree of accuracy. Quadrature formulas with maximal trigonometric degree of exactness. Numerical integration of fast oscillatory functions. Interpolation cubature formulas. Construction of formulas based on symmetry. An overview of cubature formulas for some special areas and certain weight functions. Optimal sets of quadrature formulas.

Practice classes
Implementation of the theoretically analysed methods.

References:

1. P.J. Davis, P. Rabinowitz, *Methods of Numerical Integration,* Academic Press, New York, San Francisco, 1975.
2. H. Engels, *Numerical Quadrature and Qubature*, Academic Press, London, 1980.
3. G. Mastroianni, G.V. Milovanovic, *Interpolation Processes – Basic Theory and Applications*, Springer-Verlag, 2008.
4. W. Gautschi, *Orthogonal Polynomials: Computation and Approximation*, Oxford University Press, Oxford, 2004
5. A. Ghizzetti, A. Ossicini, *Quadrature Formulae*, Akademie - Verlag, Berlin, 1970.

Active teaching hours: 5	Theoretical classes: 5	Practice classes:

Methods of teaching:
Theoretical lectures and independent work of students during practical hours.

Grading structure (100 points)
50 points on pre-exam and 50 points on oral exam