UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)			
Predmet:	Numerične metode		
Course title:	Numerical methods		
Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Interdisciplinarni univerzitetni študijski program Računalništvo in matematika	ni smeri	3	prvi
Interdisciplinary first cycle academic study programme Computer Science and Mathematics	none	3	first

Vrsta predmeta / Course type	obvezni / compulsory
Univerzitetna koda predmeta / University course code:	27215

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
45		**45**			**120**	**7**

Nosilec predmeta / Lecturer:	prof. dr. Marjeta Krajnc, prof. dr. Bor Plestenjak, prof. dr. Emil Žagar

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene
	Vaje / Tutorial:	slovenski / Slovene

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v letnik študija.	Enrolment in the programme.
Vsebina:	**Content (Syllabus outline):**

Uvod v numerično računanje. Izvori napak pri numeričnem računanju. Občutljivost problemov, konvergenca metod in stabilnost računskih procesov. Ocena za celotno napako. Reševanje nelinearnih enačb. Bisekcija. Splošna iteracija. Tangentna in sekantna metoda. Reševanje algebraičnih enačb. Reševanje sistemov nelinearnih enačb. Splošna iteracija. Newtonova metoda. Reševanje sistemov linearnih enačb. Vektorske in matrične norme. Občutljivost. Ocena za napako. Gaussova eliminacijska metoda. Pivotiranje. Posebni linearni sistemi. Linearni problem najmanjših kvadratov. Predoločeni sistemi. Normalni sistem. Ortogonalni razcep. Givensove rotacije in Householderjeve transformacije. Singularni razcep. Pseudoinverz. Uporaba singularnega razcepa. Regularizacija. Nelinearni problem najmanjših kvadratov. Iterativne metode za linearne sisteme. Jacobijeva, Gauss-Seidlova in SOR iteracija.	Introduction to numerical computations. Sources of errors in numerical computing. Stability of problems, convergence of methods and stability of computational processes. Error bounds. Solving of nonlinear systems. Bisection. Iteration. Tangent and secant method. Solving of algebraic equations. Solving systems of nonlinear equations. Iteration. Newton method. Solving of systems of linear equations. Vector and matrix norms. Stability. Error bounds. Gauss elimination. Pivoting. Special linear systems. Linear least squares problem. Predetermined systems. Normal equations. QR decomposition. Givens rotations and Householder reflections. Singular value decomposition. Pseudoinverse. SVD applications. Regularization. Nonlinear least square problem. Iterative methods for systems of linear equations. Jacobi, Gauss-Seidel, and SOR iteration.

Temeljni literatura in viri / Readings:

B. Plestenjak: Razširjen uvod v numerične metode, DMFA – založništvo, Ljubljana, 2015

M. T. Heath, Scientific Computing: An Introductory Survey, McGraw-Hill, Boston, 2002.

J. W. Demmel: Uporabna numerična linearna algebra, DMFA-založništvo, Ljubljana, 2000.

D. Kincaid, W. Cheney, Numerical Analysis, Brooks/Cole, Pacific Grove, 1996.

B. N. Datta: Numerical Linear Algebra and Applications, Brooks/Cole, Pacific Grove, 1995.

Cilji in kompetence:	**Objectives and competences:**

Študent spozna osnove numeričnega računanja in dopolni poznavanje analitičnih metod za reševanje nelinearnih enačb in sistemov linearnih enačb z nekaterimi najbolj znanimi numeričnimi metodami. Pri vajah in z domačimi nalogami se pridobljeno znanje praktično utrdi kot tudi spozna programsko opremo, namenjeno predvsem numeričnem računanju.	Student learns basic facts on numerical computation and analytical methods for solving nonlinear equations and systems of linear equations with some of well known numerical methods. In tutorial and homework the gained knowledge is increased and computer software, used by numerical computations, is applied.

Predvideni študijski rezultati:	**Intended learning outcomes:**
Znanje in razumevanje: Razumevanje računanja s plavajočo vejico in izvorov napak pri numeričnem računanju. Obvadanje osnovnih algoritmov za reševanje linearnih in nelinearnih sistemov. Znanje programiranja in uporabe Matlaba oz. drugih sorodnih orodij za reševanje tovrstnih problemov.	Knowledge and understanding: Understanding of computation in floating point arithmetics and causes of errors in numerical computations. Knowledge of basic algorithms for solving systems of linear equations and systems of nonlinear equations. Programming and use of Matlab and other similar tools for solving these kinds of problems.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, vaje, domače naloge, konzultacije.	Lectures, tutorial, homework, consultations.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, ustno izpraševanje, naloge, projekt) pisni in ustni izpit, 2 domači nalogi ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	 30 %/50 %/20 %	Type (examination, oral, coursework, project): written and oral exam, 2 homeworks grades: 1-5 (negative), 6-10 (positive) (by The statues of UL)

Reference nosilca / Lecturer's references:

Marjetka Krajnc:

KRAJNC, Marjetka. Interpolation scheme for planar cubic G [sup] 2 spline curves. Acta applicandae mathematicae, ISSN 0167-8019, 2011, vol. 113, no. 2, str. 129-143. [COBISS.SI-ID 16215385]

KRAJNC, Marjetka, VITRIH, Vito. Motion design with Euler-Rodrigues frames of quintic Pythagorean-hodograph curves. Mathematics and computers in simulation, ISSN 0378-4754. [Print ed.], 2012, vol. 82, iss. 9, str. 1696-1711. [COBISS.SI-ID 1024447572]

KOZAK, Jernej, KRAJNC, Marjetka. Geometric interpolation by planar cubic polynomial curves. Computer Aided Geometric Design, ISSN 0167-8396, 2007, vol. 24, no. 2, str. 67-78. [COBISS.SI-ID 14227545]

Bor Plestenjak:

MEERBERGEN, Karl, PLESTENJAK, Bor. An Sylvester-Arnoldi type method for the generalized eigenvalue problem with two-by-two operator determinants. Numerical linear algebra with applications, ISSN 1070-5325, 2015, vol. 22, iss. 6, str. 1131-1146. [COBISS.SI-ID 17494105]

PLESTENJAK, Bor, GHEORGHIU, C. I., HOCHSTENBACH, Michiel E. Spectral collocation for multiparameter eigenvalue problems arising from separable boundary value problems. Journal of computational physics, ISSN 0021-9991, 2015, vol. 298, str. 585-601. [COBISS.SI-ID 17347417]

MUHIČ, Andrej, PLESTENJAK, Bor. On the quadratic two-parameter eigenvalue problem and its linearization. Linear Algebra and its Applications, ISSN 0024-3795. [Print ed.], 2010, vol. 432, iss. 10, str. 2529-2542. [COBISS.SI-ID 15469913]

Emil Žagar:

KOVAČ, Boštjan, ŽAGAR, Emil. Some new G[sup]1 quartic parametric approximants of circular arcs. Applied mathematics and computation, ISSN 0096-3003. [Print ed.], 2014, vol. 239, str. 254-264. [COBISS.SI-ID 17031769]

JAKLIČ, Gašper, KOZAK, Jernej, KRAJNC, Marjetka, VITRIH, Vito, ŽAGAR, Emil. An approach to geometric interpolation by Pythagorean-hodograph curves. Advances in computational mathematics, ISSN 1019-7168, 2012, vol. 37, no. 1, str. 123-150. [COBISS.SI-ID 16051289]

JAKLIČ, Gašper, KOZAK, Jernej, KRAJNC, Marjetka, VITRIH, Vito, ŽAGAR, Emil. Hermite geometric interpolation by rational Bézier spatial curves. SIAM journal on numerical analysis, ISSN 0036-1429, 2012, vol. 50, no. 5, str. 2695-2715. [COBISS.SI-ID 16449369]