UČNI NAČRT PREDMETA / COURSE SYLLABUS			
Predmet:	Računalniško podprto (geometrijsko) oblikovanje		
Course title:	Computer aided (geometric) design		

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Magistrski študijski program Matematika	ni smeri	1 ali 2	prvi ali drugi
Master's study programme Mathematics	none	1 or 2	first or second

Vrsta predmeta / Course type	izbirni
Univerzitetna koda predmeta / University course code:	M2409

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
30	**15**	**30**			**105**	**6**

Nosilec predmeta / Lecturer:	doc. Jan Grošelj, prof. Emil Žagar, prof. Marjetka Knez	
Jeziki / Languages:	**Predavanja / Lectures:**	slovenski/Slovene, angleški/English
	Vaje / Tutorial:	slovenski/Slovene, angleški/English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vsebina:	**Content (Syllabus outline):**

Uvod: de Casteljauov algoritem, Bernsteinova oblika Bezierove krivulje, Bezierove krivulje (splošno), zlepki v Bezierovi obliki, racionalne Bezierove krivulje Geometrijska zveznost: geometrijska zveznost krivulj in ploskev, geometrijsko zvezni zlepki Bezierove ploskve: tenzorski produkti, trikotne krpe, racionalne Bezierove ploskve Stožnice: racionalne kvadratne Bezierove krivulje, eksaktna reprezentacija stožnic Krivulje B-zlepkov: lastnosti, algoritmi za delo z B-zlepki	Introduction: de Casteljau algorithm, Bernstein form of Bezier curve, Bezier curves (general), Bezier splines, rational Bezier curves Geometric continuity: geometric continuity of curves and surfaces, geometrically continuous splines Bezier surfaces: tensor products, triangular patches, rational Bezier surfaces Conics: rational quadratic Bezier curves, exact representation of conics B-spline curves: properties, algorithms for manipulating B-spline curves

Temeljni literatura in viri / Readings:

G. Farin: Curves and Surfaces for Computer Aided Geometric Design : A Practical Guide, 4th edition, Academic Press, San Diego, 1997.

C. de Boor: A Practical Guide to Splines, Springer, New York, 2001.

R. H. Bartels, J. C. Beatty, B. A. Barsky: An Introduction to Splines for Use in Computer Graphics and Geometric Modeling: Morgan Kaufmann, Palo Alto, 1996.

M.-J. Lai, L. L. Schumaker, Spline functions on triangulations, Cambridge University Press, 2007

Cilji in kompetence:	**Objectives and competences:**
Študent spozna osnove računalniškega oblikovanja. Uporaba Bezierovih krivulj in ploskev, racionalnih Bezierovih krivulj in geometrijsko zveznih zlepkov. V okviru seminarskih/projektnih aktivnosti študentje z individualnim delom in predstavitvijo ter delom v skupinah pridobijo izobraževalno komunikacijske in socialne kompetence za prenos znanj in za vodenje (strokovnega skupinskega dela).	An introduction to computer aided geometric design, use of Bezier curves and surfaces, rational Bezier curves and geometrically smooth splines. With individual presentations and team work interactions within seminar/project activities students acquire communication and social competences for successful team work and knowledge transfer.

Predvideni študijski rezultati:	**Intended learning outcomes:**

Znanje in razumevanje: Razumevanje osnovnih pojmov krivulj in ploskev. Osnovno znanje programiranja v Matlabu ali Mathematici. Sposobnost implementacije postopkov na računalniku. Uporaba: Uporaba postopkov interpolacije in aproksimacije s polinomi in zlepki pri računalniškem oblikovanju. Refleksija: Razumevanje teorije na podlagi uporabe. Prenosljive spretnosti – niso vezane le na en predmet: Spretnost uporabe teorije v praksi. Sposobnost povezovanja znanj iz numerične matematike, analize in računalništva. Kritično presojanje razlik med teorijo in prakso.	Knowledge and understanding: Knowledge of basic facts on curves and surfaces. Basic programming skill in Matlab or Mathematica. Skill to implement algorithms in programming language. Application: Application of interpolation and approximation with polynomials and splines in CAGD. Reflection: Understanding theory based on application. Transferable skills: Skill of using theory in practical use. Skill of interconnecting knowledge from numerical mathematics, analysis and computer science. Critical judgement of differences between theory and practical applications.

Metode poučevanja in učenja:	**Learning and teaching methods:**
predavanja, vaje, domače naloge, konzultacije	Lectures, exercises, homeworks, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Projekt Ustni izpit (ocene: 5 (negativno), 6-10 (pozitivno), ob upoštevanju Statuta UL)	50 50	Project Oral exam grading: 5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

Jan Grošelj:

– GROŠELJ, Jan. A normalized representation of super splines of arbitrary degree on Powell-Sabin triangulations. BIT Numerical Mathematics. Dec. 2016, vol. 56, iss. 4, str. 1257-1280 [COBISS.SI-ID 17901657]

– GROŠELJ, Jan, KNEZ, Marjetka. A B-spline basis for C1 quadratic splines on triangulations with a 10-split. Journal of Computational and Applied Mathematics. [Print ed.]. Dec. 2018, vol. 343, str. 413-427 [COBISS.SI-ID 18379609]

– GROŠELJ, Jan, SPELEERS, Hendrik. Three recipes for quasi-interpolation with cubic Powell-Sabin splines. Computer Aided Geometric Design. Dec. 2018, vol. 67, str. 47-70 [COBISS.SI-ID 18516313]

Marjetka Knez:

– KNEZ, Marjetka. Interpolation with spatial rational Pythagorean-hodograph curves of class 4. Computer Aided Geometric Design. Aug. 2017, vol. 56, str. 16-34 [COBISS.SI-ID 18144345]

– KNEZ, Marjetka. G1 motion interpolation using cubic PH biarcs with prescribed length. Computer Aided Geometric Design. Dec 2018, vol. 67, str. 21-33 [COBISS.SI-ID 18537561]

– GROŠELJ, Jan, KNEZ, Marjetka. Interpolation with C2 quartic macro-elements based on 10-splits. Journal of Computational and Applied Mathematics. [Print ed.]. Dec. 2019, vol. 362, str. 143-160 [COBISS.SI-ID 18846809]

Emil Žagar:

– ŽAGAR, Emil. Circular sector area preserving approximation of circular arcs by geometrically smooth parametric polynomials. Journal of Computational and Applied Mathematics. [Print ed.]. July 2018, vol. 336, str. 63-71 [COBISS.SI-ID 18218329]

– KNEZ, Marjetka, ŽAGAR, Emil. Interpolation of circular arcs by parametric polynomials of maximal geometric smoothness. Computer Aided Geometric Design. July 2018, vol. 63, str. 66-77 [COBISS.SI-ID 18372953]

– VAVPETIČ, Aleš, ŽAGAR, Emil. A general framework for the optimal approximation of circular arcs by parametric polynomial curves. Journal of Computational and Applied Mathematics. 2019, let. 345, str. 146-158. [COBISS.SI-ID 18388057] [COBISS.SI-ID 18388057]