Fakulteta za industrijski inženiring
Faculty of Industrial Engineering

UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	Programska oprema vozil
***Course title*:**	Vehicle software equipment

Študijski program ***Study programme and level***	**Študijska smer** ***Study field***	**Letnik** ***Academic year***	**Semester** ***Semester***
Inženiring in avtomobilska industrija Podiplomski (druga)	Program nima smeri	prvi	letni
Engineering and Automotive Industry Graduate – Master (second)	The program has no study fields	first	summer

Vrsta predmeta / *Course type* Izbirni | Optional

Univerzitetna koda predmeta / *University course code:* **MAG_21015**

Predavanja ***Lectures***	**Seminar** ***Seminar***	**Sem. vaje** ***Tutorial***	**Lab. vaje** ***Laboratory work***	**Teren. vaje** ***Field work***	**Samost. delo** ***Individ. work***	**ECTS**
45	-	45		-	150	8

Nosilec predmeta / *Lecturer:* **Prof. dr. Rudi Pušenjak**

Jeziki / *Languages:*

Predavanja / *Lectures*:	**Vaje / *Tutorial:***
Slovenski	Slovenski
Slovenian	Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti: ***Prerequisits:***

– vpis v prvi letnik študija	– enrolment in the first year of study

Vsebina: ***Content (Syllabus outline):***

– Procesi razvoja programske opreme.	– Software processes.
– Načrtovani in hitri razvoj programske opreme.	– Planned and agile software development.
– Načrtovanje zahtev.	– Requirements engineering.
– Vrste modeliranja sistemov.	– Kinds of system modeling.
– Zasnova arhitekture. Objektno-orientirano snovanje in implementiranje.	– Architectural design. Object-oriented design and implementation.
– Testiranje programske opreme.Dinamika razvoja programske opreme. Vzdrževanje programske opreme.	– Software testing. – Software evolution dynamics. Software maintenance.
– Zagotavljanje zanesljivosti in varnosti.	– Dependability and security assurance.
– Razvoj programske opreme vgrajenih sistemov z uporabo v realnem času.	– Software development of embedded systems in real-time applications.
– Upravljanje programske opreme.	– Software management.

Temeljni literatura in viri / *Readings:*

E-gradiva predmeta | E-Course material

- Pušenjak R. *Programska oprema vozil.* Učno gradivo magistrskega študija. Fakulteta za industrijski inženiring Novo mesto, 2019.

Priporočljiva literatura / *Recomended Textbooks*

- Sommerville, I. (2011). *Software Engineering*, 9th edition. Pearson Education, Inc.: Addison-Wesley. ISBN 0-13-703515-2.
- Arlow and, J., Neustadt, I. (2005). *UML$_2$ and the Unified Process: Practical Object-Oriented Analysis and Design* (2nd Edition). Addison-Wesley: Boston.
- I. Jacobson, M. Christerson, P. Jonsson and G. Overgaard, Object-Oriented Software, Wokingham.: Addison-Wesley, 1993.
- Burns, A., Wellings, A. (2009). *Real-Time systems and Programming Languages: Ada, Real-Time Java and C/Real-Time POSIX*. Addison-Wesley: Boston.
- Benra, J. T., Halang, W. A. (2009). *Software Entwicklung für Echtzeitsysteme*. Springer-Verlag Berlin: Heidelberg. ISBN 978-3-642-01595-3.
- Brinkschulte, U., Wörn, H. (2005). *Echtzeitsysteme*. Springer-Verlag Berlin: Heidelberg.
- Lee, I., Leung, J. Y-T., Son, S. H. (2008). *Handbook of Real-Time and Embedded Systems*. Chapman&Hall/CRC Taylor&Francis Group. ISBN 978-1-58488-678-5.

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

Cilji	***Objectives***
– Študent bo obvladal terminologijo in posamezne faze procesa razvoja programske opreme. – Seznanil se bo s teoretičnimi osnovami razvoja programske opreme, s poudarkom na programski opremi vozil. – Metodologija razvoja programske opreme bo pojasnjena na izbranih primerih, ki vključuje poznavanje objektno orientiranih programskih okolij (Java) in večparadigemskih programskih okolij (Matlab/Simulink, Mathematica). – Študent se bo razen s planiranjem programske opreme seznanil tudi z upravljanjem projektov razvoja programske opreme.	***Objectives*** – Student will master terminology and individual phases of the process of software development. – Student will be familiar with theoretical basis of the software development, where the emphasis will be focused on the automotive software. – Methodology of the software design will be clarified through selected examples, which includes knowledge of object oriented programming envinronment (Java) and multi-paradigm programming envinronment (Matlab/Simulink, Mathematica). – In addition to software planning, the student will be familiar with managing of software projects.
Kompetence – sposobnost izvesti analizo problema, – sposobnost izvedbe posameznih faz projekta razvoja programske opreme, – sposobnost planiranja in upravljanja projektov razvoja programske opreme – sposobnost načrtovanja programske opreme vgrajenih sistemov z delovanjem v realnem času v vozilih, – sposobnost uporabe pridobljenega teoretičnega znanja v praksi,	***Competences*** – ability to perform the analysis of the given problem, – ability to perform individual steps of the development of the software project, – ability of planning and managing software projects – ability of planning embedded software in real-time automotive applications – ability to apply the gained theoretical knowledge in practice,

– sposobnost uporabe sodobne informacijske in komunikacijske tehnologije na področju inženiringa in avtomobilske industrije.	– ability to apply advanced information and communication technologies in engineering and automotive industry.

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

Študent/študentka:	***Student:***
– obvlada proces razvoja programske opreme, – uporablja napredne metodologije razvoja programske opreme v posameznih fazah projekta, – obvlada metodologije razvoja programske opreme z uporabo objektno orientiranih programskih okolij (Java) in večparadigemskih programskih okolij (Matlab/Simulink, Mathematica), – obvlada metodologije razvoja programske opreme vgrajenih sistemov z delovanjem v realnem času.	– master the process of software development, – is able to apply the advanced methodology in induvidual steps of the software project, – master the methodology of software development by using the object-oriented programming envinronment (Java) as well as multi-paradigm programming envinronments (Matlab/Simulink, Mathematica). – master the methodology of development of the embedded software in real-time applications.

Metode poučevanja in učenja: ***Learning and teaching methods:***

– *predavanja* z aktivno udeležbo študentov, ki vsebujejo razprave, diskusije, odgovore na vprašanja in reševanje nalog ob pomoči sodobnih pedagoških pripomočkov, – *seminarske vaje*, ki so namenjene poglobitvi teoretičnih znanj, vključno z računalniškimi vajami, – individualne in/ali skupinske konzultacije. – računalniške vaje Predmet je oblikovan na kombinirani način študija, ki vključuje aktivnosti preko elektronskega (on-line) okolja: te aktivnosti so sestavljene iz samostojnih in skupinskih aktivnosti z uporabo učnega okolja Moodle in drugih elektronskih vsebin. Praviloma vključujejo diskusije v forumih, spletne strani, ogled posnetih predavanj in vaj, preverjanje znanja, odgovori na vprašanja, iskanje po spletu (bazah) itd.	– *lectures* with active attendance of students, which incorporate discussions, answers on the questions and solving of exercises with application of the contemporary pedagogical aids – *seminar work* , which serves to the deepening of the theoretical knowledge and includes lab work in computing, – individual and/or group consultations. The course is designed as blended learning that includes online activities: Online activities consist of independent and group activities using the LMS Moodle and other electronic or online content. Activities usually include discussions in forums, websites, viewing of recorded lectures and tutorials, assessments, answering questions, searching the web (databases), etc.

Načini ocenjevanja:	**Delež/Weight (%)**	**Assessment:**
Pogoj za opravljanje pisnega izpita so pozitivno ocenjene računalniške vaje.		The prerequisite for accession to the exam is positive grade of the lab work in computing.
– računalniške vaje – pisni izpit – ustni izpit	20% 50% 30%	– laboratory work in computing – written exam – oral exam

Ocenjevalna lestvica je skladna z ECTS in Pravilnikom o preverjanju in ocenjevanju znanja FINI NM.		Evaluation scale in accordance with ECTS and the Rules on the Evaluation and Assessment of Knowledge FINI NM.

Reference nosilca / *Lecturer's references:*

- PUŠENJAK, Rudi, OBLAK, Maks. Rešavanje Helmholtzove (talasne) jednačine metodom konačnih elemenata. Elektrotehnika (Beogr.), 1978, 27, št. 12, str. 1789-1795.
- PUŠENJAK, Rudi, OBLAK, Maks. Finite element method using continous elementswith constant geometries. V: ROBINSON, John (ur.). Quality assurance in FEMtechnology : [proceedings of the Fifth world congress sponsored by ISTEL England].Okehampton: Robinson and Associates, cop. 1987, str. 369-378.
- PUŠENJAK, Rudi, OBLAK, Maks. The use of continuous finite elements in electronoptics. V: TANAKA, Masataka (ur.), CRUSE, Thomas A. (ur.). Boundary elementmethods in applied mechanics : proceedings of the First Joint Japan/US Symposium onBoundary Element Methods, Tokyo, Japan, 3-6 October 1988. Oxford [etc.]: PergamonPress, 1988, str. 47-52.
- PUŠENJAK, Rudi, OBLAK, Maks. Design of axisymmetric electron optical systemswith use of continuous and fully discretized finite elements. V: FEMCAD-88 :proceedings of the Fourth SAS-World Conference, Paris, 17-19 October 1988,(Technology transfer series). Gournay-sur- Marne: IITT-International, 1988, str. 256-263.
- PUŠENJAK, Rudi, OBLAK, Maks. Continuous finite element model for solution ofparaxial ray equation in electron optics. V: Proceedings. [S.l.]: American Academy ofMechanics, 1989, str. 316-319.
- PUŠENJAK, Rudi, OBLAK, Maks. Numerische Lösung einiger Torsionsprobleme unterAnwendung von kontinuierlichen Elementen. Z. angew. Math. Mech., 72 (1992), 6 ; str.T 489-493. JCR IF (1994): 0.17, SE (54/61), mechanics, x: 0.83, SE (71/85),mathematics, applied, x: 0.484
- PUŠENJAK, Rudi. Nonlinear almost periodic analysis of FET amplifiers by incrementalharmonic balance and multiple time scales. V: BARTOLIĆ, Juraj (ur.). ICECOM '99 :proceedings. Zagreb: KoREMA, 1999, str. 130-134.
- PUŠENJAK, Rudi. Computation of electromagnetic waveguide transverse resonances byusing continuous finite elements. V: BONEFAČIĆ, Davor (ur.). 16th InternationalConference on Applied Electromagnetics and Communications, 1-3 October 2001,Dubrovnik, Croatia. ICECOM 2001 : conference proceedings. Zagreb: KoREMA,2001, str. 257-264
- PUŠENJAK, Rudi. Razvejitve pri Van der Pol-Duffingovem nihalu = Bifurcations of theVan der Pol-Duffing oscillator. Stroj. vestn., 2003, letn. 49, št. 7/8, str. 370-384.JCR IF: 0.048, SE (99/106), engineering, mechanical, x: 0.61
- PUŠENJAK, Rudi, OBLAK, Maks. Incremental harmonic balance method withmultiple time variables for dynamical systems with cubic non-linearities. Int. j. numer.methods eng., Jan. 2004, vol. 59, iss. 2, str. 255-292 JCR IF: 1.501, SE (3/61),engineering, multidisciplinary, x: 0.57, SE (7/162), mathematics, applied, x: 0.698
- KASTREVC, Mitja, PUŠENJAK, Rudi. Fuzzy pressure control of hydraulic systemwith gear pump driven by variable speed induction electro-motor. Exp. tech. (WestportConn.), May/June 2005, vol. 29, no. 3, str. 57-62.JCR IF: 0.363, SE (64/104), engineering, mechanical, x: 0.644, SE (92/110), mechanics,x: 0.96, SE (19/25), materials science, characterization & testing, x: 0.575
- PUŠENJAK, Rudi. Extended Lindstedt-Poincare method for non-stationary resonancesof dynamical systems with cubic nonlinearit. J. Sound Vib., July 2008, vol. 314, iss. 1/2,str. 194-216.JCR IF (2007): 1.024, SE (11/28), acoustics, x: 1.012, SE (23/107), engineering,mechanical, x: 0.706, SE (39/112), mechanics, x: 1.049
- PUŠENJAK, Rudi, OBLAK, Maks. Discussion on: "Analysis of control relevant coupled nonlinear oscillatory systems". *Eur. j. control*, 2008, vol. 14, 4, str. 283-285. http://dx.doi.org/10.3166/ejc.14.283-285. [COBISS.SI-ID 12640790] JCR IF (2007): 1.153, SE (20/52), automation & control systems, x: 0.927
- PUŠENJAK, Rudi, OBLAK, Maks, TIČAR, Igor. Nonstationary Vibration andTransition through Fundamental Resonance of Electromechanical Systems Forced by aNonideal Energy Source. Int. J. of Nonl. Sci. Num. Sim., May 2009, vol. 10, iss. 5, str.635-657.JCR IF (2007): 5.099, SE(1/67), engineering, multidisciplinary,SE(1/165),mathematics,applied, SE(2/112) mechanics, (1/43), physics, mathematical.
- PUŠENJAK, Rudi, OBLAK, Maks, TIČAR, Igor. Modified Lindstedt-Poincare method with multiple time scales for combination resonance of damped dynamical systems with strong linearities. *Int. J. of Nonl. Sci. Num. Sim.*, May 2010, vol. 11, no. 3, str. 173-201. [COBISS.SI-ID 13917718], [JCR, SNIP, WoS].
- PUŠENJAK, Rudi, TIČAR, Igor, OBLAK, Maks.Self-excited oscillations and Fuel Control of a Combustion

Process in a Rijke Tube. *International Journal for Nonlinear Sciences and Numerical Simulation*, 2014, vol. 15(2), str. 87-106. [COBISS.SI-ID 17621526], [JCR, SNIP, WoS].

- PUŠENJAK, Rudi, TIČAR, Igor. Combustion processes with external harmonic excitation using extended Lindstedt-Poincare method with multiple time scales. V: G. KYPRIANIDIS, Konstantinos (ur.), SKVARIL, Jan (ur.). *Developments in combustion technology*. Rijeka: InTech. 2016, str. 372-396. [COBISS.SI-ID 19938838]