

INTERDISCIPLINARNI PROJEKT - RRP

UČNI NAČRT PREDMETA/COURSE SYLLABUS

Predmet:	Interdisciplinarni projekt - RRP
Course title:	Interdisciplinary Project - RRP
Članica nosilka/UL Member:	UL FS

Študijski programi in stopnja	Študijska smer	Letnik	Semestri	Izbirnost
Strojništvo - razvojno raziskovalni program, prva stopnja, univerzitetni	Ni členitve (študijski program)	3. letnik	2. semester	izbirni

Univerzitetna koda predmeta/University course code:	0545370
Koda učne enote na članici/UL Member course code:	2040-U

Predavanja /Lectures	Seminar /Seminar	Vaje /Tutorials	Klinične vaje /Clinical tutorials	Druge oblike študija /Other forms of study	Samostojno delo /Individual student work	ECTS
15		15			45	3

Nosilec predmeta/Lecturer:	Andrej Kitanovski, Božidar Šarler, Edvard Govekar, Franci Pušavec, Iztok Golobič, Janko Slavič, Lidija Slemenik Perše, Marko Nagode, Mihael Sekavčnik, Mitjan Kalin, Niko Herakovič, Nikola Vukašinović, Primož Podržaj, Robert Kunc, Rok Petkovšek, Roman Šturm
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Izvajalci:	Aljoša Peperko, Andraž Kravos, Andrej Kitanovski, Boris Jerman, Boštjan Mavrič, Božidar Šarler, Ciril Arkar, Damjan Klobčar, Darja Rupnik Poklukar, Davorin Kramar, Domen Šeruga, Dominik Kozjek, Drago Bračun, Edvard Govekar, Franc Majdič, Franci Pušavec, Gregor Čepon, Igor Petrovič, Iztok Golobič, Jaka Tušek, Janez Žerovnik, Janko Slavič, Jernej Klemenc, Joško Valentinčič, Jovan Trajkovski, Jože Kutin, Jurij Prezelj, Katja Klinar, Lidija Slemenik Perše, Marko Hočever, Marko Nagode, Marko Polajnar, Marko Šimic, Martin Česnik, Matevž Dular, Matevž Zupančič, Matija Jezeršek, Miha Brojan, Mihael Sekavčnik, Miroslav Halilović, Mitja Mori, Mitjan Kalin, Niko Herakovič, Nikola Vukašinović, Nikolaj Mole, Peter Gregorčič, Primož Podržaj, Primož Potočnik, Robert Kunc, Rok Petkovšek, Rok Vrabič, Roman Šturm, Sašo Medved, Simon Oman, Tomaž Berlec, Tomaž Katrašnik, Tomaž Kek, Tomaž Pepelnjak, Uroš Stritih, Vid Agrež
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Vrsta predmeta/Course type:	Splošni izbirni predmet /Elective general course
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Jeziki/Languages:	Predavanja/Lectures:	Slovenščina
	Vaje/Tutorial:	Slovenščina

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
V sklopu predmeta se student po poveže v interdisciplinarne skupine in spozna s širšim	In the scope of this course a student participates in inter-disciplinary teams and acquires knowledge from

področjem določenega dela strokovne tematike. Zato so pogoj za vključitev v delo opravljene študijske obveznosti prvih štirih semestrov študijskega programa RRP.	a wider field of a specified professional area. The necessary condition is finished study obligations from the first four semesters of the RRP programme.
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Vsebina: Študentje bodo v manjših interdisciplinarnih skupinah, ali posamično, reševali ter analizirali aplikativne inženirske probleme v obliki projektno-seminarskega dela. Projekti se bodo nanašali na dele ali celotne sklope znanj iz posamičnih ali več področij predhodnih semestrov. Projekti bodo zahtevali integracijsko znanje in inženirske pristope, ob upoštevanju širših teoretičnih in praktičnih vidikov, tudi inter- in intra-disciplinarnih. Izzivi bodo vključevali aktualne tematike iz industrije, širše družbe, mednarodnih ali domačih študentskih tekmovanj in drugih akademskih izzivov. Pri tem bo uporabljen tematsko-problemski pristop, kjer se bo združevalo znanja z različnih področij. Zato bodo študenti spodbujeni, da se povezujejo tudi s kolegi drugih fakultet in/ali industrije in družbe, in na ta način razširijo praktične izkušnje reševanja interdisciplinarnih nalog. Vsebinsko bodo aktivnosti razdeljene v sledeče časovno sosledne vsebine: 1. Kreacija skupin in oblikovanje ustrezne projektne ideje. Formalizacija projektnih ciljev. 2. Teoretične podlage ter iskanje optimalnih rešitev skozi analizo obstoječega stanja in pristopom inoviranja. 3. Razčlenitev projektne ideje v obvladljive podsklope in iskanje morebitnih kritičnih točk. 4. Razdelitev nalog in določitev časovnice. Spremljanje napredka preko predstavitve vmesnih rezultatov in praktičnega dela. 5. Predstavitev in razširjanje rezultatov.	Content (Syllabus outline): The students individually or as a member of a small team analyse and solve applied engineering problems in the form of project-seminar work. The projects are related to partial or comprehensive knowledge areas from the former study semesters. Integrated knowledge and engineering approaches are inherently linked to these projects as well as application of wider theoretical and practical inter- and intra-disciplinary aspects. The content consists of concurrent industrial problems, social issues, domestic and international student's competitions and academic challenges. A contextual hand-on approach is followed when using knowledge integration from different areas of expertise. The students are encouraged to link themselves with the colleagues from the other faculties and/or industry or wider society in order to widen their professional horizon and practical experience by solving inter-disciplinary tasks. The course content consists of the following: 1. Team building and formation of a suitable project idea. Formalisation of project objectives. 2. Theoretical content for finding optimal solutions through the state-of-the-art analysis and innovation approach. 3. Segmentation of the project idea into manageable sub-tasks in identification of risks. 4. Task allocation and definition of time-sheet. Progress control through intermediate-results presentation and practical work. 5. Presentation and dissemination of results.
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Temeljna literatura in viri/Readings:

Določena je smiselno v dogovoru z izbranim nosilcem (mentorjem) predmeta za vsakega študenta posebej glede na izbrano problematiko. Literatura je dosegljiva v knjižnici laboratorija, fakultetni knjižnici ali širše. Praviloma študent študira iz člankov, ki so obravnavali podoben primer, kakor ga ima sam definirane. It is determined appropriately in agreement with the selected lecturer (mentor) for each student according to the chosen topic. Literature is available at the lab library, faculty library or beyond. As a rule, a student studies from articles dealing with a similar case as he or she has defined.

Cilji in kompetence: Cilji: 1. Omogočiti študentu seznanitev s temeljno in predmetno specifično literaturo na delu tematike, ki bo obravnavana v zaključni nalogi. 2. Seznanitev z namensko opremo na področju eksperimentiranja in uporabe računalniških orodij. Študent tako spozna	Objectives and competences: Objectives: 1. To enable the student to get acquainted with the basic and specific literature on the topic that will be discussed in the Bachelor's degree thesis. 2. To familiarize with the specific equipment in the field of experimentation and use of computer tools. Thus the student learns about the basic functionality of the equipment he can use.
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osnovno funkcionalnost opreme, ki jo lahko uporabi. 3. Predmet se izvaja v laboratoriju (enem ali več) odvisno od dogovora z mentorjem in nosilci predmeta. Kompetence: S1-RRP: Sposobnost za opredelitev, razumevanje in ustvarjalno reševanje strokovnih izzivov. S2-RRP: Razvijanje sposobnosti kritičnega, analitičnega in sintetičnega mišljenja ter učenje z evalvacijo in refleksijo lastnega dela (izkustveno učenje, supervizija). S4-RRP: Sposobnost strokovnega sporazumevanja in pisnega izražanja, vključno z uporabo tujega strokovnega jezika. S6-RRP: Usposobljenost za uporabo pridobljenih znanj pri samostojnem reševanju tehničnih problemov v strojništvu. S7-RRP: Sposobnost iskanja virov, kritične presoje informacij, samostojnega nadgrajevanja pridobljenih znanj in poglobljanja znanja na posameznih specializiranih področjih strojništva. S8-RRP: Usposobljenost za delo v skupini in interdisciplinarno povezovanje. P1-RRP: Obvladovanje temeljnih teoretičnih znanj, ki so bistvena za obvladovanje tehničnega področja strojništva. P4-RRP: Sposobnost osnovnega fizikalnega, matematičnega in numeričnega modeliranja problemov z razvito sposobnostjo kritične analize rezultatov. P6-RRP: Sposobnost samostojnega izvajanja manj zahtevnih razvojnih, inženirskih in strokovno organizacijskih del ter sposobnost kreativnega reševanja posameznih dobro definiranih nalog na področju strojništva.	3. The course is carried out in the laboratory (one or more), depending on the agreement with the mentor and course lecturers. Competencies: S1-RRP: The ability to define, understand and creatively solve professional challenges. S2-RRP: Development of creative, analytical and synthetic thinking. S4-RRP: Professional communication and writing communication skills, including the use of foreign technical language. S6-RRP: The ability to use the acquired knowledge to solve professional engineering problems independently. S7-RRP: The ability to find sources, make critical judgement of information, upgrade the acquired skills independently and further develop the knowledge on various specific areas of engineering. S8-RRP: Following safety, functional, economic and environmental principles at their work. P1-RRP: Mastery of basic theoretic skills, fundamental to the technical aspect of mechanical engineering. P4-RRP: The ability of basic physical, mathematical and numerical modelling of problems with the ability of critically analysing the results. P6-RRP: A Level 1 graduate is able to perform easier development, engineering and professional organisational tasks as well as to solve individual well-defined engineering tasks.
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Predvideni študijski rezultati:	Intended learning outcomes:
Znanja: Z1: Poglobljeno strokovno teoretično in praktično znanje na določenem področju, podprto s širšo teoretično in metodološko osnovo. Spretnosti: S1.1 Izvajanje kompleksnih operativno-strokovnih opravil, ki vključujejo tudi uporabo metodoloških orodij. S1.2 Obvladovanje zahtevnih, kompleksnih delovnih procesov ob samostojni uporabi znanja v novih delovnih situacijah. S1.3 Diagnosticiranje in reševanje problemov v različnih specifičnih delovnih okoljih, povezanih s področjem izobraževanja in usposabljanja. S1.4 Osnova za izvirna dognanja/ stvaritve in kritično refleksijo.	Knowledge: Z1: Thorough professional theoretical and practical knowledge in a selected field of expertise that is supported with a broad theoretical and methodological basis. Skills: S1.1 Executing complex operational-professional tasks that incorporate usage of methodological tools. S1.2 Mastering demanding and complex work processes by independent usage of knowledge in new working situations. S1.3 Problem diagnostics and solving in different and specific working environments that are linked to the teaching and training content. S1.4 Basis for unique innovations and critical reflections.

Metode poučevanja in učenja:	Learning and teaching methods:
Klasične oblike poučevanja: P1 Avditorna predavanja z reševanjem izbranih - za področje značilnih - teoretičnih in praktično uporabnih primerov. P2 Obravnava snovi po urejeni in vnaprej razloženi sistematiki. P5 Uporaba študijskega gradiva v obliki (knjiga, skripta, e-knjiga, tiskana verzija predstavitve predavanj). Moderne in prožne oblike poučevanja: P6 Interaktivna predavanja. P7 Študij literature in razprava (timsko delo, viharjenje možgan, organizacija in/ali udeležba tekmovanj, organizacija in/ali udeležba delavnic). P8 Izdelava in predstavitev aplikativnih seminarских nalog P14 Virtualni eksperimenti	Conventional teaching methods: P1 Auditorial lectures with solving selected field-specific theoretical and applied use cases. P2 Presenting the content according to the explained system. P5 Application of study material (textbook, e-book, printed lecture presentations, etc.). Contemporary and flexible teaching methods: P6 Interactive lectures. P7 Literature study and discussion (teamwork, brainstorming, organisation- and/or participation at student's competitions or workshops). P8 Making and presenting applied seminar exercises. P14 Virtual experiments.

Načini ocenjevanja:	Delež/Weight	Assessment:
Ocena končnega poročila.	50,00 %	Final report.
Ocena končnih predstavitev rezultatov.	50,00 %	Presentation of final results.

Ocenjevalna lestvica:	Grading system:
5 - 10, pri čemer velja, da je pozitivna ocena od 6 - 10	5 - 10, a student passes the exam if he is graded from 6 to 10

Reference nosilca/Lecturer's references:
Iztok Golobič: 1. GREGORČIČ, Peter, ZUPANČIČ, Matevž, GOLOBIČ, Iztok . Scalable surface microstructuring by a fiber laser for controlled nucleate boiling performance of high- and low-surface-tension fluids. <i>Scientific reports</i> . May 2018, vol. 8, f. 1-8, ilustr. ISSN 2045-2322. https://www.nature.com/articles/s41598-018-25843-5.pdf , DOI: 10.1038/s41598-018-25843-5 . [COBISS.SI-ID 16034331] 2. RAVNIK, Jure, GOLOBIČ, Iztok , SITAR, Anže, AVANZO, M., IRMAN, Špela, KOČEVAR, K., CEGNAR, Mateja, ZADRAVEC, Matej, RAMŠAK, Matjaž, HRIBERŠEK, Matjaž. Lyophilization model of mannitol water solution in a laboratory scale lyophilizer. <i>Journal of drug delivery science and technology</i> . [Print ed.]. June 2018, vol. 45, str. 28-38, ilustr. ISSN 1773-2247. DOI: 10.1016/j.jddst.2018.02.015 . [COBISS.SI-ID 21209622] 3. ZUPANČIČ, Matevž, NOVAK, Dušan, DIACI, Janez, GOLOBIČ, Iztok . An evaluation of industrial ultrafiltration systems for surface water using fouling indices as a performance indicator. <i>Desalination</i> . [Print ed.]. Jul. 2014, vol. 344, str. 321-328, ilustr. ISSN 0011-9164. DOI: 10.1016/j.desal.2014.04.002 . [COBISS.SI-ID 13420827] Edvard Govekar: 1. GOVEKAR, Edvard , JEROMEN, Andrej, KUZNETSOV, Alexander, LEVY, Gideon N., FUJISHIMA, Makoto. Study of an annular laser beam based axially-fed powder cladding process. <i>CIRP annals</i> . 2018, vol. 67, iss. 1, str. 241-244, ilustr. ISSN 0007-8506. https://www.sciencedirect.com/science/article/pii/S0007850618301069 , DOI: 10.1016/j.cirp.2018.04.082 . [COBISS.SI-ID 16026395] 2. POTOČNIK, Primož, GOVEKAR, Edvard . Semi-supervised vibration-based classification and condition monitoring of compressors. <i>Mechanical systems and signal processing</i> . Sep. 2017, vol. 93, str. 51-65, ilustr. ISSN 0888-3270. http://www.sciencedirect.com/science/article/pii/S088832701730047X , DOI: 10.1016/j.ymssp.2017.01.048 . [COBISS.SI-ID 15296539] 3. KUZNETSOV, Alexander, JEROMEN, Andrej, GOVEKAR, Edvard . Droplet detachment regimes in annular laser beam droplet generation from a metal wire. <i>CIRP annals</i> . 2014, vol. 63, iss. 1, str. 225-228, ilustr. ISSN 0007-8506. DOI: 10.1016/j.cirp.2014.03.051 . [COBISS.SI-ID 13402651]

Niko Herakovič:

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Mitjan Kalin:

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3. **KALIN, Mitjan**, OBLAK, Eva, AKBARI, Somayeh. Evolution of the nano-scale mechanical properties of tribofilms formed from low- and high-SAPS oils and ZDDP on DLC coatings and steel. *Tribology international*, ISSN 0301-679X, Apr. 2016, vol. 96, str. 43-56, ilustr., doi: [10.1016/j.triboint.2015.12.013](https://doi.org/10.1016/j.triboint.2015.12.013). [COBISS.SI-ID [14398491](#)]

Andrej Kitnovski:

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Robert Kunc:

1. BASAN, Robert, FRANULOVIC, Marina, PREBIL, Ivan, **KUNC, Robert**. Study on Ramberg-Osgood and Chaboche models for 42CrMo4 steel and some approximations. *Journal of constructional steel research*. [Print ed.]. sep. 2017, vol. 136, str. 65-74, ilustr. ISSN 0143-974X. <http://www.sciencedirect.com/science/article/pii/S0143974X17302341>, DOI: [10.1016/j.jcsr.2017.05.010](https://doi.org/10.1016/j.jcsr.2017.05.010). [COBISS.SI-ID [15531035](#)]
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on-in-wheel-motor-and-a-poss-performance-div/A4D5DB17B7102D3897C02AAAC07A32A7, DOI: 10.1017/jmech.2016.95. [COBISS.SI-ID 15295259]

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Marko Nagode:

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2. ŠERUGA, Domen, **NAGODE, Marko**. A new approach to finite element modelling of cyclic thermomechanical stress-strain responses. *International journal of mechanical sciences*. Dec. 2019, vol. 164, str. 1-14, ilustr. ISSN 0020-7403. <https://www.sciencedirect.com/science/article/pii/S0020740319306964?via%3Dihub>, DOI: 10.1016/j.ijmecsci.2019.105139. [COBISS.SI-ID 16795675]
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Rok Petkovšek:

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Primož Podržaj:

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