

## UČNI NAČRT PREDMETA/COURSE SYLLABUS

<b>Predmet:</b>	MEHANIZMI
<b>Course title:</b>	MECHANISMS

<b>Študijski programi in stopnja</b>	<b>Študijska smer</b>	<b>Letnik</b>	<b>Semestri</b>
Strojništvo, tretja stopnja, doktorski	Konstruktivsko mehanske inženirske znanosti (smer)		Celoletni

**Univerzitetna koda predmeta/University course code:** 7109

Predavanja	Seminar	Vaje	Klinične vaje	Druge oblike študija	Samostojno delo	ECTS
90					160	10

**Nosilec predmeta/Lecturer:** Robert Kunc

<b>Izvajalci predavanj:</b>	Robert Kunc
<b>Izvajalci seminarjev:</b>	
<b>Izvajalci vaj:</b>	
<b>Izvajalci kliničnih vaj:</b>	
<b>Izvajalci drugih oblik:</b>	
<b>Izvajalci praktičnega usposabljanja:</b>	

**Vrsta predmeta/Course type:** Izbirni predmet /Elective course

<b>Jeziki/Languages:</b>	<b>Predavanja/Lectures:</b>	Slovenščina, Angleščina
	<b>Vaje/Tutorial:</b>	Slovenščina, Angleščina

<b>Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:</b>	<b>Prerequisites:</b>
Veljajo splošni pogoji za doktorski študij.	General prerequisites for the third level studies.

<b>Vsebina:</b>	<b>Content (Syllabus outline):</b>
Modeliranje dinamike sistemov togih in/ali elastičnih teles. Snovanje in oblikovanje mehanizmov. Karakteristike mehanizmov. Kinematična in dinamična analiza mehanizmov v širši uporabi. Optimiranje geometrijskih parametrov in modifikacija mehanizmov. Vpliv elastičnosti delov in zračnosti v kinematičnih parih mehanizma na obremenitev in gibanje. Oblikovanje in dinamika pri višjih kinematičnih parih. Računalniško podprta sinteza in analiza mehanizmov pri razvoju strojev in naprav.	Modeling of rigid and/or flexible multibody systems. Methods of mechanism design. Mechanism characteristics. Analysis of kinematics and dynamics of broadly used types of mechanisms. Mechanism modification and optimization. Role of elasticity and clearance in mechanism joints. Role of cam design. Computer-aided synthesis and analysis of mechanism in development process.

<b>Temeljna literatura in viri/Readings:</b>
[1] Uicker, J. J., Pennock, R. R., Shigley, E. J.: Theory of Machines and Mechanisms; Third Edition; Oxford University Press, 2003: ISBN 0-19-515598-X
[2] Norton, L. R.: Design of Machinery (Synthesis and Analysis of Mechanisms and Machines), Second Edition; McGraw-Hill: ISBN 0-07-237960-X
[3] Chironis, P. N.: Mechanisms and Mechanical Devices Sourcebook, Fourth Edition McGraw-Hill, 2006: ISBN-

13 978-0071467612

[4] Howel, L. L.: Compliant Mechanisms; Wiley-Interscience, 2001: ISBN-13 978-0471384786

[5] Mabie, H. H., Reinholtz, C. F.: Mechanisms and Dynamics of Machinery, Fourth Edition; Wiley, 1987: ISBN-13 978-0471802372

[6] Tsai, L.-W.: Mechanism Design: Enumeration of kinematic Structures According to Function (Advanced Topics in Mechanical Engineering Series), First Edition; CRC, 2000: ISBN-13 978-0849309014

[7] Hahn, H.: Rigid Body Dynamics of Mechanisms, 1 Theoretical Basis; Springer, 2002: ISBN 978-3-540-42373-7

[8] Hahn, H.: Rigid Body Dynamics of Mechanisms, 2 Applications; Springer, 2003: ISBN 978-3-540-02237-4

[9] Mechanism and Machine Theory; Elsevier, ISSN 0094-114X

#### Cilji in kompetence:

##### Cilji:

Študente naučiti naprednih postopkov pri snovanju, oblikovanju in analizi mehanizmov, seznaniti s primeri uporabe mehanizmov v praksi, razviti sposobnost kritične ocene z vidika funkcionalnosti, modeliranja ter izdelave mehanizmov. Obvladovanje temeljnega in poglobljenega znanja, povezovanje znanja z različnih področij in aplikacije znanja na določenem področju.

##### Kompetence:

Študent spozna:

- principe delovanja mehanizmov in namen njihove uporabe, pomen in vlogo mehanizmov v strojih in napravah ter sodobnem proizvodnem procesu,
- pomen definicije mehanskega modela in pristope k formuliranju matematičnega modela mehanizma,
- gradnike mehanizmov in načine povezovanja v funkcionalni sklop,
- prednosti in posebnosti uporabe računalniške podpore pri razvoju in analizi mehanizmov.

#### Objectives and competences:

##### Goals:

The principal goal is to teach the student advanced methods of mechanism design and development, to introduce diverse mechanism applications, to evolve the student's ability of critical judgment of the mechanism from functionality, modeling and production point of view. Further goals are, to give basic and in-depth information about the mechanism science and related engineering fields, and to evolve the application of the knowledge in practice.

##### Competences:

The student acquires the knowledge of:

- principles of mechanism operation and application, and their role in manufacturing processes,
- the meaning of mechanical model definition and approaches to mechanism mathematical model formulation,
- mechanism members and joints, assembly requirements,
- advantages and specialties of computer support in mechanism development and analysis.

#### Predvideni študijski rezultati:

Študent spozna:

- principe delovanja mehanizmov in namen njihove uporabe, pomen in vlogo mehanizmov v strojih in napravah ter sodobnem proizvodnem procesu,
- pomen definicije mehanskega modela in pristope k formuliranju matematičnega modela mehanizma,
- gradnike mehanizmov in načine povezovanja v funkcionalni sklop,
- prednosti in posebnosti uporabe računalniške podpore pri razvoju in analizi mehanizmov.

#### Intended learning outcomes:

The student acquires the knowledge of:

- principles of mechanism operation and application, and their role in manufacturing processes,
- the meaning of mechanical model definition and approaches to mechanism mathematical model formulation,
- mechanism members and joints, assembly requirements,
- advantages and specialties of computer support in mechanism development and analysis.

#### Metode poučevanja in učenja:

Predavanja, laboratorijske vaje, seminarsko delo, e-izobraževanje, konzultacije. Seminarsko delo v čim večji meri navezuje se na področje doktorskega raziskovanja. Študij z uporabo priporočene literature.

#### Learning and teaching methods:

Lectures, laboratory practice & seminar work, e-education, consulting. The seminar work is related, as much as possible, to the student's doctoral research field. Study on a recommended literature basis.

#### Načini ocenjevanja:

Ustni izpit, poročilo o seminarskem delu. Pogoj za opravljanje ustnega izpita je uspešno izdelano in pozitivno ocenjeno seminarsko delo. Način (ustno izpraševanje, naloge, projektni seminar) •

#### Delež/Weight

#### Assessment:

Oral exam, report on seminar work. The condition for admission to oral exam is successful completion of seminar work, rewarded with a passing grade. Method (oral examination,

naloge (30%) • projektni seminar (40%) • ustno izpraševanje (30%)	assignments, project seminar (30%) • project seminar (40%) • oral examination (30%)	assignments • assignments
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**Reference nosilca/Lecturer's references:**

**izr. prof. dr. Robert KUNC**

1. KUNC, Robert, OMEROVIĆ, Senad, AMBROŽ, Miha, PREBIL, Ivan. Comparative study of european tunnel emergency-stop-area-wall protection measures. *Accident analysis and prevention*, ISSN 0001-4575, Feb. 2014, vol. 63, str. 9-21, ilustr., doi: [10.1016/j.aap.2013.10.020](https://doi.org/10.1016/j.aap.2013.10.020). [COBISS.SI-ID [13216027](#)], [JCR, SNIP, WoS do 27. 11. 2016: št. citatov (TC): 1, čistih citatov (CI): 0, Scopus do 31. 8. 2017: št. citatov (TC): 1, čistih citatov (CI): 0]
2. KUNC, Robert, ŽEROVNIK, Andrej, PREBIL, Ivan. Verification of numerical determination of carrying capacity of large rolling bearings with hardened raceway. *International journal of fatigue*, ISSN 0142-1123. [Print ed.], 2007, letn. 29, št. 9/11, str. 1913-1919. <http://dx.doi.org/10.1016/j.ijfatigue.2007.02.003>. [COBISS.SI-ID [10120475](#)], [JCR, SNIP, WoS do 10. 12. 2017: št. citatov (TC): 23, čistih citatov (CI): 19, Scopus do 20. 11. 2017: št. citatov (TC): 25, čistih citatov (CI): 21]
3. ŽEROVNIK, Andrej, KUNC, Robert, PREBIL, Ivan. Yield-point phenomenon in constitutive models of cyclic plasticity. *Computational materials science*, ISSN 0927-0256. [Print ed.], 2010, vol. 49, iss. 3, str. 473-482, doi: [10.1016/j.commatsci.2010.05.038](https://doi.org/10.1016/j.commatsci.2010.05.038). [COBISS.SI-ID [11451419](#)], [JCR, SNIP, WoS do 23. 10. 2017: št. citatov (TC): 5, čistih citatov (CI): 1, Scopus do 23. 10. 2017: št. citatov (TC): 6, čistih citatov (CI): 2]
4. BIČEK, Matej, KUNC, Robert, ZUPAN, Samo. Mechanical impact on in-wheel motor's performance. *Journal of mechanics*, ISSN 1727-7191. [Print ed.], 2016, str. 1-12, ilustr. <https://www.cambridge.org/core/journals/journal-of-mechanics/article/div-classtilemechanical-impact-on-in-wheel-motorandaposs-performancediv/A4D5DB17B7102D3897C02AAAC07A32A7>, doi: [10.1017/jmech.2016.95](https://doi.org/10.1017/jmech.2016.95). [COBISS.SI-ID [15295259](#)], [JCR, SNIP, WoS do 13. 10. 2017: št. citatov (TC): 0, čistih citatov (CI): 0, Scopus do 18. 2. 2017: št. citatov (TC): 0, čistih citatov (CI): 0]
5. PREBIL, Ivan, KUNC, Robert. Stahlleitplanken. V: BURG, Heinz (ur.), MOSER, Andreas (ur.). *Handbuch Verkehrsunfallrekonstruktion : Unfallaufnahme, Fahrdynamik, Simulation*, (Praxis), (ATZ-MTZ-Fachbuch). 2., aktualisierte Aufl. Wiesbaden: Vieweg + Teubner. 2009, str. 901-933, ilustr. [COBISS.SI-ID [11087387](#)]