UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2017/18)			
Predmet:	Dinamično modeliranje		
Course title:	Dynamical modelling		
Študijski program in stopnja Study programme and level	**Študijska smer Study field**	**Letnik Academic year**	**Semester Semester**
Visokošolski strokovni študijski program Praktična matematika	ni smeri	3	prvi ali drugi
First cycle professional study programme Practical Mathematics	none	3	first or second

Vrsta predmeta / Course type	izbirni / elective
Univerzitetna koda predmeta / University course code:	M0442

Predavanja Lectures	**Seminar Seminar**	**Vaje Tutorial**	**Klinične vaje work**	**Druge oblike študija**	**Samost. delo Individ. work**	**ECTS**
30		**30**			**90**	**5**

Nosilec predmeta / Lecturer:	doc. dr. Pino Koc

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):**

Gravitacija in centralne sile. Gibanje v polju centralne sile. Gibanje v polju gravitacijske sile. Keplerjevi zakoni. Integrabilnost gibanja v polju centralne sile. Seminar: Diferencialna enačba orbite in energijska enačba gibanja. Neinercialni sistemi. Pospešeni koordinatni sistemi in inercialne sile. Vpliv vrtenja Zemlje. Foucaltovo nihalo. Seminar: Gibanje izstrelka z upoštevanjem zračnega upora in vrtenja Zemlje. Numerično integriranje in grafični prikaz trajektorije gibanja. Nihanja. Sistemi z več prostostnimi stopnjami. Lastna nihanja. Linearizacija gibanja v okolici ravnotežne lege. Majhna nihanja okrog ravnovesne lege. Seminar: Dvojno matematično nihalo. Določitev lastnih frekvenc, lastnih vektorjev in nihajnih oblik gibanja. Kinematika in dinamika togega telesa. Gibanje telesa okoli stalne točke. Koordinatne transformacije in Eulerjevi koti. Eulerjeve dinamične enačbe. Prosta vrtavka. Seminar: Gibanje osnosimetrične proste vrtavke. Precesija vektorja kotne hitrosti. Enakomerna rotacija in stabilnost gibanja. Sistemi s spremenljivo maso. Splošne enačbe gibanja sistemov s spremenljivo maso. Gibanje enostopenjske rakete. Seminar: Optimizacija gibanja večstopenjskih raket. Optimizacija porabe goriva in trajektorije letenja rakete.	Gravitation and central forces. Motion in gravitational and central force fields. Kepler's laws. Integrability of motion in central force field. Seminar: Differential equation of the orbit and energy equation of motion. Non-inertial systems. Accelerated coordinate systems and inertial forces. Influence of Earth rotation. Foucault's pendulum. Seminar: Projectile motion including air resistance and Earth rotation. Numerical integration and graphical representation of trajectory of motion. Oscillations. Systems with many degrees of freedom. Eigenfrequencies and eigenmodes. Linearization of motion in the vicinity of the equilibrium state. Small oscillations in the vicinity of equlibrium state. Seminar: Double pendulum. Eigenmodes and eigenfrequencies. Normal modes of harmonic motion. Rigid body kinematics and dynamics. Motion about a fixed point. Coordinate transformations and Euler's angles. Euler's dynamic equations. Free gyro or top. Seminar: General motion of a symmetric gyro or top. Steady precession of a vector of angular velocity. Uniform rotation and stability of motion. Systems with variable mass. General equations of motion for systems with variable mass. Motion of one-stage space rocket. Seminar: Motion optimization for multistage rockets. Optimization of fuel consumption and trajectory of flight.

Temeljni literatura in viri / Readings:

M. W. McCall: Classical Mechanics, a modern introduction, John Wiley, Chichester, 2001.
W. Greiner: Classical Mechanics: Point Particles and Relativity, Springer, 2004.
W. T. Thomson: Introduction to Space Dynamics, Dover, Publ. Inc., 1986.

Cilji in kompetence:

Študentje se bodo seznanili z zahtevnejšimi pojmi in vsebinami klasične in analitične mehanike s poudarkom na korektni matematični formulaciji in povezovanju že osvojenih matematičnih znanj s področja matematičnega modeliranja.

Objectives and competences:

Students will acquire knowledge about more comprehensive facts and ingredients of rational mechanics with emphasis on strict mathematical formulation based on previously mastered mathematical knowledge.

Predvideni študijski rezultati:

Znanje in razumevanje: Poznavanje in razumevanje zahtevnejših pojmov in principov s področja klasične analitične mehanike.

Uporaba: Temelj za nadgraditev osvojenega znanja s specifičnimi znanji iz prakse s področja mehanike in podobnih naravoslovno tehničnih področij.

Refleksija: Povezovanje osvojenega matematičnega znanja v okviru enega predmeta in njegova uporaba na področju mehanike.

Prenosljive spretnosti – niso vezane le na en predmet: Celovit pogled na matematične metode modeliranja v okviru mehanike. Reševanje nalog in problemov iz sorodnih področij uporabne matematike, naravoslovja in tehnike.

Intended learning outcomes:

Knowledge and understanding: To establish knowledge and understanding of fundamental principles of rational mechanics at more advanced level.

Application: Mastered coursework represents a foundation for specialized research in the field of mechanics.

Reflection: Connecting acquired mathematical knowledge within the course with implementation of that knowledge in a general field of mechanics.

Transferable skills: A global overview of mathematical methods of modelling within the framework of rational mechanics. Solving problems from related areas of applied mathematics, natural sciences and engineering.

Metode poučevanja in učenja:

Learning and teaching methods:

Predavanja in seminar. Študent v okviru predmeta spozna možnosti uporabe višjih simbolnih programskih jezikov (npr. Mathematice ali podobnih) pri reševanju konkretnih problemov. Seznani se s projektnim pristopom reševanja problemov, ki je sestavljen iz faze načrtovanja, matematične zasnove, izbora metode reševanja in uporabe razpoložljivih računalniških orodij.	Theoretical lectures and seminar work. During the course student gets acquainted with application of symbolic languages (like Mathematica etc.) in real-problem solving. Student becomes familiar with a project problem solving approach which consist of different phases: the phase of planning, the phase of mathematical conceptualization, the choice of appropriate method of solution together with implementation of available computational tools.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Pogoj za pristop h končnemu izpitu je sodelovanje na predavanjih in izdelava predlaganih seminarskih nalog ali projektov po izboru.		Active participation at the theoretical part of lectures is required. Completion of seminar assignments or projects by individual choice.
izdelava in zagovor izbrane teme seminarske naloge		Oral defense of seminar assignments.
zagovor teoretičnega dela predavanj		Written defense of theoretical part
	50%	Grade is combination of the above.
Ocene: 1-5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50%	Grading: 1-5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

KOC, Pino. Sea-wave dynamic loading of sailing yacht`s retractable keel. Strojniški vestnik, ISSN 0039-2480, Mar. 2014, vol. 60, no. 3, str. 203-209, ilustr. [COBISS.SI-ID 13401627]
KOC, Pino, HALILOVIČ, Miroslav, ŠTOK, Boris. Impact of restrained thermal expansion on NPP Krško primary loop piping. Tehnički vjesnik, ISSN 1330-3651, 2013, god. 20, br. 5, str. 897-904, ilustr. [COBISS.SI-ID 13212955]
KOC, Pino, ŠTOK, Boris. Computer-aided identification of the yield curve of a sheet metal after onset of necking. Computational materials science, ISSN 0927-0256. [Print ed.], 2004, letn. 31, št. 1/2, str. 155-168. [COBISS.SI-ID 7467803]