UČNI NAČRT PREDMETA / COURSE SYLLABUS			
Predmet:	Mehanika fluidov		
Course title:	Fluid mechanics		

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

Vrsta predmeta / Course type	izbirni

Univerzitetna koda predmeta / University course code:	M2114

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. George Mejak

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):**

Kinematika mehanike fluidov:

Eulerjev opis gibanja. Tenzor deformacijskih hitrosti. Materialni odvod in transportni izrek. Tokovnice, tirnice, slednice in vrtinčnice.

Fizikalno mehanske osnove:

Pojem površinske sile in napetostnega tenzorja. Zakon o ohranitvi mase. Cauchyjeva momentna enačba. Termodinamični principi. Konstitutivna zveza med napetostjo in tenzorjem deformacijskih hitrosti. Hidrostatika.

Newtonovi fluidi:

Pojem viskoznosti. Navier-Stokesova enačba. Primeri laminarnega viskoznega toka, ravninski Coettov tok, Poiseuillev tok, Stokesova naloga. Difuzija in konvekcija vrtinčnosti. Turbulenca.

Idealen fluid:

Eulerjeva enačba. Bernoullijev izrek. Potencialni tok nestisljivega fluida. Reševanje ravninskega potencialnega toka z metodo kompleksnih potencialov. Potencialni tok stisljivega fluida, akustična aproksimacija.

Pregled numeričnih metod reševanja enačb mehanike fluidov:

Ohranitveni zapis enačb gibanja. Metoda končnih volumnov. Pregled osnovnih modelnih primerov.

Kinematics of the fluid flow:

Eulerian description. Rate of deformation tensor. Material derivative and transport theorems. Stream lines, pathlines, streak lines, vortex lines.

Physical properties of fluids:

Stress vector and tensor. Mass conversation law. Momentum equation. Thermodinamical principles. Constitutive relation. Hydrostatics.

Newtonian fluids:

Viscosity. Navier-Stokes equation. Examples of laminar flow, plane Coette flow, Poiseuille flow, Stokes problem. Diffusion and convection of the vorticity. Turbulence.

Ideal fluids:

Eulerian equation. Bernoulli's theorem. Potential flow of incompressible fluid.

Complex variable methods. Compressible fluid. Acoustic approximation.

Review of numerical methods in fluid mechanics:

Equations in conservative forms. Finite volume method. Benchmark problems.

Temeljni literatura in viri / Readings:

L. Škerget: Mehanika tekočin, Fakulteta za strojništvo, Ljubljana, 1994.

G.K. Batchelor, An introduction to Fluid Dynamics, Cambridge University Press, 1967.

A. J. Chorin, J. E. Marsden: A Mathematical Introduction to Fluid Mechanics, 3rd edition, Springer, New York, 2000.

J. H. Spurk: Fluid Mechanics : Problems and Solutions, Springer, Berlin, 1997.

Cilji in kompetence:

Cilj predmeta je pridobiti osnovna znanja s področja mehanike fluidov. Pridobljeno znanje omogoča nadaljni samostojni študij mehanike fluidov.

Objectives and competences:

The goal is to obtain basic knowledge of fluid mechanics. Acquired knowledge allows further individual study of fluid mechanics.

Predvideni študijski rezultati:

Znanje in razumevanje:
Poznavanje in razumevanje osnovnih pojmov in principov iz mehanike fluidov

Uporaba:

Temelj za nadgraditev osvojenega znanja s specifičnimi znanji iz prakse s področja mehanike fluidov. Osnova za nadaljnji specialistični študij mehanike fluidov.

Refleksija:

Povezovanje osvojenega matematičnega znanja v okviru enega predmeta in njihova uporaba na področju mehanike fluidov.

Prenosljive spretnosti – niso vezane le na en predmet:

Celovit pogled na mehaniko fluida v okviru mehanike kontinuuma. Sposobnost reševanja nalog in problemov iz sorodnih področij uporabne matematike.

Intended learning outcomes:

Knowledge and understanding:
Knowledge and understanding of basic prnciples of fluid mechanics.

Application:

Application of the acquired knowledge in solving real-life problems of fluid mechanics. First step for further graduate level study of fluid mechanics.

Reflection:

Crossbreeding of different mathematical subjects within a single course and their application in the field of fluid mechanics.

Transferable skills:

Understanding of fluid mechanics in the context of the continuum mechanics. Ability of solving related problems from the applied mathematics.

Metode poučevanja in učenja:

Learning and teaching methods:

predavanja, vaje, domače naloge, konzultacije	Lectures, exercises, homeworks, consultations

Načini ocenjevanja:	Delež (v %) / Weight (in %)	Assessment:
Tedenske domače naloge Zagovor domačih nalog		Regular homework assignments Oral presentation of homework
Ocene: 5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50% 50%	Grading: 5 (fail), 6-10 (pass) (according to the Statute of UL)

Reference nosilca / Lecturer's references:

MEJAK, George. Finite element solution of a model free surface problem by the optimal shape design approach. International journal for numerical methods in engineering, ISSN 0029-5981. [Print ed.], 1997, vol. 40, str. 1525-1550. [COBISS.SI-ID 9983833]

MEJAK, George. Numerical solution of Bernoulli-type free boundary value problems by variable domain method. International journal for numerical methods in engineering, ISSN 0029-5981. [Print ed.], 1994, let. 37, št. 24, str. 4219-4245. [COBISS.SI-ID 8166745]

MEJAK, George. Finite element analysis of axisymmetric free jet impingement. International journal for numerical methods in fluids, ISSN 0271-2091, 1991, let. 13, št. 4, str. 491-505. [COBISS.SI-ID 8167769]