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.	Kinematics of the fluid flow: Eulerian description. Rate of deformation tensor. Material derivative and transport theorems. Stream lines, pathlines, streak lines,

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.	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:	**Objectives and competences:**

Cilj predmeta je pridobiti osnovna znanja s področja mehanike fluidov. Pridobljeno znanje omogoča nadaljni samostojni študij mehanike fluidov.	The goal is to obtain basic knowledge of fluid mechanics. Acquired knowledge allows further individual study of fluid mechanics.

Predvideni študijski rezultati:	**Intended learning outcomes:**
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.	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 Ocene: 5 (negativno), 6-10 (pozitivno) (po Statutu UL)	50% 50%	Regular homework assignments Oral presentation of homework 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]