UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	IZBRANA POGLAVJA IZ TRANSPORTNIH POJAVOV
Course Title:	SELECTED TOPICS IN TRANSPORT PHENOMENA

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
DR Kemijske znanosti, 3. stopnja	/	1.	1. in 2.
Doctoral programme in Chemical Sciences, 3rd Cycle	/	1st	1st and 2nd

Vrsta predmeta / Course Type: izbirni/Elective

Univerzitetna koda predmeta / University Course Code: KZ315

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
30	45	/	/	75	/	5

Nosilec predmeta / Lecturer: prof. dr. Igor Plazl /Dr. Igor Plazl, Full Professor

Jeziki / Languages:

Predavanja / Lectures:	slovenski / Slovenian
Vaje / Tutorial:	slovenski / Slovenian

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	Prerequisites:
Študent oziroma kandidat mora imeti predmet opredeljen kot študijsko obveznost.	The course has to be assigned to the student.

Vsebina:

- kompleksne tekočine – izvor ne-Newtonskega obnašanja;
- konstitutivne enačbe za ne-Newtonske tekočine;
- robni pogoji na trdnih stenah in na tekočih mejnih ploskvah (kinematični pogoji, termični robni pogoji, dinamični robni pogoji);
- neusmerjen in enodimenzijski tok in problemi prenosa toplote;
- uvod v asimptotične aproksimacije (vpliv oddane toplote zaradi viskoznosti na preprost strižni tok, tok tekočine skozi rahlo ukrivljeno cev – »the Dean problem«, difuzija v sferi s hitro reakcijo, dinamika

Content (Syllabus outline):

- Complex fluids – origins of Non-Newtonian behavior;
- constitutive equations for Non-Newtonian fluids;
- boundary conditions at solid walls and fluid interfaces (the kinematic condition, thermal boundary conditions, the dynamic boundary condition);
- unidirectional and one-dimensional flow and heat transfer processes;
- introduction to asymptotic approximations (the effect of viscous dissipation on a simple shear flow, the motion of a fluid through a slightly curved tube – the Dean problem, diffusion in a sphere with fast reaction –

mehurčkov v mirujočem toku – Reyleigh-Plessetova enačba); - filmi s prosto površino; - plazeči tokovi - splošne lastnosti in rešitve za 2D in asimetrične probleme; - plazeči tokovi - 3D problemi; - konvekcija in prenos toplote viskoznih tokov; - teorija mejnega sloja za laminarne tokove; - prenos toplote in snovi pri velikih Reynoldsovih številih.	singular perturbation theory, bubble dynamics in a quiescent flow – the Reyleigh-Plesset equation - films with a free surface; - creeping flow - general properties and solutions for 2D and axisymmetric problems; - creeping flow - 3D problems; - convection effects and heat transfer for viscous flows; - boundary layer theory for laminar flows; - heat and mass transfer at large Reynolds number.

Temeljna literatura in viri / Readings:

- L. Gary Leal, Advanced Transport Phenomena: fluid mechanics and convective trasport processes, Cambridge University Press, 2007, 899 str.
- J. C. Slaterry, Advanced Transport Phenomena, Cambridge University Press, 1999, 703 str.
- Članki vodilnih revij s področja klemijskega inženirstva.

Cilji in kompetence:	**Objectives and Competences:**
Cilj predmeta je, da podiplomski študentje nadgradijo osvojena znanja iz transportnih pojavov, ki predstavljajo temelje kemijsko inženirske znanosti. Študentje si pri predmetu pridobijo naslednje specifične kompetence: poglobljeno razumevanje fluidne dinamike, prenosa toplote in prenosa snovi.	Upgrading knowledge of fluid dynamics, heat and mass transfer.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
Znanje in razumevanje Nadgradnja temeljnih znanj o transportnih pojavih, ki omogoča reševanje realnih industrijskih problemov pri razvoju in optimizaciji (bio)kemijskih procesov in razvoj novih tehnologij.	Knowledge and Comprehension Expand the abilities and knowledge of transport phenomena to solve real industrial problems in the development and optimization of (bio) chemical processes and in the development of new technologies.
Uporaba Sposobnost uporabe pridobljenih znanj pri samostojnem razvojnem in raziskovalnem delu na področju načrtovanja in optimizacije procesov.	Application Acquired knowledge is necessary for independent research and development in the area of process design and optimization.
Refleksija Sposobnost samostojnega sklepanja, definicije problema in njegovo rešitev; sposobnost vodilne vloge timskega dela pri razvoju procesov.	Analysis Development of abilities of autonomous deducting, problem defining and problem solving; ability to communicate and to lead teams at the processes development.

Prenosljive spretnosti	Skill-transference Ability
Identifikacija in reševanje kompleksnih problemov transportnih pojavov, sposobnost zbiranja in kritične analize podatkov, ter sinteza pridobljenih znanj.	Ability to identify and solve complex problems of transport phenomena, to collect and interpret data, to analyse results critically and to synthesize knowledge.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Predavanja, seminar.	Lectures, seminar.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Seminar	40	Written report on a given topic
Ustni izpit.	60	Oral examination.

Reference nosilca / Lecturer's references:

G. N. Jovanovic, M. Y. Coblyn, I. Plazl. Time Scale Analysis & Characteristic Times in Microscale-Based Bio-Chemical Processes: Part II - Bioreactors with Immobilized Cells, and Process Flowsheet Analysis, *Chemical Engineering Science*, 2021, **236,** 116499, doi: 10.1016/j.ces.2021.116499.

G. N. Jovanovic, M. Y. Coblyn, I. Plazl. Time Scale Analysis & Characteristic Times in Microscale-Based Chemical and Biochemical Processes: Part I - Concepts and Origins, *Chemical Engineering Science*, 2021, 2021, **238,** 11650, doi: 10.1016/j.ces.2021.116502.

F. Strniša, T. V. Sagar, P. Djinović, A. Pintar, I. Plazl. Ni-containing CeO2 rods for dry reforming of methane: activity tests and a multiscale lattice Boltzmann model analysis in two model geometries. *Chem. Eng. J.*, doi: 10.1016/j.cej.2020.127498