UČNI NAČRT PREDMETA / COURSE SYLLABUS	
Predmet:	PRAKTIKUM IZ MATERIALOV
Course Title:	PRACTICAL COURSE IN MATERIALS CHARACTERISATION

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
VSŠP Kemijska tehnologija, 1. stopnja	/	3.	6.
PSP Chemical Technology, 1st Cycle	/	3rd	6th

Vrsta predmeta / Course Type: izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code: KTSI34

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
/	/	25 SV + 50 LV	/	/	75	5

Nosilec predmeta / Lecturer: Doc. dr. Boštjan Genorio / Dr. Boštjan Genorio, Assistant Professor

Jeziki / Languages: **Predavanja / Lectures:** / ; **Vaje / Tutorial:** slovenski / Slovenian

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

Vsebina:	Content (Syllabus outline):
Praktikum obsega seminarske in laboratorijske vaje. Študenti se na teoretičnem nivoju seznanijo z osnovnimi postopki in metodami preiskovanja lastnosti različnih materialov. Pri eksperimentalnem delu spoznajo aplikativno uporabo karakterizacijskih metod. Tekom dela se praktično seznanijo z mikroskopskimi tehnikami (optični mikroskop, vrstični elektronski mikroskop, mikroskop na atomsko silo, segrevalni mikroskop …), rentgensko fotoelektronsko spektroskopijo, termo analitskimi tehnikami, karakterizacijo velikosti in porazdelitve velikosti delcev, specifične površine, porazdelitve por, merjenje mehanskih, elektrokemijskih lastnosti … Med praktičnim delom je eksperimentalno delo podprto s sprotnim računanjem in ovrednotenjem rezultatov in njihovo kritično presojo ter posledično	The practical course includes seminar and laboratory exercises. On a theoretical level, students learn the basic procedures and methods for the investigation of material properties. In experimental work they learn the applied use of characterization methods. During the work they can learn microscopic techniques (optical microscope, scanning electron microscope, atomic force microscope, heating microscope...), x-ray photoelectron spectroscopy, thermoanalytical techniques, characterization of particle size distribution, specific surface area, pore distribution, measurement of mechanical, electrochemical properties. During the practical work, the experimental work will be supported by

diskusijo dobljenih rezultatov in ustreznostjo uporabljenih metod. Delo se izvaja projektno za specifične materiale.	continuous calculation and evaluation of the results and their critical assessment and thus a discussion of the results obtained and the appropriateness of the methods used.

Temeljna literatura in viri / Readings:

- Callister, Rethwisch, Materials science and engineering, 9th edition, A John Wiley and Sons Publication, New Jersey, 2015 (20%)
- Askeland, Wright, The science and engineering of Materials, 7th edition, Cengage Learning, Boston, USA, 2016 (20%)
- Michio Inagaki, Feiyu Kang; Materials Science and Engineering of Carbon: Fundamentals, 2nd Edition, 2014 (10%)

Cilji in kompetence:	**Objectives and Competences:**
Študenti osvojijo ter utrdijo znanje o naprednih metodah preiskovanja lastnosti in kakovosti materialov. Soočeni z realnimi problemi, spoznajo delo, možnosti uporabe in zmogljivosti posamezne metode karakterizacije. Dobljene rezultate so sposobni komentirati in aplikativno prenesti na izbrano tematiko. Pridobljene kompetence vključujejo poleg strokovne usposobljenosti tudi socialne zmožnosti sodelovanja z ostalimi kolegi in konstruktivnega reševanja problemov.	Students acquire or deepen knowledge of advanced methods for the investigation of properties and quality of materials. Confronted with real problems they get to know the working methods, possible applications and capabilities of the individual characterisation methods. They are able to comment on the results obtained and apply them to the chosen topic. The acquired competences include not only technical skills but also social skills for cooperation with other colleagues and constructive problem solving.

Predvideni študijski rezultati:	**Intended Learning Outcomes:**
<u>Znanje in razumevanje</u> Študenti pridobijo spretnosti rokovanja in delovanja metod karakterizacije. Seznanijo se s teoretičnimi osnovami metode, pripravo vzorca za karakterizacijo, pogoji meritve, obsegom dobljenih rezultatov in drugimi uporabnimi spoznanji s katerimi krepijo poznavanje tega področja.	<u>Knowledge and Comprehension</u> Students will acquire the ability to handle and operate characterization methods. They will learn the theoretical basis of the method, how to prepare a sample for characterisation, measurement conditions, the range of results obtained and other useful knowledge that will enhance their knowledge in the field.
<u>Uporaba</u> Praktikum spodbuja prenos teoretičnih dejstev v uporabna znanja. Študent razvije občutek za izbor, načrtovanje in uporabo ustreznih metod na konkretnem primeru.	<u>Application</u> The practical course promotes the transfer of theoretical facts into useful knowledge. The student develops a sense of selecting, planning and applying appropriate methods to a specific case.
<u>Refleksija</u> Znanja, ki so uporabna pri laboratorijskih in seminarskih vajah praktikuma so vezane na vsebine predmetov, ki obravnavajo napredne karakterizacijske metode in osnove vede o	<u>Analysis</u> The knowledge usable in the laboratory and seminar exercises of the practical course is related to the contents of the subjects dealing with advanced characterization methods and

materialih. Interdisciplinarnost vsebine pa jih povezuje tudi z osnovnimi znanji s področij fizike in kemije.	the fundamentals of materials science. The interdisciplinary nature of the content also links it to fundamental knowledge from the fields of physics and chemistry.
Prenosljive spretnosti Sposobnost uporabe analitskih tehnik karakterizacije in njihovega vrednotenja na uporabnih materialih. Zmožnost sodelovanja in strokovnega dialoga z raziskovalci na drugih področjih.	Skill-transference Ability Ability to apply analytical characterisation methods and evaluate them on useful materials. Ability to collaborate and engage in professional dialogue with researchers from other disciplines.

Metode poučevanja in učenja:	**Learning and Teaching Methods:**
Računski seminarji, laboratorijske vaje, individualna seminarska naloga.	-Computational seminars , - practical course , -individual seminar work

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Ocena pisnega poročila	**70 %**	Written report
Ocene predstavitve sklepnih ugotovitev	**30 %**	The presentation of conclusions

Reference nosilca / Lecturer's references:

- Bobnar, J.; Lozinšek, M.; Kapun, G.; Njel, C.; Dedryvère, R.; **Genorio, B**.; Dominko, R. Fluorinated Reduced Graphene Oxide as a Protective Layer on the Metallic Lithium for Application in the High Energy Batteries. Sci. Rep. 2018, 8 (1), 5819. https://doi.org/10.1038/s41598-018-23991-2.

- Bobnar, J.; Vizintin, A.; Kapun, G.; Njel, C.; Dedryvère, R.; Dominko, R.; **Genorio, B**. A New Cell Configuration for a More Precise Electrochemical Evaluation of an Artificial Solid-Electrolyte Interphase. Batter. Supercaps 2020, 3, 1–10. https://doi.org/10.1002/batt.202000255.

- Gorgieva, S.; Osmić, A.; Hribernik, S.; Božič, M.; Svete, J.; Hacker, V.; Wolf, S.; **Genorio, B**. Efficient Chitosan/Nitrogen-Doped Reduced Graphene Oxide Composite Membranes for Direct Alkaline Ethanol Fuel Cells. Int. J. Mol. Sci. 2021, 22 (4). https://doi.org/10.3390/ijms22041740.