

UČNI NAČRT PREDMETA / COURSE SYLLABUS

Predmet:	BIOTEHNOLOGIJA
Course Title:	BIOTECHNOLOGY

Študijski program in stopnja Study Programme and Level	Študijska smer Study Field	Letnik Academic Year	Semester Semester
UŠP Kemijsko inženirstvo, 1. stopnja	/	2.	4.
USP Chemical Engineering, 1 st Cycle	/	2 nd	4 th

Vrsta predmeta / Course Type: izbirni strokovni / Elective Professional

Univerzitetna koda predmeta / University Course Code: INSI1

Predavanja Lectures	Seminar Seminar	Vaje Tutorial	Klinične vaje Work	Druge oblike študija	Samost. delo Individual Work	ECTS
45	15	15 LV	/	/	75	5

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

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

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Študent oz. kandidat mora imeti predmet opredeljen kot študijsko obveznost.

Prerequisites:

The course has to be assigned to the student.

Vsebina:

Biotehnologija, njen pomen in interdisciplinarnost. Zgodovina biotehnologije. Vloga biotehnologije v družbi. Bioekonomija, krožno gospodarstvo. Osnove mikrobiologije in tehnologije rekombinantne DNA. Osnove pripravljanih, produkcijskih in zaključnih procesov. Stopnje razvoja bioprocasa. Uporaba mikrobioreaktorjev pri razvoju in intenzifikaciji bioprocasa. Uporaba biotehnologije v kemijski, farmacevtski in živilski industriji, v medicini, kmetijstvu in okoljevarstvu. Industrijska biotehnologija. Izbrani primeri industrijskih bioprocasa: proizvodnja piva, organskih kislin, aminokislin, antibiotikov, vitaminov, biogoriv, biofarmacevtikov.

Content (Syllabus outline):

Biotechnology, its importance and interdisciplinarity. The history of biotechnology and its role in the society. Bioeconomy, circular economy. Basic aspects of microbiology and DNA recombinant technology. Basic aspects of upstream, production and downstream processing. Bioprocess development stages. Microbioreactors application in bioprocess development and intensification. Biotechnology in chemical, pharmaceutical and food industry, in medicine, agriculture and environment protection. Industrial biotechnology. Selected examples of industrial bioprocesses: production of beer, organic and amino acids, antibiotics, vitamins, biofuels, biopharmaceuticals.

Bioprocesi z mikroorganizmi, rastlinskimi in živalskimi celicami. Valorizacija lignocelulozne biomase z bioprocesi. Bioplastika. Biogoriva. Etika in umetna inteligenca v biotehnologiji.

Bioprocesses with microorganisms, plant and animal cells. Bioprocess-based lignocellulose biomass valorization. Bioplastics. Biofuels. Ethics and artificial intelligence in biotechnology.

Temeljna literatura in viri / Readings:

- Ratledge C., Kristiansen B., Basic Biotechnology, Cambridge Press, (2001), 342 str.
- Enfors S-O., Häggström L., Bioprocess technology, KTH Press (1996), 356 str.
- Žnidaršič Plazl, P., Podgornik, H. Vaje iz biotehnologije. 2. izd. Ljubljana: Fakulteta za kemijo in kemijsko tehnologijo, 2011. 96 str., ilustr. ISBN 978-961-6756-23-5.
- Tekoča znanstvena periodika.

Cilji in kompetence:

Cilj predmeta je spoznavanje študentov z interdisciplinarnostjo in zakonitostimi biotehnologije in vloge, mikrobiologije, biokemije in biokemijskega inženirstva v biotehnologiji. Predmet se povezuje s kemijskim inženirstvom, fizikalno kemijo, industrijsko mikrobiologijo, rastlinsko in animalno biotehnologijo.

Študentje si pri predmetu pridobijo naslednje specifične kompetence:

- sposobnost razumevanja vloge in možnosti aplikaciji inženirskih znanj v biotehnologiji
- sposobnost povezovanja inženirskih znanj z znanji mikrobiologije, biokemije, genetike in genskega inženiringa
- sposobnost razumevanja delovanja in vloge in mikroorganizmov v biotehnoških procesih
- sposobnost razumevanja strukture delovanja biotehnoškega procesa od laboratorijskih raziskav do industrijskega postopka
- Sposobnost razumevanja vloge pripravljanih procesov, produkcijskih in zaključnih procesov v biotehnologiji

Objectives and Competences:

The aim of this course is to introduce students the interdisciplinary and legality of biotechnology in the sense of its applications, microbiology, biochemistry and biochemical engineering. The focus of the study is to learn how to use engineering technology skills and application in laboratory and industrial practice. The course is linked to chemical engineering, physical chemistry, industrial microbiology, plant and animal biotechnology

- Capability and insight in the strategy and the role of bioreactor design according to the type of microorganism or tissue culture, type of bioprocess and the mode of operation.
- Capability and interlinking of bioreactor operation and techniques with chemical and biochemical engineering principles – mass and heat transport processes, fluid dynamics, process rheology and the modes of operation.
- Capability of understanding the influence of microbial physiology to the bioreactor design and the modes of operation and their influence to the bioprocess development and design.
- Capability of understanding of pilot and larged scale bioreactors operation.

Predvideni študijski rezultati:

Znanje in razumevanje
Študentje spoznajo strukturo in interdisciplinarnost področja biotehnologije. Pridobijo osnovna znanja mikrobiologije in mikrobne fiziologije, potrebna za razumevanje poročja in spoznajo pomen in vlogo inženirstva v biotehnoških postopkih.

Uporaba
Študent uporabi znanja in razumevanja o mehanizmih in vlogi mikroorganizmov v biosintezi različnih produktov visokotonažne, rekombinantne in fine biotehnologije, ki jih v praksi nadgradi z inženirskimi znanji.

Refleksija
Študentje so sposobni samostojno sklepati, definirati problem, kritičnega ovrednotenja skladnosti med teoretičnimi načeli in praktičnim ravnanjem, postavljati zaključke in reševati nekatere zanimive probleme v biotehnologiji.

Prenosljive spretnosti
Študentje pridobijo sposobnost identificiranja in reševanja tehnoloških problemov, sposobni so zbiranja in interpretacije podatkov, kritične analize in sinteze pridobljenih znanj v tehnoloških študijah, povezovanja znanj iz strokovne literature s prakso in prenosom pridobljenih znanj v sorodne tehnologije. Znanje v obliki predavanj, seminarjev in teoretičnih znanj in znanja iz znanstvene literature.

Intended Learning Outcomes:

Knowledge and Comprehension
Students learn about the structure and interdisciplinary field of biotechnology. Acquire basic knowledge of microbiology and microbial physiology needed to understand the area and learn about the importance and role of engineering aspects in biotechnological processes.

Application
Student use of knowledge and understanding the mechanisms and the role of microorganisms in the biosynthesis of various bulk, recombinant and fine biotechnology products, that in practice upgrade with the engineering skills.

Analysis
Students are able to conclude independently, define a problem, to make a critical evaluation of conformity between theoretical principles and practical behavior, and to formulate independent conclusions and solve some actual biotechnology problems.

Skill-transference Ability
Students gain the ability to identify and solve technological problems, they are capable of collecting and interpreting data, critical analysis and synthesis of acquired knowledge in technological studies, integration of knowledge from the scientific literature with the practice and transmission of the acquired knowledge in related technologies. Knowledge in the form of lectures, seminars and theoretical skills and knowledge from the scientific literature.

Metode poučevanja in učenja:

Predavanja, seminarji in praktične vaje, strokovne ekskurzije v industriji.

Learning and Teaching Methods:

Lectures, seminars, exercises

Načini ocenjevanja:

Pisni izpit
Vaje
Seminar

Delež (v %) /

Weight (in %) **Assessment:**

70%
15%
15%

Written exam
Laboratory practice
Seminar

Reference nosilca / Lecturer's references:

- Wohlgemuth, R., Plazl, I., **Žnidaršič Plazl, P.**, Gernaey, K.V., Woodley, J.M. Microscale technology and biocatalytic processes: opportunities and challenges for synthesis. Trends Biotechnol., 2015, 33: 302-314.
- Cvjetko, M., Vorkapić-Furač, J., **Žnidaršič Plazl, P.** Isoamyl acetate synthesis in imidazolium-based ionic liquids using packed bed enzyme microreactor. Process Biochem., 2012, 47: 1344-1350.
- **Žnidaršič Plazl, P.**, Plazl, I. Microbioreactors. V: Moo-Young, M. (ur.). Comprehensive Biotechnology, 2nd Ed. Amsterdam [etc.]: Elsevier, 2011, str. 289-301

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