Course Unit Descriptor

Study Programme: Biotechnology, Pharmaceutical Engineering
Course Unit Title: Bioreactors
Course Unit Code: O6BO1
Name of Lecturer(s): Associate Professor Bojana Bajić, Associate Professor Damjan Vučurović
Type and Level of Studies: Bachelor Academic Degree
Course Status (compulsory/elective): Compulsory
Semester (winter/summer): Summer
Language of instruction: English
Mode of course unit delivery (face-to-face/distance learning): Face-to-face
Number of ECTS Allocated: 6
Prerequisites: None
Course Aims: Acquiring adequate knowledge in the field of theory of bioreactors in laboratory and industrial conditions, also analysis, calculations, construction and acquisition of skills in the application of bioreactors in biotechnology, food and pharmaceutical industries.
Learning Outcomes: The ability to adequately understand the significance and role of different types of bioreactors in bioprocesses, the principles, calculation, structural solutions and the application of bioreactors, basic principles of discontinuous, continuous and semi-continuous bioreactors, immobilized bioreactors, bioreactors for animal and plant cells, photobioreactors.
Syllabus: *Theory* Concept, types, characteristics and application of chemical reactors. An integral and differential method of analysing experimental data. Ideal discontinuous, continuous and plug flow reactor. Introduction to bioreactor theory. Characteristics, calculation and application of the discontinuous bioreactor. Chemostat with and without recirculation. Characteristics, calculation and application of turbidostat. Characteristics, calculation and application of semi-continuous bioreactors. Characteristics, application and calculation of tubular bioreactor with and without recirculation. Bioreactors for enzymatic processes. Hydrodynamics of column bioreactors. Division, characteristics and application of membrane bioreactors. Mass transfer in membrane bioreactors. Characteristics of immobilized bioreactors. Mass transfer in immobilized bioreactors. Characteristics of bioreactors for immobilized animal cells, plant cells in suspension, immobilized plant cells. Characteristics of photobioreactor. Comparison of bioreactors. Selection of bioreactors. Mixing and aeration systems in bioreactors. Bioreactor operation in sterile conditions. Methods for scale-up of bioreactors. Dimensional analysis and theory of similarity. Constant parameter method. *Practice* Computational exercises in the field of calculation of different types of bioreactors.
Required Reading: 1. Binoy Ranjan Maiti: Principles of bioreactor design. Viva Books Private Ltd, 2018. 2. Shijie Liu: Bioprocess engineering: Kinetics, biosystems, sustainability, and reactor design. Elsevier B.V, 2013. 3. Topobrada Panda: Bioreactors: Analysis and Design, McGraw-Hill, 2011. 4. Paolo G Antolli; Liu, Zhiming. Bioreactors, Design Properties and Applications. Nova Science, 2012.

Weekly Contact Hours: 6	**Lectures:** 3	**Practical work:** 3

Teaching Methods:

Interactive lectures using video presentations, computational and experimental exercises, consultations.

Knowledge Assessment (maximum of 100 points):

Pre-exam obligations	points	**Final exam**	points
Active class participation		written exam	
Test I and Test II	40	oral exam	50
Practical work	10	…….	
Seminar(s)			

The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.