

**Course title:** **Biochemical Reactors Engineering**

**Institute/Division:** **FACULTY OF CHEMICAL ENGINEERING AND TECHNOLOGY**  
**Erasmus subject code:** WITCh ICHIP oIIS D14  
**Number of contact hours:** 60 hours (30h lectures + 30h project)  
**Course duration:** 1 semester (spring)  
**ETCS credits:** **4**

**Course description:** The course presents the principles of processes occurring in biochemical reactors of various types, broadens the knowledge about mathematical modeling of mass transfer processes and numerical methods used in calculations of biological reactors. The students develop the ability to solve mathematical models with use of specialized computer software and compare technological solutions and to propose modifications for improvement of process efficiency.

**Lectures content:** Technical and economical importance of biotechnological processes and bio-engineering. Classification of bioprocesses and their characteristics. / Manner of stoichiometric equations notation. / Kinetic models of microbiological processes. Unstructured and structured models of microbiological processes. Experimental methods in kinetic research of microbiological processes. / Mathematical modelling of batch reactors dynamics. / Design of continuous flow bioreactors. Single- and multi-substrate processes. Nonlinear characteristics of steady-states of tank bioreactors. / Modelling of biochemical cascades./ Existence and significance of predator-prey processes on biodegradation. / Modelling method of bubble bioreactors. / Methods allowing for presence of biofilm in bioreactors. / Enzyme immobilization engineering. Types, properties and method of membrane bioreactor modelling. / Design solutions of biochemical reactors.

**Project content:** Technological analysis of chosen biotechnological processes. In the project student is obligated to describe in detail individually chosen biotechnological process and perform its technological analysis. / Kinetic analysis of chosen microbiological processes. / Evaluation of work conditions of cascade of two tank bioreactors with partial recirculation and determination of productivity and stability of cascade work in steady state.

**Literature:** [1 ] I.J. Dunn, E. Heinzle, J. Ingham, J.E. Prenosil — Biological reaction engineering, Weinheim, 2003, Wiley; [2 ] J.E.Bailey, D.F.Ollis — Biochemical engineering fundamentals, New York, 1986, McGraw-Hill; [3 ] S.Aiba, A.E.Humphrey, N.F.Millis — Biochemical engineering, New York, 1973, Academic Press; [4 ] M.L. Shuler, F. Kargi — Bioprocess Engineering: Basic Concepts, New Jersey, 1992, Prentice Hall

**Assessment method:** **Project and final exam**  
**Prerequisites:** **Completed courses: Mathematics, Chemical engineering, Chemical reactors engineering, Numerical methods. Skills: Computer literacy; programming in selected high-level language e.g.: Fortran, basic knowledge of Matlab.**  
**Primary target group:** **4<sup>th</sup> Chemical Technology students/ 1<sup>st</sup> year of II cycle of study in Chemical Engineering**

**Lecturer:** dr inż. S. Skoneczny  
**Contact person:** dr inż. S. Skoneczny, e-mail: skoneczny@chemia.pk.edu.pl

**Deadline for application:** **15<sup>th</sup> January**  
**Remarks:** **The course runs regularly**