PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
SCHOOL OF ENGINEERING
DEPARTAMENT OF CHEMICAL ENGINEERING AND BIOPROCESSES
ABET COURSE SYLLABI

IIQ2683 MICROBIAL BIOTECHNOLOGY

Credits and contact hours:	10 UC credits / 10 hours (3 h. Lectures; 1,5 h. Labs; 5,5 h. Independent learning experiences)
Instructor's name:	Eduardo Agosin
Course coordinator's name	To be defined
Textbook:	Nielsen, J., Villadsen, J. & Liden (20012). Bioreaction Engineering Principles, 3rd Edition, Plenum Press, 561 pp.
Course Catalog Description:	Biotechnology is a key discipline for the development and implementation of manufacturing processes of new food products, drugs and a host of other compounds of high added value through the application of genetic engineering, microbiology, enzyme technology and various engineering disciplines as engineering of reactions and separation technologies. In this course we focus on the study and application of the process engineering tools for designing and optimizing processes of synthesizing biological products.
Prerequisite Courses:	BIO228C Biochemistry and Molecular Genetics o (IIQ2113 Biochemistry and Molecular Genetics + course Biochemistry + course Microbiology)
Co-requisite Courses:	None
Status in the Curriculum:	Minimum course
Course Learning Outcomes:	a. Identify key microorganisms used as cell factories. b. Report design and operation parameters of a biotechnological process. c. Identify the different microbial culture systems at laboratory and industrial level. d. Experimentally develop a microbial process for the production of a biotechnological product.

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
c. Design a system, component, or process
e. Identify, formulate, and solve engineering problems
g. Effective communication
i. Recognition of the need for, and an ability to engage in life-long learning
k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. INTRODUCTION
   a. From bioprocess design to systems biology
   b. The potential: some numbers.
   c. Course Structure.

2. CELL METABOLISM AND DERIVATIVE PRODUCTS
   a. Products of the bioeconomy.
   b. Catabolism and Fueling: Fermentation - Breathing - Anaerobiosis - Litotrophya.
   c. Anabolism: biosynthetic reactions, quantify metabolic costs.
   d. Secondary metabolism
   e. Fundamental design criteria of a bioprocess
   f. Microorganisms and genetic improvement
   g. Protein secretion

3. KINETICS OF FERMENTATIONS
   a. Growth quantification methods.
   b. Cropping systems: batch culture, continuous culture and fed-batch culture.

4. MASS TRANSFER GAS - LIQUID (OXYGEN)

5. MASS BALANCES AND REDOX BALANCES
   a. Mass balance in a continuous reactor: the steady state
   b. Yields
   c. Black box stoichiometries
   d. redox balance
   e. Systematic analysis of black box stoichiometries

6. METABOLIC FLOW ANALYSIS
   a. Stoichiometry of cellular responses;
   b. Analysis of metabolic fluxes
   c. Methodologies
   d. Applications.

7. MODELING THE GROWTH KINETICS
   a. Structure and complexity of a model

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