Universidade Federal de Santa Catarina
Centro Tecnológico
Departamento de Engenharia Química e
Engenharia de Alimentos

Programa de Pós-Graduação em Engenharia Química

COURSE PROGRAM
ACADEMIC QUARTER 2024.3

I. IDENTIFICATION

Code	Course Title	Credits	
ENQ410036	***Biochemical Engineering***	***3***	***Thursday*** 8h20 – 11h50

II. INSTRUCTOR

Prof. Agenor Furigo Junior

III. TEACHING ASSISTANT

N/A

IV. FREQUENCY

The minimal registered frequency of the activities must be 75%.

V. LEVEL

M.Sc. and Ph.D.

VI. SYLLABUS

Enzymatic Catalysis. Energy Metabolism. Stoichiometry and Microbial Growth Kinetics. Analysis, Dimensioning, and Modes of Operation of Bioreactors. Oxygen Transfer in Bioreactors. Sterilization. Bioprocess Scale up.

VII. OBJECTIVES

Develop models to represent enzymatic kinetics and size enzymatic reactors.
Recognize the main microorganism growth kinetic models and stoichiometric parameters.
Sizing, simulating, and optimizing ideal bioreactors in continuous and discontinuous operation of a biological process.
Use mass transfer and agitation requirements for the project of bioreactors.

VIII. COURSE CONTENT

As syllabus

IX. TEACHING METHODOLOGY

In the class activities, there will be content presentations with audiovisual resources, interactive discussions among students and professor, and seminars held by students. The asynchronous activities will be conducted with the proposal problems to be solved by the students, in addition to studying for the

presential classes. For asynchronous activities, the Moodle platform provided by UFSC will be supported.

X. EVALUATION

Three seminars (two in teams and one individual) and exercises will be evaluated.

XI. SCHEDULE

09/19 - Presentation of the course program. Team formation for seminars. Stoichiometry: microbial growth equation and yield coefficient, degree of reduction, and electron balance (Part 1).

09/26 - Stoichiometry: microbial growth equation and yield coefficient, degree of reduction, and electron balance (Part 2).

10/03 - Microbial kinetics: definitions of rate, characteristic phases of microbial growth, and kinetic models.

10/10 - Student seminars: biochemistry of energy production (Group A); microorganisms (Group B), and culture media (Group C).

10/17 - Bioreactors: mass balances in a bioreactor with batch, fed-batch, and continuous modes of operation. Analysis of continuous bioreactors; mass balance in real bioreactors (Part 1).

10/24 - Bioreactors: mass balances in a bioreactor with batch, fed-batch, and continuous modes of operation. Analysis of continuous bioreactors; mass balance in real bioreactors (Part 2).

10/31 - Student seminars: bioreactor (Group A); agitation and mixture (Group B); sterilization (Group C).

11/07 - Transport of oxygen: importance and basic concepts; determination of mass transfer capacity in bioreactors; scale-up of bioreactors using k_La.

11/14 - Introduction to enzymology; simple and inhibited homogeneous enzyme kinetics; enzyme immobilization (Part 1).

11/21 - Introduction to enzymology; simple and inhibited homogeneous enzyme kinetics; enzyme immobilization (Part 2).

11/28 - Preparation of individual student seminars.

12/05 - Individual student seminars on biotechnology-related articles in biofuels, food & beverage, agriculture, environment, and health.

XII. BIBLIOGRAPHY

SHULER, Michael L.; KARGI, Fikret. Bioprocess engineering: basic concepts. 2nd. ed. Upper Saddle River: Prentice Hall PTR, c2002.553p. (Chemical engineering series) ISBN 0130819085.