MINISTRY OF EDUCATION
FEDERAL RURAL UNIVERSITY OF PERNAMBUCO
PROVOST OF RESEARCH

I – IDENTIFICATION		
COURSE: BIOPROCESS SUSTAINABILITY		CODE: XXXXX
DEPARTMENT/ACADEMIC UNIT: DEPAq/UFRPEHeadquarters		
GRADUATE COURSE: Fisheries and Aquaculture Resources	CLASS: XXXXX	SHIFT: MORNING
NATURE: ( ) MANDATORY(X) ELECTIVE		
ACADEMIC PERIOD OF THE COURSE: 2024.1		
TOTAL WORKLOAD: 15hours	THEORETICAL: 15hours	PRACTICAL: 0hours
FORMAT: (X) IN-PERSON ( ) IN-PERSON/REMOTE ( ) REMOTE		

PROFESSORS	**WORKLOAD**
JUAN JOSÉ GALLARDO RODRÍGUEZ	**15**

II – SYLLABUS (Content Synopsis)

This course covers the application of life cycle thinking (LCT) and Life Cycle Assessment (LCA) in bioprocesses, with an emphasis on aquaculture. It includes fundamental concepts of LCT and LCA, their applicability to aquatic bioprocesses, challenges faced, and future prospects. The course explores LCA methodologies, covering life cycle phases, inventory, impact assessment, and interpretation. Specific analysis of biological-based products includes sectors such as human and animal nutrition, pharmaceuticals, biofuels, and other inputs. The course also examines microalgae bioprocesses for animal and human nutrition, from biomass production to environmental impact assessment, using case studies.

III – OBJETICTIVES

Main objective

- At the end of the course, students should be able to understand the main applications of sustainability in bioprocesses, applying this knowledge to aquafeed and food.

Specific objectives

- Understand the fundamental principles of life cycle thinking (LCT) and Life Cycle Assessment (LCA) and their specific application in aquatic bioprocesses, especially in aquaculture.
- Explore the challenges and opportunities associated with the successful implementation of LCA in bioprocesses, highlighting its implications and benefits for environmental sustainability.
- Familiarize participants with practical LCA methodologies, covering different life cycle phases, inventory techniques, impact assessment, and interpretation of results in specific contexts of biological products.
- Enable students to apply LCA techniques in the critical analysis of microalgae bioprocesses, both for animal feed production and human consumption, including the formulation of end products and the assessment of environmental impacts through case studies.

IV – PROGRAM CONTENT

(Indicate the subjects to be covered in the course)

THEORECTICAL PARTS:

1. Life cycle thinking (LCT) and Life Cycle Assessment (LCA) in bioprocesses
1.1 Concepts and definitions of LCT and LCA
1.2 Applicability to aquaculture bioprocesses
1.3 Relevance and challenges
1.4 Future techniques
2. Life Cycle Assessment (LCA) Methodologies
2.1 Life cycle phases
2.2 Life cycle inventory
2.3 Life cycle impact assessment
2.4 Interpretation, standardization, and certification of results
3. Life Cycle Assessment (LCA) of biological-based products
3.1 Production of inputs for human nutrition
3.2 Production of inputs for animal nutrition
3.3 Production of inputs for the pharmaceutical industry
3.4 Production of inputs for the biofuels industry
3.5 Production of other inputs
4. Microalgae bioprocess for animal feed
4.1 Biomass production
4.2 Post-harvest processing and manipulation
4.3 Formulation of final product/supplementary input
4.4 Assessment of bioprocess impacts (case study)
5. Microalgae bioprocess for human food
5.1 Biomass production
5.2 Processing, manipulation, and stock storage
5.3 Formulation of final product
5.4 Evaluation of safety for human consumption
5.5 Assessment of bioprocess impacts (case study)

V – TEACHING METHODS

( )Video lecture (Google Meet)
(X) Directed reading
( )Directed study
(X) Seminar
(X) Handouts
(X) Exercises

VI – REMOTE TEACHING PLATFORM

( )Virtual Learning Environment (AVA Moodle / UFRPE)
(x) Google Classroom
( )Professor's website
( )Dropbox
( )Others: _____

VII – EVALUATION CRITERIA
Evaluation of seminars and participation in the classroom. The evaluation procedures adopted will be continuous assessment through the presentation of reports and seminars on specific topics.

VIII – SCHEDULE	
DAYS	**DETAILS**
1 DATE: 01/30/24 (**TUE**.)	CONTENT COVERED: Life cycle thinking (LCT) and Life Cycle Assessment (LCA) in bioprocesses METHODOLOGY: Explanatory class (in-person) LOCATION: Classroom of PPG-RPAq (DEPAq) EVALUATIVE PRACTICES: In-class discussion DATE: 01/30/24 (**TUE**.)
2 DATE: 01/31/24 (**WED**.)	CONTENT COVERED: Methodologies of Life Cycle Assessment (LCA) METHODOLOGY: Explanatory class (in-person) LOCATION: Classroom of PPG-RPAq (DEPAq) EVALUATIVE PRACTICES: In-class discussion DATE: 01/31/24 (**WED**.)
3 DATE: 02/01/24 (**THU**.)	CONTENT COVERED: Life Cycle Assessment (LCA) of biological-based products METHODOLOGY: Explanatory class (in-person) LOCATION: Classroom of PPG-RPAq (DEPAq) EVALUATIVE PRACTICES: Seminar DATE: 02/01/24 (**THU**.)
4 DATE: 02/02/24 (**FRI**.)	CONTENT COVERED: Microalgae bioprocess for animal (feed) and human (food) nutrition – case studies METHODOLOGY: Explanatory class (in-person) LOCATION: Classroom of PPG-RPAq (DEPAq) EVALUATIVE PRACTICES: Seminar DATE: 02/02/24 (**FRI**.)

IX – BIBLIOGRAPHY

BASIC:

1. HOECK, C.; MANN, D.; JAHNS, H.M. **Algae**: An Introduction to Phycology. Cambridge: Cambridge Univ. Press, 1995.
2. LÓPEZ-ROSALES, Lorenzo et al. Characterization of bubble column photobioreactors for shear-sensitive microalgae culture. **Bioresource technology**, v. 275, p. 1-9, 2019.
3. ZERIOUH, Ouassim et al. New insights into developing antibiofouling surfaces for industrial photobioreactors. **Biotechnology and Bioengineering**, v. 116, n. 9, p. 2212-2222, 2019.
4. LÓPEZ-ROSALES, Lorenzo et al. Modeling shear-sensitive dinoflagellate microalgae growth in bubble column photobioreactors. **Bioresource technology**, v. 245, p. 250-257, 2017.
5. ZERIOUH, Ouassim et al. Biofouling in photobioreactors for marine microalgae. **Critical reviews in biotechnology**, v. 37, n. 8, p. 1006-1023, 2017.

I AM AWARE that recorded synchronous interactions constitute strictly educational material and are not allowed to be used (in full or in part) for purposes other than this. I commit to respecting the image rights of the students in recordings of synchronous activities, questioning them about the authorization for recording, and advising those who object to keep their cameras and microphones turned off during the recording.

Recife, December 18, 2023.