University of Gdańsk

Subject card

Subject name and code	Biotechnology, PG_00081884		
Field of study	Chemistry		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	6	ECTS credits	3.0
Learning profile	academic	Assessment form	exam
Conducting unit	Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Bogdan Banecki	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	30	5.0	40.0	75

Subject objectives	The aim of the course is to provide students with practical preparation for designing, conducting, and supervising biotechnological processes on a laboratory and pilot scale, with an emphasis on the conscious selection of materials, equipment, and methods. The course covers work with biomaterials in medicine; understanding the design, selection, and operation of bioreactors (including basic balance calculations and scale-up) and associated bioreactor processes; the use and interpretation of biosensor data; the management of by-products from the agri-food industry; the engineering of biologically neutral and active surfaces and their practical applications; the selection and evaluation of equipment for solid material comminution; an overview of selected GMO modifications and relevant legal regulations; as well as a review of the types of biofuels and energy sources and the biotechnological and chemical methods of their production. Particular emphasis is placed on the validation of equipment and analytical methods, experimental design, critical data analysis, and teamwork, in line with quality management systems (ISO/IEC 17025, ISO 9001) and the principles of GLP and GMP

Learning outcomes

Course outcome	Subject outcome	Method of verification
[CHEML3_K03] Establishes priorities in the right way for the implementation of tasks specified by herself/himself and/or by others.	Sets priorities and a schedule for the bioprocess, identifies critical parameters (CPP/CQA), decides on the order of activities, and justifies time/resource/quality trade-offs	[SK1] oral statement/conversation/ discussion
[CHEML3_U07] Prepares documented elaboration on a specific problem in the field of selected chemical and physical issues.	Develops a documented bioprocess design (technology description + basic balances + outline of scale-up + analytical method validation plan + GMO legal aspects) in compliance with ISO/IEC 17025/GLP requirements.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
[CHEML3_W10] Enumerates and describes the basic aspects of the construction, operation and use of measuring apparatus and equipment used in experimental works in the field of chemistry and related sciences.	Lists, describes, and justifies the selection of equipment: fermenters and ancillary equipment (aeration, impellers, sensors), comminution devices, concentration/extraction systems, UV–Vis/HPLC and biosensors; identifies key metrological parameters (accuracy, precision, LOD/LOQ, linearity).	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task
[CHEML3_K02] Works individually demonstrating initiative and independence of activity and cooperates in a team fulfilling various roles in it.	Works effectively both individually and in a team; actively participates in lectures and asks questions.	[SK1] oral statement/conversation/ discussion
[CHEML3_U03] Selects the appropriate equipment and laboratory apparatus for conducting uncomplicated chemical experiments.	Selects and configures the bioreactor type, aeration and mixing systems, measurement setup, and feedstock-preparation equipment (comminution, extraction) appropriate to the objective and material, justifying choices with process parameters and metrological constraints.	[SU5] implementation of a problem task
[CHEML3_W05] Has basic knowledge of the chemical specialisation studied.	Explains and critically compares solutions used in bioprocesses: types and modes of bioreactor operation, cultivation strategies, principles for selecting biomaterials and surfaces (biologically neutral/inert vs. active), and regulatory/quality requirements (GLP/GMP, ISO 9001, ISO/IEC 17025).	[SW4] test/exam - oral or written
[CHEML3_U02] Performs analyses using experimental methods and draws conclusions based on them.	Analyzes assay results (UV–Vis, HPLC, biosensor measurements) for low-concentration samples and draws conclusions regarding data quality and process parameters (yield, selectivity, impact of CPP).	[SU4] test/exam - oral or written
[CHEML3_K05] Observes established procedures in laboratory work and is responsible for the safety of her/his and others' work.	Understands the concept of SOPs and the principles of H&S/GLP/ GMP; assesses risk and ensures safe working practices.	[SK4] test/exam - oral or written [SK8] observation of student's independent or team work

Subject contents

- **Biomaterials in medicine**
- **Bioreactors**
- **Bioreactors basic calculations**
- **Biosensors**
- **Processing of by-products from the agri-food industry**
- **Biologically neutral and active surfaces and their applications**
- **Solid material comminution equipment**
- **Types and classification of biofuels ecological sources of energy**
- **Biotechnological and chemical methods of obtaining biofuels from natural sources**
- **Methods of concentration, extraction, and analysis of low-concentration samples**
- **Validation of equipment and analytical methods**

Prerequisites and co-requisites

General and Organic Chemistry
Biochemistry

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
exam	50.0%	100.0%

Recommended reading	Basic literature	Szewczyk K., Krzysztof W. *Technologia biochemiczna*. Tabiś, Bolesław; Grzywacz, Robert. *Procesy i reaktory biochemiczne* Singleton, Paul. *Bakterie w biologii, biotechnologii i medycynie*. **Bednarski, Włodzimierz; Reps, Arnold** (red.). *Biotechnologia żywności*. **BuLock, John D.; Kristiansen, Bjørn** (eds.). *Basic Biotechnology* **Libudzisz, Zdzisława; Kowal, Krystyna; Żakowska, Zofia** (red.). *Mikrobiologia techniczna* **Lewicki, Piotr P.** (red.). *Inżynieria procesowa i aparatura przemysłu spożywczego* **Bałdyga, Jerzy; Henczka, Marek; Podgórska, Wioletta.** *Obliczenia w inżynierii bioreaktorów* European Directorate for the Quality of Medicines & HealthCare (EDQM). *Quality Management (QM) documents General European OMCL Network (GEON)*. Dostęp: **https://www.edqm.eu/en/quality-management-qm-documents** International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (**ICH**). Strona domowa i wykaz wytycznych: **https://www.ich.org/** *Twardowski, Jacek* (red.). **Biospektroskopia.**
	Supplementary literature	1) J. Bulock, B. Kristiansen. "Basic biotechnology" 2) European Pharmacopeia
	eResources addresses	
Example issues/ example questions/ tasks being completed	**Biofuel production** **Optimization of the production process in fermentors** **Biologically active surfaces practical application** **Trace contaminant analysis** **Method validation**	
Work placement	Not applicable	

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