Odesa I. I. Mechnikov National University
Faculty of Biology
Department of Microbiology, Virology and Biotechnology

COURSE SYLLABUS

Course title: Biological Sensors and Diagnostic Systems

Workload	Credits – 4,5; Hours – 135; Content Modules – 2
Semester, Year of Study	Full-time program: Year – 1, Semester – 1 (Autumn)
Days, Time, Location	According to the schedule
Workplace	Faculty of Biology, Department of Microbiology, Virology, and Biotechnology
Consultations	Off-line consultations by prior appointment. Online consultations via the Zoom platform according to the schedule

COMMUNICATION

Communication during class sessions takes place according to the timetable on the premises of the Department of Microbiology, Virology, and Biotechnology. Outside of scheduled class hours, all current issues are discussed via official working chats in Viber, Telegram, or via email.

COURSE ANNOTATION

The subject of the discipline covers the field of Biosensorics, including the fundamental components and operating principles of biological sensors and diagnostic systems, their applications across various sectors, as well as the development of conceptual schemes for their future design and implementation.

Prerequisites: Basic knowledge of the courses «Physics», «Microbiology», «Biochemistry», «General Cytology», «Genetics», «Molecular Biology», «Organic Chemistry», as well as familiarity with research methods in Microbiology and Biotechnology and the principles of biotechnological process design and factors affecting process efficiency.

Postrequisites: Application of biosensor and diagnostic system concepts in advanced professional courses and use of modern knowledge to solve practical problems in Biological Sciences.

Purpose of the course «Biological Sensors and Diagnostic Systems». The purpose of the discipline is to provide students with a set of knowledge necessary for qualified approaches to solving practical problems in the field of biosensing, methods of creating and applying biological sensors and diagnostic tools in Biotechnology. The acquired knowledge can be applied in work at Research Institutes and Institutions in the Biological and Biotechnological fields.

Objectives of the discipline:

1. To provide in-depth theoretical knowledge about the composition and principles of operation of biological sensors and diagnostic tools.

2. To form an understanding of the principles of biological sensors and diagnostic systems.

3. To familiarize students with the application fields and advantages of biological sensors and diagnostic tools.

4. To provide knowledge on the directions of developing promising schemes for creating biological sensors and diagnostic tools.

Learning Outcomes

As a result of studying the course, students are expected to:

know:

- concepts of biological sensors and diagnostic systems;
- structure and operating principles of bioaffinity and enzyme-metabolic biosensors;
- main properties and advantages of diagnostic systems;
- principles of design of biological sensors and diagnostic platforms;
- most promising application areas of biosensors and diagnostic systems;
- kinetics of biological reactions underlying biosensor operation;
- influence of diffusion processes on the kinetics of biological reactions;
- functional features and applications of cellular biosensors;
- specific characteristics of biosensors based on microorganisms.

be able to:

- define the concepts of biological sensors and diagnostic systems;
- assess the pplicability of specific biosensor models used in diagnostic platforms;
- identify general and specific application areas of biological sensors and diagnostic systems;
- describe the historical development of biosensorics;
- provide examples of modern applications of biological sensors in scientific, biotechnological, and everyday contexts.

COURSE DESCRIPTION

Forms and Methods of Instruction

The course is delivered in the form of lectures (16 hours)*, practical classes (14 hours)*, and independent student work (60 hours)*.

The following teaching methods are employed:

- electronic and information-based methods (presentations, video materials, methodological guidelines, lecture notes);
- research-oriented methods (student participation in research projects related to the discipline);
- assessment and control methods (tests, situational tasks, evaluation of practical skills).

* may vary for Ukrainian and English language classes

Course content

CONTENT MODULE 1. BIOLOGICAL SENSORS

Topic 1. Characteristics of Biological Sensors.

Topic 2. Biological Reaction.

Topic 3. Kinetics of Biological Reactions.

Topic 4. Electrochemical Biosensors.

Topic 5. Calorimetric Biosensors.

Topic 6. Piezoelectric Biosensors.

Topic 7. Optical Biosensors.

CONTENT MODULE 2. DIAGNOSTIC SYSTEMS

Topic 8. Whole-cell Diagnostic Tools.

Topic 9. Microorganism-based Diagnostic Tools.

Topic 10. Enzyme-based Diagnostic Tools.

Topic 11. Immunodiagnostic Tools.

Topic 12. Nucleic Acid-based Diagnostic Tools.

ASSESSMENT

Methods of current/periodic assessment include oral questioning (during practical classes, evaluation of individual assignments, assessment of presentations), and MCQs (paper-based or computer-based) for each content module.

The Final grade is calculated by taking into account all scores obtained in current assessment and the Final Task for the two content modules.

The final form of assessment for the Discipline is a pass. Assessment of academic performance is based on a 100-point scale.

The following table defines the percentage contribution of each module to the Total course grade.

Periodic knowledge assessment is conducted after completing the material of each content module. The Lecturer informs students in advance about the dates and content of assessment activities.

Grading Scale: National and ECTS

Total Score	ECTS Grade	National Grade
90-100	**A**	passed

85-89	**B**	
75-84	**C**	
70-74	**D**	
60-69	**E**	
35-59	**FX**	failed (with the right to retake)
0-34	**F**	failed (with mandatory re-study of the discipline)

COURSE POLICY

Policy on Deadlines and Retake Procedures:

Student attendance at Practical Classes, as well as participation in Continuous and Periodic Assessments, constitutes an integral component of the overall final grade. Assignments submitted after the established deadlines without valid justification are assessed with a reduced score (–10%). Clearance of academic arrears (make-up work) is permitted only with the approval of the Dean's Office and in the presence of valid reasons.

Academic Integrity Policy:

is regulated by the Regulations on the Prevention and Detection of Academic Plagiarism in Educational and Research Activities of Participants in the Educational Process and Researchers at Odesa I. I. Mechnikov National University https://onu.edu.ua/pub/bank/userfiles/files/acad_council/polozhennya-antiplagiat-2021.pdf

Attendance and Punctuality Policy:

to successfully complete the course, students are required to regularly attend Practical Classes; be theoretically prepared for Practical Classes in accordance with the course topics; arrive on time and avoid unjustified absences; complete all required assignments and actively participate in each class session; demonstrate the ability to work collaboratively with a partner or as part of a group. Lecture attendance is not mandatory.

Students with special educational needs are encouraged to meet with the lecturer or notify the Lecturer prior to the beginning of classes; upon the student's request, this may be done by the group representative. Should any questions arise, students are encouraged to contact the Lecturer directly.

Mobile Devices Policy

During Practical Classes, mobile devices must be set to silent mode.

Classroom Conduct

Students are expected to adhere to the rules of appropriate conduct within the University. These rules apply equally to students, academic staff, and University employees and are consistent with generally accepted standards of professional behavior.

During classes:

- Permitted:
  - leaving the classroom briefly if necessary;
  - consuming non-alcoholic beverages;
  - photographing presentation slides;
  - active participation in class activities.
- Prohibited:
  - eating (except in cases where a documented medical condition requires otherwise);
  - smoking or consuming alcoholic, low-alcohol, or narcotic substances;
  - using offensive or obscene language or expressions that demean the dignity of peers or academic staff;
  - gambling;
  - causing damage to the university's material and technical resources (including damage to equipment, furniture, walls, floors, or littering University premises or surrounding areas);
  - making excessive noise, shouting, or playing loud music in classrooms or corridors during class sessions.