SYLLABUS

1. Course title:

Pharmaceutical biotechnology

2. Code:

3. Cycle of study:

1

4. ECTS credits:

3

5. Type of course:

(●) Mandatory ( ) Elective

6. Prerequisites:

none

7. Class restrictions:

none

8. Duration / semester:

1 9

9. Weekly contact hours:

9.1. Lectures: 2

9.2. Seminars: 1

9.3. Laboratory/Practice classes: 0

10. Faculty:

Faculty of Pharmacy

11. Department/study program:

Pharmacy (integrated 1st and 2nd cycle)

12. Lecturer:

Ph.D. Aida Smajlović, full professor

13. Lecturer's e-mail:

aida.smajlovic@untz.ba

14. Web site:

www.frmf.untz.ba

15. Course aims:

The course is focused on goals important to the pharmaceutical profession and pharmaceutical sciences, with a particular intention to arouseInternship of pharmacists to further acquire knowledge and deal with biotechnology. In this regard, the course is focused on acquisitionknowledge from basic sciences related to the design and production of bipharmaceuticals as well as knowledge from clinical applicationbiotechnologically produced pharmaceuticals.

16. Learning outcomes:

Knowledge of the physico-chemical aspect of proteins, protein engineering, production of recombinant proteins, biochemical and biophysical methods of analysis of recombinant proteins, aggregates and amyloid fibrils, formulations of commercially available biopharmaceuticals and their clinical application, gene therapy and animal bioengineering.

17. Course content:

Engineering and production of recombinant proteins. Point mutants. Site-directed mutagenesis. Enzyme engineering. Fusion proteins. Antibody engineering. Biophysical and biochemical methods of evaluating the structure, function and homogeneity of recombinant proteins. Protein folding and aggregation characterization techniques. Techniques for determining the stability of proteins and amyloid fibrils. Analytical techniques for testing the quality, purity and activity of recombinant proteins. Production of biotechnological compounds. Cultivation (growing) and "downstream" processing. Targeted delivery of protein drugs. Colloidal particles as carrier systems for targeted protein delivery. Liposomes. Immunoliposomes. Biopharmaceuticals (insulin, growth hormone, interleukins and interferons, pharmaceuticals based on monoclonal antibodies, vaccines). Gene therapy. Genetic engineering of animals. Production of transgenic animals. Protein production in transgenic animals.

18. Learning methods:

Teaching is conducted in the form of lectures, auditory exercises and seminars. Active participation of the student in the interpretationexercise and its results in accordance with the set objectives of the course. The student's seminar work is mandatory.

19. Assessment methods:

Knowledge verification will be done through pre-examination tasks and the final exam. Pre-examination duties consist of lecture activities, exercise activities, colloquiums, tests and seminar work. During the semester, the student is required to do a seminar work independently or as a group project. The test and the colloquium take place in the 15th week of classes and include material covered during the semester in lectures and exercises. The final exam is taken on the regular exam dates and includes a test and a colloquium, which the student did not pass as part of the pre-exam obligations, i.e. did not achieve the minimum number of points. A student who passes the test and the colloquium with a total of 55-100 points as part of the pre-examination requirements acquires the right to enter the grade on the first regular exam period.

Point value of knowledge checks (min-max):

Activity in the lecture	2,5-5
Activity in the lecture	2,5-5
Colloquium	18-30
Test	28-50
Seminar work	4-10
TOTAL	55-100

20. Assessment components:

< 55	5 (F, FX) - does not meet the minimum criteria
55-64	6 (E) - meets the minimum criteria
65-74	7 (D) - generally good, but with significant shortcomings
75-84	8 (C) - average, with noticeable errors
85-94	9 (B) - above the average, with some errors
95-100	10 (A) - outstanding performance without errors or with minor errors

21. Required reading list:

1. Smajlovic A, Eksperimentalna biohemija, Off-set, Tuzla, 2015
2. Softić A, Smajlović A, Srabović N Ćelijske kulture u biohemijskim istraživanjima, Tuzla, 2021.
3. Crommelin D, Sindelar R, Pharmaceutical Biotechnology, Harwood Academic Pub., 2008.

22. Web sources:

23. Applicable starting from the academic year:

2023/2024.

24. Adopted in the Faculty/Academy session:

17.11.2025.