COURSE SYLLABUS STEM Ed Abroad Program

Course Title: Microbiology

Course Semester: Fall

University and Country: Adam Mickiewicz University; Poznan, Poland

Number of ECTS: 6 (lecture) and 2 (laboratory)

Course Designations for Transfer Credit: MB351/352 (NCSU)

Content: General Microbiology is a comprehensive one-semester course on the fascinating world of microbiology. Students will be introduced to the biology of microorganisms with the emphasis on prokaryotes and their adaptation to the environment. It covers the structure, growth, energy metabolism, genetics, biochemistry, physiology, classification, and evolution of prokaryotes. This course will also survey the microorganisms associated with infectious diseases, emphasize the distribution and activities of microbes as related to their role in the ecosystem, epidemiology, infection and immunity. This course will provide a conceptual background in microbiology sufficient to enable students to take more advanced courses in related fields.

Pre-requisites: General Biology with a grade of C- or better. Credit cannot be received for similar level Anatomy or Physiology course.

Aims: The aim of the course is to provide knowledge and familiarize students with: 1) history of microbiology, 2) the prevalence of microorganisms, 3) specialist terminology and terms used in the microbiology field, 4) microscopic techniques used in microbiology, 5) prokaryotic cell structure and function, 6) comparison between Procaryota and Eucaryota, 7) microbial growth and the control of microbial growth, 8) microbial metabolism, 9) the diversity and classification of microorganisms, 10) structure and function of viruses, 11) microbial genetics, 12) the use of microorganisms in biotechnology, 13) microbial ecology, 14) epidemiology, pathogenesis and immunology, as well as 15) antimicrobials and vaccines.

1. Course learning outcomes (EU) in terms of knowledge, skills and social competences and their reference to study programme learning outcomes (EK):

Course learning outcome symbol (EU)	On successful completion of this course, a student will be able to:	Reference to study programme learning outcomes (EK)
MIBIO1_01	Define and use microbiological terms.	
MIBIO1_02	Describe most important discoveries of microbiology.	
MIBIO1_03	Compare and contrast the fundamental structure of prokaryotic vs. eukaryotic organisms.	

MIBIO1_04	Compare and distinguish the basic groups of microbes, including prokaryotic microbes (Archaea, Bacteria), and viruses according to their physiological characteristics.	
MIBIO1_05	Describe and differentiate the various environments (diverse, dynamic) and conditions (biofilm, planktonic) where microbes live.	
MIBIO1_06	Describe the principles applied in culturing and characterizing microorganisms.	
MIBIO1_07	Recognize and apply methods of microbial control through physical, chemical, mechanical, and biological means.	
MIBIO1_08	Describe the process needed for one bacterium to become two.	
MIBIO1_09	Draw a typical microbial growth curve, and predict the effect of different environmental conditions on the curve.	
MIBIO1_10	Compare and contrast the major pathways of catabolism, specify the relative energy yield from each pathway, list the key products of each pathway, and describe biochemical pathways used by various microorganisms.	
MIBIO1_11	Discuss the extensive metabolic diversity of Bacteria.	
MIBIO1_12	Compare and contrast eukaryotic vs. prokaryotic genomes.	
MIBIO1_13	Describe the process of DNA replication, transcription, and translation in microorganisms.	
MIBIO1_14	Describe the basic approaches used to genetically modify prokaryotes.	
MIBIO1_15	Compare and contrast the different systems of gene regulation employed by microorganisms.	
MIBIO1_16	Predict how regulation of gene expression is influenced by various external or internal molecular cues and or signals.	
MIBIO1_17	Compare and contrast the acquisition of novel genetic information in microbes via mutations and genetic exchange, specifically conjugation, transformation and transduction.	
MIBIO1_18	Identify the diversity of microorganisms and their role in food production.	
MIBIO1_19	Explain the role of microbes in the evolution of life on earth.	
MIBIO1_20	Explain the role of phylogenetic trees in describing the evolutionary relatedness of organisms.	

MIBIO1_21	Develop an awareness of the impact that microbes have on the biosphere and humans.	
MIBIO1_22	Describe the role of microbiology in biotechnology.	
MIBIO1_23	List different types of symbiotic interactions between microbes and other organisms, including commensalism, mutualism, and parasitism, and provide examples of each.	
MIBIO1_24	Identify pathogens involved in human health and approaches to control them.	
MIBIO1_25	Summarize common features of bacterial and viral pathogens.	
MIBIO1_26	Compare and contrast beneficial and harmful uses of microorganisms, including applications in biotechnology and bioterrorism.	
MIBIO1_27	Discuss how humans impact on the environment influences the evolution of microbes.	
MIBIO1_28	Describe the variety of human immune responses towards pathogenic microorganisms.	
MIBIO1_29	Summarize mechanisms of animal defenses to infection, including primary defenses, innate immunity, and acquired immunity.	
MIBIO1_30	Describe how antimicrobials function and discuss the emergence of resistance.	
MIBIO1_31	Explain how vaccines provide immune protection.	
MIBIO1_32	Apply microbiological knowledge to the analysis of some current social questions.	
MIBIO1_33	Effectively communicate fundamental concepts of microbiology, in written and oral format. Gain an appreciation for the unity and diversity of microbial life.	
MIBIO1_34	Demonstrate ability to use microbiology laboratory skills including: Properly use aseptic techniques for the transfer and handling of microorganisms and instruments; Safely and correctly use standard microbiology laboratory equipment; Properly prepare slides and use a bright field light microscope to view and interpret different microbiological examinations; Use various microbiological media and test systems; Estimate the number of microbes in different samples, Perform antimicrobial susceptibility tests.	
MIBIO1_35	Demonstrate an increased skill level in laboratory thinking skills including: design of a laboratory experiment, performance according to protocol and appropriate interpretation of the results.	

MIBIO1_36	Demonstrate ability to thoroughly maintain laboratory safety.	
MIBIO1_37	Demonstrate ability to work independently as well as in a team.	

2. Learning content with reference to course learning outcomes (EU)

Course learning content:	Course learning outcome symbol (EU)
Abundance of microorganisms	MIBIO1_01, 19
History of microbiology	MIBIO1_02
Microscopy	MIBIO1_06, 34
Comparison between prokaryotic and eukaryotic cell structure and function	MIBIO1_01, 03, 04, 12, 33
Microbial growth and culture	MIBIO1_05, 06, 08, 09, 34, 35, 36, 37
Control of microbial growth	MIBIO1_07, 34
Microbial metabolism	MIBIO1_010, 11, 33, 37
Diversity and classification of microorganisms	MIBIO1_01, 03, 19, 20, 33
Virus structure and function	MIBIO1_01, 25
Microbial genetics	MIBIO1_08, 12, 13, 14, 17
Genetic regulation	MIBIO1_13, 15, 16
Microorganisms in biotechnology	MIBIO1_05, 18, 22, 26, 32, 35
Microbial symbiosis/ecology	MIBIO1_05, 21, 23, 27, 33
Epidemiology, pathogenesis and immunology	MIBIO1_01, 21, 24, 25, 26, 28, 29, 32
Antimicrobials & vaccines	MIBIO1_30, 31, 32, 34

Books: Microbiology, An Introduction (9th, 10th, 11th, 12th Editions) Tortora, Funke & Case. Mastering Microbiology with Pearson eText -- Instant Access -- for Microbiology: An Introduction, 11th Edition

Instructors:

Dr. Jakub Baranek (coordinator)
Dr. hab. Joanna Mokracka, prof. UAM
Dr. hab. Ryszard Koczura, prof. UAM
with consultation by Dr. Alice Lee (NC State University).

Grading System and Percentage Contribution

COURSE SYLLABUS STEM Ed Abroad Program

A. Lecture assessment

Quizzes (4 x 5% each)	20%
Exam (4 @ 20% each)	80%
Total	100%

B. Laboratory assessment

Lab safety procedures	10%
Quizzes	40%
Laboratory reports	20%
Final test and lab practical	30%
Total	100%

AMU Grading system and scale

The grading system used at Adam Mickiewicz University, whose name is abbreviated as AMU or UAM, is as follows:

Tests, exams, homework assignments grading scale

5 100%-91%
4+ 90%-86%
4 85%-76%
3+ 75%-71%
3 70%-60%
2 59% and less

This translates into the following ECTS (European internationally recognized system) grading scale:

ECTS Grade	AMU grade	Definition
A	5.0	EXCELLENT – outstanding performance with only minor errors
B	4+ / 4.5	VERY GOOD – above the average standard but with some errors
C	4.0	GOOD – generally sound work with a number of notable errors
D	3+ / 3.5	SATISFACTORY – fair but with significant shortcomings
E	3.0	SUFFICIENT – performance meets the minimum criteria
FX	2.0	FAIL – some more work required before the credit can be awarded
F	2.0	FAIL – considerable further work is required

Hours: 3 Lecture hours and 1 Tutorial hour per week. The laboratory component consists of 10 topics listed below. Each laboratory has a duration of 3 hours.

COURSE SYLLABUS STEM Ed Abroad Program

Course Lecture Topics:

Topic 1 Foundations of Microbiology

- Microbial world and you
- History of Microbiology
- Microscopy
- Cell structure
- Culture methods

Topic 2 Metabolism & Genetics

- Control of growth
- Microbial metabolism
- Classification
- Microbial genetics

Topic 3 Microbial-Host Interactions

- Gene regulation
- Virology
- Epidemiology
- Mechanisms of pathogenicity

Topic 4 Microbial impact

- Immunology
- Microbial pathogens
- Immunizations
- Food & Industrial Microbiology

Laboratory Topics:

1. Aseptic technique and sterilization
2. Microscopy, staining and bacterial cell morphology
3. Microbiological media
4. Metabolism and biochemical tests
5. Identification
6. Antimicrobial susceptibility testing
7. Enumeration of viable bacteria. Coliform count.
8. Food microbiology
9. Unknown identification & Revision for the test
10. Laboratory practical & Final test