

1. COURSE DESCRIPTION – GENERAL INFORMATION			
1.1. Course teacher	Assoc. Professor Ivan Kosalec Assoc. Professor Maja Šegvić Klarić	1.6. Year of study	2 nd
1.2. Name of the course	Microbiology with Parasitology	1.7. Credit value (ECTS)	8
1.3. Associate teachers	Daniela Jakšić Despot, MPharm	1.8. Type of instruction (number of hours L+E+S+e-learning)	60+30+0
1.4. Study programme (undergraduate, graduate, integrated)	Pharmacy integrated study programme	1.9. Expected enrolment in the course	130
1.5. Status of the course	Compulsory	1.10. Level of use of e-learning (1, 2, 3 level), percentage of instruction in the course on line (20% maximum)	2 nd
2. COURSE DESCRIPTION			
2.1. Course objectives	Students will learn: the basics of microbial biology (structure, replication, metabolism, biofilm formation, etc.); the host-pathogen interactions and its drug, vaccine or biocide modulation; etiology of bacterial, fungal and viral infectious diseases; targets of antimicrobial drugs, systemic view of the role of microbes in the life of the host (human), the importance of prevention and the wider systemic role (environmental, anthroponoses) of microbes in order to prevent infectious diseases.		
2.2. Enrolment requirements and required entry competences for the course	Passed exam in Cell Biology with Genetics.		
2.3. Learning outcomes at the level of the study programme to which the course contributes	<ul style="list-style-type: none"> The application of knowledge and skills related to the broader environmental role of infectious agents of bacterial, viral, fungal and parasitic etiology and implementation of pharmacotherapy and pharmaceutical care to patients. Active participation in prevention of infectious diseases and health care as well as in public health initiatives. 		
2.4. Expected learning outcomes at the level of the course (4-10 learning outcomes)	<p>At the end of the course students will be able to:</p> <ol style="list-style-type: none"> Describe and differentiate biological properties of medically important bacteria, viruses, fungi and parasites as well as their role in host (human). 		

	<ol style="list-style-type: none"> 2. List the main etiological agents of infectious diseases. 3. Identify the main pathogenic, commensal, opportunistic and saprophytic microbial species. 4. Explain and relate mechanisms of virulence and microbial pathogenesis. 5. Relate systemically the role of anthroozoonoses and prevention of their transmission. 6. Describe the properties of antimicrobial drugs and relate the mechanisms of antimicrobial resistance. 7. List the types of vaccines and argue the importance of active immunization for the prevention of infectious diseases.
<p>2.5. Course content broken down in detail by weekly class schedule (syllabus)</p>	<p>LECTURES</p> <ul style="list-style-type: none"> • The introduction to course content and its importance in biomedicine and public health. • The history of microbiology. Functional division of microbiology. Basics of microbial taxonomy. Microscope and types of microscopy. • Differences in the structure of prokaryotic and eukaryotic cells. Morphology of bacteria and fungi. • Biology of viruses and prions. • Bacterial metabolism and genetics: growth, sources of nutrients and energy, the specificity of bacterial metabolism, bacterial chromosome, mutation and recombination of genes, role of plasmids and bacteriophages. • QS and biofilm. Methods of isolation, cultivation and identification of microorganisms in medical microbiology. • Infection: microbial virulence, sources and routes of transmission. • Infection: host-pathogen interactions, types of infection and consequences. • Basics of immunology: immune system, antigens and antibodies. The immune response to microorganisms. • Active and passive immunization, types of vaccines, vaccination schedule in Croatia. • Antimicrobial drugs: classification, mechanism of action, resistance, methods of testing antimicrobial activity. • Sterilization and disinfection: methods and procedures; properties of disinfectants, antiseptics and preservatives and control of their effectiveness. • European Pharmacopoeia methods for microbiological quality control of drugs, efficiency of preservatives and other biological tests. • Species of genera <i>Staphylococcus</i>, <i>Streptococcus</i>, <i>Enterococcus</i>. • Species of genera <i>Corynebacterium</i>, <i>Listeria</i>, <i>Erysipelothrix</i>, <i>Lactobacillus</i>, <i>Gardnerella</i>. • Species of genera <i>Bacillus</i>, <i>Clostridium</i> and other anaerobic bacteria. • Actinomycetes; Species of genera: <i>Mycobacterium</i>, <i>Neisseria</i>, <i>Moraxella</i>, <i>Acinetobacter</i>. • Primary pathogenic and opportunistic enterobacteria.

- Species of genera *Pseudomonas*, *Vibrio*, *Campylobacter*, *Helicobacter*.
- Species of genera *Haemophilus*, *Pasteurella*, *Bordetella*, *Brucella*, *Francisella*.
- Species of genera *Treponema*, *Borrelia*, *Leptospira*.
- Species of genera *Mycoplasma*, *Ureaplasma*, *Chlamydia*, *Rickettsia*, *Coxiella*.
- Respiratory viruses, Mumps, Measles, Rubella, and other childhood exanthems, Enteroviruses, Hepatitis viruses.
- Herpesviruses, Viruses of diarrhea, Arthropod-borne viruses and other zoonotic viruses, Retroviruses, Papovaviruses, Prions
- Medically important fungi: Ascomycota, Basidiomycota, Zygomycota, primary and opportunistic mycoses.
- Mycotoxins and mycotoxicoses.
- Parasites from phylum Protozoa.
- Parasites from phylum Platyhelminthes and Nematodes.
- Arthropoda.
- News in Medical Microbiology.

EXERCISE

- Introduction to the organization, measures of protection and work in the microbiology lab. Preparing the slides for microscopy, staining methods in microbiology, microbial cell size measurement, types of growth media in microbiology.
- Micromorphological and physiological properties of some Gram-positive bacteria (*Staphylococcus aureus*, *Enterococcus faecalis*); *Neisseria gonorrhoeae* - methylene blue stained smear of uretra.
- Micromorphological, physiological and antigenic properties of some Gram-positive spore-forming bacteria (*Bacillus anthracis*, *Bacillus cereus*, *Clostridium* spp.); Methods of cultivation of anaerobic bacteria; *Corynebacterium diphtheriae* - Lubiński stain procedure for metachromatic granules; Physiological, micromorphological and staining properties of mycobacteria (*M. bovis* BCG strain).
- Antimicrobial susceptibility testing (diffusion and dilution, detection of beta-lactamase); determination of the antibiotic concentration in a sample using diffusion method.
- Application of selective and differential media for the isolation of some Gram-negative bacteria (Enterobacteriaceae); physiological characteristics of enterobacteria.
- Microbiological quality control tests of non-sterile pharmaceutical products according to the European Pharmacopoeia.
- Methods of cultivation and identification of medically important fungi (yeasts, dermatophytes, molds)
- Methods for virus propagation and detection of viral cytopathic effect .
- Morphological characteristics and diagnostically important stages of parasites (Protozoa: *Trypanosoma gambiense*, *Leishmania donovani*, *Giardia lamblia*, *Trichomonas vaginalis*, *Entamoeba coli*, *Cryptosporidium parvum*,

	<i>Plasmodium falciparum</i> ; Platodes and Cestodes: <i>Fasciola</i> , <i>Taenia saginata</i> , <i>Hymenolepis nana</i> , <i>Echinococcus granulosus</i>). <ul style="list-style-type: none">Morphological characteristics and diagnostically important stages of parasites (Nemathelminthes: <i>Ascaris lumbricoides</i>, <i>Enterobius vermicularis</i>, <i>Trichuris trichiura</i>, <i>Trichinella spiralis</i>); Arthropods-vectors of pathogenic microbes: <i>Ixodes</i>, <i>Sarcoptes</i>, <i>Musca</i>, <i>Anopheles</i> (<i>Culex</i>, <i>Aedes</i>), <i>Phtirius</i>, <i>Pulex</i>.				
2.6. Type of instruction	lectures seminars and workshops exercises online in entirety mixed e-learning field work	independent study multimedia and the internet laboratory work with the mentor (other)	2.7. Comments:		
2.8. Student responsibilities	Attending the lectures and practicum completed.				
2.9. Screening of student's work (specify the proportion of ECTS credits for each activity so that the total number of CTS credits is equal to the credit value of the course)	Class attendance	2	Research		Practical training
	Experimental work	1	Report		
	Essay		Seminar essay		(Other--describe)
	Tests	1	Oral exam	3	(Other—describe)
	Written exam		Project		(Other—describe)
2.1. Grading and evaluation of student work over the course of instruction and at a final exam	In grading and evaluation of student work class attendance and active participation in class activity, results of final test in practicum and oral exam are taken into account.				
2.2. Required literature (available at the library and via other media)	Title				
	S. Kalenić i i suradnici, Medinska mikrobiologija, Medicinska naklada, Zagreb, 2013.				
	V. Presečki, Virologija, Medicinska naklada, Zagreb, 2002.				
	G. Mlinarić Galinović, M. Ramljak Šešo i sur.: Specijalna medicinska mikrobiologija i parasitologija, Merkur A.B.D., Zagreb, 2003.				
2.12. Optional literature	e-articles: Croatian National Institute of Public Health, European Centre for Disease Prevention and Control (ECDC), World Health Organisation (WHO), European Medicines Agency (EMA)				
2.13. Methods of monitoring quality that ensure acquisition of exit competences	Learning outcomes 1-7 are evaluated by oral exam, and outcome 3 by test after completed practicum.				