COURSE DATA

Data Subject	
Code	34078
Name	Microbiology
Cycle	Grade
ECTS Credits	10.5
Academic year	2017 - 2018

Study (s)

Degree	Center	Acad. year	Period
1201 - Degree in Pharmacy	Faculty of Pharmacy and Food Sciences	2	Annual
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	2	Annual

Subject-matter

Degree	Subject-matter	Character
1201 - Degree in Pharmacy	12 - Microbiology	Obligatory
1211 - D.D. in Pharmacy-Human Nutrition and Dietetics	1 - Asignaturas obligatorias del PDG Farmacia-Nutrición Humana y Dietética	Obligatory

Coordination

Name	Department
ZUECO CRUZ, JESUS	275 - Microbiology and Ecology

SUMMARY

SUBJECT: Microbiology- 10,5 ECTS credits, compulsory.

- Introduction to Microbiology. Observation and structure of microorganisms.
- Nutrition and microbial metabolism.
- Development and control of microorganisms.
- Antimicrobial chemotherapeutic agents.
- Microbial Ecology. Parasitism in vertebrates.
- Microbial Genetics and Genetic Engineering.
- Virology and viral diseases.
- Bacterial Taxonomy. Bacteria as agents of poisoning and infectious diseases.
- Microscopic fungi and fungal infections.
- Introduction to Industrial Microbiology and Food Microbiology.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

It is recommended for students to have passed the subjects Biology and Physiology before enrolling.

OUTCOMES

1201 - Degree in Pharmacy

- To possess and to understand the knowledge in the different areas of study included in the formation of the pharmacist.
- To know how interpret, value and communicate relevant data in the different aspects of pharmaceutical activity, making use of information and communication technologies.
- Skill to communicate ideas, analyze problems and solve them with a critical mind, achieving team-working abilities and assuming leadership whenever required.
- Development of skills to update their knowledge and undertake further studies, including pharmaceutical specialization, scientific research and technological development, and teaching.
- Develop know-hows for their professional career.
- Know how to apply the scientific method and acquire skills for managing the main bibliographic sources.
- Know and apply correctly the vocabulary and specific terminology of Microbiology.
- Know the different types of microorganisms and understand their growth, both at the level of individual cells and populations, their requirements and the methods used for their control.
- Know the basic aspects of the biology of microorganisms in their structural, metabolic, genetic, ecological, taxonomic, evolutionary and applied aspects.

- Know and understand the criteria for classification and identification of microorganisms, with special emphasis on microorganisms of clinical and industrial interest.
- Understand the mechanisms of microbial pathogenicity and the importance of nonspecific and specific defenses against infection.
- Know the main biotechnological applications of microorganisms, sterility control systems for raw materials and finished products and techniques of microbiological control in the production processes of medicines.
- To master the basic techniques of the Microbiology laboratory, with special attention to the techniques of asepsis, sterilization, culture, isolation, visualization and identification of the basic types of microorganisms.

LEARNING OUTCOMES

It is expected that, as a result of his learning the student acquires a basic knowledge and understanding in the area of Microbiology and he/she is able to apply that knowledge to the various forms of professional practice.

Students will learn about the different types of microorganisms and understand how they grow, both at the individual and at population level, their growth requirements and the methods used for their control.

The students will acquire knowledge and understanding of the criteria for classification and identification of microorganisms, with special emphasis on micro-organisms of interest in the fields of human health and industry.

It is expected that the students understand the mechanisms of microbial pathogenicity and the importance of nonspecific and specific defenses against infection, and know the major groups of pathogens: viruses, bacteria and fungi.

Finally, it is expected that students master the basic microbiological techniques used in the laboratory, with special emphasis on aseptic techniques, sterilization, culture, isolation, visualization and identification of the basic types of microorganisms.

DESCRIPTION OF CONTENTS

1. INTRODUCTION TO MICROBIOLOGY

UNIT 1. INTRODUCTION AND HISTORY OF MICROBIOLOGY

1. Definition
2. Microorganisms and man
3. Brief History of Microbiology
4. Microbiology as a science

5. Microorganisms in the biological scale
6. Types of microorganisms
7. Types of cellular organization
8. Evolutionary relationships among living organisms

2. CELLULAR BIOLOGY

UNIT 2. OBSERVATION OF THE MICROORGANISMS
1. Introduction
2. Optical microscope
3. Techniques used in optical microscopy
4. Electron microscopy

UNIT 3. CELL ESTRUCTURE AND FUNCTION
1. Prokaryotic cell
2. Bacterial groups
3. Chemical composition of bacteria
4. Cell wall
5. Plasma membrane
6. Ribosomes
7. Nuclear region
8. Capsules and mucosal layers
9. Appendices
10. Reserve substances
11. Other intracytoplasmic structures
12. Bacterial spores

3. MICROBIAL NUTRITION AND METABOLISM

UNIT 4. MICROBIAL NUTRITION
1. Nutritional requirements
2. Types of culture media
3. Pure cultures
4. Special cultures
5. Storage of microorganisms

UNIT 5. MICROBIAL METABOLISM
1. Nutrient transport
2. Power Generation
3. Pyruvic acid formation
4. Nutritional types of bacteria
5. General principles of anabolism
6. Regulation of metabolism

4. MICROBIAL GROWTH AND CONTROL

UNIT 6. MICROBIAL GROWTH
1. Cell growth
2. Population Growth
3. Phases of population growth
4. Continued growth
5. Synchronous growth
6. Growth in natural conditions
7. Cell differentiation

UNIT 7. EFFECT OF THE ENVIRONMENT ON MICROBIAL GROWTH
1. Temperature
2. Water and osmotic pressure
3. Acidity and alkalinity (ph)
4. Oxygen concentration
5. Radiation

UNIT 8. CONTROL OF MICROORGANISMS
1. Introduction
2. Control by physical agents
3. Control by chemical agents

5. MICROBIAL ECOLOGY. PARASITISME IN VERTEBRATES

UNIT 9. MECHANISMS OF MICROBIAL PATHOGENICITY
1. Introduction
2. Pathogenicity and virulence
3. Bacterial Toxins
4. Mechanisms of transmission of infectious diseases

UNIT 10. INMUNOLOGY
1. Introduction
2. Antigens and antibodies
3. Immune response
4. The complement system
5. Artificial immunization, vaccination and serum therapy
6. Serological reactions for the identification of microorganisms

6. BACTERIAL GENETICS

UNIT 11. INTRODUCTION TO BACTERIAL GENETICS
1. Genetic characteristics of bacteria
2. Genotype and phenotype
3. Organization in operons

UNIT 12. MUTAGENESIS
1. Spontaneous and induced mutations
2. Techniques used for the generation and isolation of bacterial mutants
3. Conditional mutants
4. Mutation and evolution
5. Mechanism of action of mutagens
6. Ames test

UNIT 13. GENETIC RECOMBINATION IN BACTERIA. TRANSFORMATION
1. Genetic recombination in bacteria and limiting factors
2. Transformation experiments of Griffith, Avery, MacLeod and McCarty
3. Concept of genetic marker

UNIT 14. TRANSDUCTION
1. Generalized transduction
2. Especialized transduction

UNIT 15. CONJUGATION AND PLASMIDS
1. Concept and types of plasmid
2. F factor in E. coli
3. HFR strains
4. F´ Factor and sexduction
5. R Factors

UNIT 16. GENETIC ENGINEERING
1. Biotechnology and genetic engineering
2. Basic tools for genetic engineering
3. Cloning of a gene
4. Some applications of genetic engineering

7. THE VIRUSES

UNIT 17. INTRODUCTION TO VIROLOGY
1. Characteristics of the virus particle
2. Nucleic acids and proteins. Classification of viruses
3. Replication cycle
4. Bacterial virus: lytic and lysogenic cycles. Phage conversión
5. Other infectious agents: viroids and prions

UNIT 18. ANIMAL VIRUSES
1. General Features
2. Replication cycle
3. Latent infection
4. Techniques: diagnostic, culture and detection and particle count
5. Chemotherapy

UNIT 19 ADN VIRUSES THAT CAUSE DISEASE IN HUMANS
1. Parvoviruses
2. Adenoviruses
3. Papovaviruses
4. Herpes-viruses
5. Poxviruses

UNIT 20. ARN VIRUSES THAT CAUSE DISEASE IN HUMANS
1. Picornaviruses
2. Coronaviruses
3. Calciviruses
4. Arenaviruses
5. Rotaviruses
6. Filoviruses
7. Arboviruses
8. Orthomixoviruses. Influenzaviruses
9. Paramixoviruses
10. Rhabdoviruses

UNIT 21. HUMAN HEPATITIS VIRUS
1. HAV
2. HBV
3. HCV
4. HDV
5. HEV

UNIT 22. HUMAN INMUNEDEFICIENCY VIRUS
1. The beggining of the pandemic
2. Structure and genome
3. Replication cycle
4. The disease
5. Chemotherapy
6. Origin of the virus

8. BACTERIOLOGY. BACTERIAL TAXONOMY. BACTERIA AS AGENTS OF POISONING AND INFECTIOUS DISEASE

UNIT 23. ESPIROCHETES
1. Genus TREPONEMA. Treponema pallidum
2. Genus Borrelia. Borrelia recurrentes. Borrelia burgdorferi
3. Genus leptospira. Leptospira interrogans

UNIT 24. AEROBIC/MICROAEROPHILIC MOTILE HELICAL/VIBROID GRAM NEGATIVE BACTERIA
1. Genus CAMPYLOBACTER. Campylobacter jejuni
2. Genus HELICOBACTER. Helicobacter pylori

UNIT 25. AEROBIC GRAM NEGATIVE RODS AND COCCI
1. Genus PSEUDOMONAS. Pseudomonas aeruginosa
2. Genus LEGIONELLA. Legionella pneumophila
3. Genus NEISSERIA. Neisseria gonorrhoeae. Neisseria meningitidis
4. Genus BORDETELLA. Bordetella pertussis
5. Genus BRUCELLA. Brucella melitensis. Brucella abortus

UNIT 26. GRAM NEGATIVE FACULTATIVE ANAEROBIC RODS.
1. Genus ESCHERICHIA. Escherichia coli
2. Genus SHIGELLA. Shigella dysenteriae
3. Genus SALMONELLA. Salmonella typhi
4. Genus KLEBSIELLA. Klebsiella pneumoniae
5. Genus PROTEUS. Proteus mirabilis
6. Genus YERSINIA. yersinia pestis
7. Genus VIBRIO. Vibrio cholerae
8. Genus HAEMOPHILUS. Haemophilus influenzae. Haemophilus ducreyi

UNIT 27. RICKETTSIA AND CHLAMYDIA
1. Genus RICKETTSIA. Rickettsia prowazekii. Rickettsia conorii
2. Genus COXIELLA. Coxiella burnetii
3. Genus CHLAMYDIA. Chlamydia trachomatis

UNIT 28. GRAM POSITIVE COCCI
1. Genus STAPHYLOCOCCUS: Staphylococcus aureus.
2. Genus STREPTOCOCCUS:
a.1. Piogenic group: Streptococcus pyogenes
b.1. Oral group: S. pneumoniae, S. mutans y S. sanguis.

UNIT 29. SPORE FORMING RODS AND COCCI
1. Genus BACILLUS: Bacillus anthracis. Bacillus cereus
2. Genus CLOSTRIDIUM : Clostridium botulinum. Clostridium tetani. Clostridium perfringens. Clostridium difficile

UNIT 30. REGULAR NON-SPORE FORMING RODS
Genus LISTERIA: Listeria monocytogenes

UNIT 31. IRREGULAR NON-SPORE FORMING RODS
Genus CORYNEBACTERIUM: Corynebacterium diphtheria

UNIT 32. MYCOBACTERIA
Genus MYCOBACTERIUM: Mycobacterium tuberculosis. Mycobacterium leprae

9. MYCOSES

TEMA 33. FUNGAL DISEASES
1. Basic structure of microscopic fungi
2. Types of fungal infection: superficial, cutaneous, subcutaneous, systemic and oportunistic
3. Treatment

10. INTRODUCTION TO INDUSTRIAL MICROBIOLOGY AND FOOD MICROBIOLOGY

UNIT 34. BIOTECHNOLOGY AND INDUSTRIAL MICROBIOLOGY
1. Industrial microbiology and biotechnology
2. Microbial growth processes on a large scale
3. Main products obtained
4. Bioconservation processes
5. Biodegradation and control
6. Biosensors

UNIT 35. FOOD MICROBIOLOGY
1. Microorganisms and food spoilage
2. Alternatives for food preservation
3. Foodborne Illnesses
4. Microbiology of fermented foods
5. Microorganisms as food source

11. LABORATORY PRACTICALS

FIRST SESSION
- Aseptic technique for inoculation
- Single dye staining
- Negative staining

SECOND SESSION
- Gram staining
- Study of the effect of temperature on the production of pigments.
- Study the influence of incubation temperature on bacterial growth (7 days)

THIRD SESSION
- Reading of the tests inoculated the previous day.
- Study of the growth of microorganisms in selective, differential and enriched media.
- Study of the type of metabolism of microorganisms. Hugh-Leifson method.
- Counting of viable organisms. Plate count technique.

FOURTH SESSION

- Reading of the tests inoculated the previous day. Catalase.
- Study of the skin flora: Demonstration of the presence of mixed populations in nature.
- Study of the effect on the growth of different antimicrobial agents
- Detection and count of sulphite-reducing Clostridium.

FIFTH SESSION

- Reading of the tests inoculated the previous day.
- Cell wall staining
- Staining of spores

SIXTH SESSION

- Reading of the tests inoculated on the second day.
- Acid-fast staining.
- Study the effect of UV light on bacterial growth.
- Bacteriophage count.

SEVENTH SESSION

- Reading of the tests inoculated the previous day.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	68,00	100
Laboratory practices	28,00	100
Tutorials	4,00	100
Seminars	3,00	100
Development of group work	17,00	0
Preparing lectures	129,50	0
Preparation of practical classes and problem	10,00	0
TOTAL	**259,50**	

TEACHING METHODOLOGY

Classroom Theory (7,9 ECTS, 197,5 hours)

Lectures aimed at providing the student with basic knowledge.

- Presential 68 h
- Preparation and study 129,5 h

Laboratory practicals (1,52 ECTS, 38 hours)

They will be conducted in small groups and attendance is mandatory.

- Presential 28 h
- Preparation and study 10 h

Seminars (0,36 ECTS, 9 hours)

There will be two seminars on topics provided by the teacher and related to the module. The seminars will be submitted in writing and orally presented by students. Following the oral presentation the work will be opened for discussion among students, and moderated by the teacher.

- Presential 3 h
- Preparation and study 6 h

Tutorials (0,6 ECTS, 15 hours)

They will be structured in small groups and attendance is mandatory. Students will have the opportunity to ask questions about the course, and provide answers to short questions given beforehand.

- Presential 4 h
- Preparation and study 11 h

Exams (0,12 ECTS, 3 hours)

- Presential 3 h

TOTAL:

- Presential 106 h
- Non-presential 156,5 h

EVALUATION

The evaluation of the course will be done through an examination of the theoretical and practical content. In the final grade the seminars / work done by students will also be valued. The maximum final score a student can get is 10 points, broken down into:

1. Evaluation of theoretical contents, which corresponds to 90% (9 out of 10 points) of the final grade, and will be evaluated by performing two exams. A partial/first semester exam that is passed with a 50% of the maximum score, and a final exam/second semester exam that will be passed with a 50% of the maximum score. Students that had passed the first semester exam need only to take the exam of the second semester material, students that failed the first semester exam will have to sit the final exam. In addition, to pass both tests the student will need to have a balanced exam without clear deficiencies in any of the parts in which the program is divided. Oral exams may be part of the evaluation. To pass the subject, a minimum mark of 4,5 points out of 9 will be required in the exams of the first and second semesters or in the final exam if the student did fail the first semester exam. It is a prerequisite to have passed the exam/exams of the theory part of the subject to pass the subject.

2. Evaluation of practical contents: corresponds to 1 point (10%) of the final mark, being mandatory the completion of the practical classes (100% attendance) as well as an examination of the contents of practical classes for evaluation of this section. Assistance shall not be assessed as part of the note. Is a prerequisite to have passed the practical content exam to pass the subject.

Furthermore, it is an essential requirement to pass the practical part of the subject to obtain a minimum score of 2 out of 8 points on the examination of theory. Students who do not obtain this minimum score will have to retake the practical part and pass the exam of the practical part of the subject the following academic year.

3. Evaluation of seminars / voluntary work (uncoordinated with other subjects): they are valued on 1 point, and only serve to increase the final grade, provided that the student obtains a grade of 0.5 points and has passed both the exams of the theory and practical parts of the subject.

4. The final grade will be global, and to pass the course the student must independently approve both the theory and practical exams of the subject. Students who fail the subject in the academic year, can use the marks obtained in the practical exam and seminars / work for two additional academic years.

REFERENCES

Basic

- Madigan, M.T. et al. Brock: Biología de los Microorganismos (12ª Ed.). Prentice Hall. (2009).
- Willey, J. et al. Microbiología de Prescott/Harley/Klein (7ª Ed.). McGraw Hill. (2008).
- Tortora, G.J. et al. Introducción a la Microbiología (9ª Ed.). Panamericana. (2007)

Additional

- Murray, P. R. et al. Microbiología Médica (5ª Ed.). Elsevier. (2006)
- Black, J.G. Microbiology: Principles and Explorations (7th Ed.). Wiley. (2008)
- Tortora, G.J. et al. Microbiology: An Introduction (10th Ed.). Benjamin Cummings. (2009)