



Course Handbook

Ministry of Higher Education and Scientific research

Salahaddin University- Erbil

College of Education/ Shaqlawa

Biology Department

Third Stage: First Semester

Subject: Introduction to Microbiology

Academic Year: 2023-2024

Lecturer names:

Lec. Sherko Muhammed Abdul-Rahman (Theory)

Lec. Dr. Muayad Mahmood Ahmad (Practical)

Course Book

1. Course name	Introduction to Microbiology
2. Lecturer in charge	Assist. Lec. Sherko Muhammed Abdul-Rahman
3. Department/ College	Biology Dept./ College of Education/Shaqalawa
4. Contact	E-mail: sherko.abdulrahman@su.edu.krd, Mob.: 00964 750 445 6357 E-mail: muayad.mahmud@epu.edu.iq, Mob.: 00964 750 477 3872
5. Time (in hours) per week	Total (8) hours weekly: Theory (2) hrs. Practical. (2) hrs.
6. Office hours	2 Hours per week
7. Course code	EdB1405
8. Teacher's academic profile	<p>Education:</p> <ul style="list-style-type: none"> • Graduated from Nursing Preparatory School-Erbil in 1991-1994. • Obtained Diploma from Nursing Dept., Medical Technical Institute-Erbil in 1994-1996 • Obtained B.Sc. in Biology/Microbiology from college Science/ Salahaddin University-Erbil in 1996-2001. • Obtained Master in Management Business Administration (MBA)/Business Management University (BMU)/ Lebanon-French University in 2007-2010. • Obtained M.Sc. in Biology/ Microbiology from College Education/ Salahaddin University-Erbil in 2017-2019. <p>Thesis Title:</p> <ul style="list-style-type: none"> • Neonatal Sepsis: Bacteriological Profile, Molecular Detection and Antimicrobial Susceptibility Test Among Preterm Pediatric in Erbil City. <p>Experiences & Qualifications:</p> <ul style="list-style-type: none"> • He worked as a teacher in college of nursing from 2004-2016 during these periods of time, he tried to work in collaboration with university and health sectors to improve nurse's role and participated in many education trainings courses. Also, he worked to introduce graduated nurses from the college of nursing as new models of career in Erbil city's hospitals. • 2006 until 2010, Head of Planning & Follow up Department in College of Nursing. • 2004-2016 experience in Journalism field, writing many articles in newspapers and websites. • Excellent computer skills in the whole Windows and Microsoft Office versions. • More than 20 years' experience in managing of Companies administration. • He has been assigned as laboratory demonstrator in the Laboratory department between 2004-2016 in Nursing College, Hawler Medical

	<p>University. This included practical Biology (such as Zoology, and Pathogenic Bacteria, Physiology and Biochemistry) in the laboratories.</p> <ul style="list-style-type: none"> • He started to study M.Sc./Microbiology in 2019, at department of Biology/ College of Education/Shaqlaw, Salahaddin University-Erbil. Then, he started to work in the same department, as an assistant lecturer. • Member of the examination committee for College of Nursing from 2010-2016 except 2012, and at College of Education/Shaqlaw, from 2019 till now. • He worked as Registrar of college of Education /shaqlawa from 2019-2021. • Now, He is working as Head of Biology Department, college of Education /shaqlawa from 01-01-2021 till now. • Has six published researches from International Journals around Microbiology specialist. <p>Research and publications</p> <ul style="list-style-type: none"> • Has five published researches and one acceptance letter from International Journals around Microbiology specialist as following: <ol style="list-style-type: none"> 1. Neonatal sepsis: Bacteriological profile, molecular detection and antimicrobial susceptibility test among pre-term pediatrics in Erbil city, Iraq. https://zjms.hmu.edu.krd/index.php/zjms/article/view/767 2. Molecular detection of β-lactamase genes in Klebsiella pneumoniae and Escherichia coli isolated from different clinical sources.) https://pubmed.ncbi.nlm.nih.gov/35809290/ 3. Impact of Alcoholic and Aqueous Extracts of Annona Muricata on the Growth of Staphylococcus aureus and Escherichia coli Isolates. https://svu.journals.ekb.eg/article_273914.html 4. Serological Diagnosis and Epidemiological impact of Helicobacter pylori infection on human health in Diyala Governorate, Iraq. https://tjps.tu.edu.iq/index.php/tjps/article/view/57 5. Prevalence of Hepatitis B Virus Infection among General People and Hemophilia Patients in Erbil City, Iraq during 2020-2021. https://ejhm.journals.ekb.eg/article_277513.html#:~:text=Results%3A%20The%20overall%20HBV%20infection,caused%20by%20visiting%20dental%20clinics. 6. Application of Salmonella phages to reduce in-vitro and in-vivo colonization of Salmonella enteritidis and Salmonella typhi) Zanco J. Med. Sci., (Acceptance letter). <p>Training course & conferences:</p> <ul style="list-style-type: none"> • June, 2000, Ishik Language Center, participant in WOW course (Window of the World). • June 2005, Participant in First Nursing conference of Salahaddin University- Erbil. • Dec. 2006, participant in E-Learning Courses in college of Nursing broadcasted from Greece supported by KLIMAKA NGO.
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	<ul style="list-style-type: none"> • July, 2007 participant in Internet & Computer Courses in Technical Institute by KPA Center. • 2016-2019, completed four levels in face2face English language learning (Starter, Elementary, Pre-intermediate and Intermediate) in CIS institute center. • Competition of the pedagogical training for teacher professional development (30 ECTS) from 01.12.2019 - 01.06.2020. <p>Membership of professional Bodies:</p> <ul style="list-style-type: none"> • Member of Syndicate of Kurdistan Biological. • Member in Erbil Trading & Commercial Chamber. • Member in Kurdistan Journalists Syndicate. • Member in Kurdistan Teachers Union. <p>References:</p> <ul style="list-style-type: none"> • Prof. Dr. Badia Mohammed Najeeb, College of Nursing, Hawler Medical University, Erbil, Iraq. Mob.: 0750 488 80 59. • Prof. Dr. Adel Kamal Khedir, Department of Biology, College of Education, Salahaddin University- Erbil, Iraq. Mob.: 0750 447 29 08. • Assist. Prof. Dr. Farhad Ali Mustafa, Dean of College of Education/Shaqalawa, Salahaddin University- Erbil, Iraq. Mob.: 0750 455 39 19.
9. Keywords	Microbiology, Bacteria, Microbes and Microorganisms
<p>10. Course overview:</p> <p>Medical microbiology is both a branch of medicine and microbiology which deals with the study of microorganisms including bacteria, viruses, fungi and parasites which are of medical importance and can cause diseases in human beings. It includes the study of microbial pathogenesis and epidemiology and is related to the study of disease a pathology and immunology. Microorganisms have a tremendous impact on all life and the physical and chemical makeup of our planet. They are responsible for cycling the chemical elements essential for life, including carbon, nitrogen, sulfur, hydrogen, and oxygen; more photosynthesis is carried out by microorganisms than by green plants. This course will introduce students to the microbial species that cause human disease. We will cover bacteria, fungi, viruses, and protozoa, an discuss current topics including antibiotic resistance, public health threats, and global health. Humans also have an intimate relationship with microorganisms; more than 90% of the cells in our bodies are microbes. The bacteria present in the average human gut weigh about 1 kg, and a human adult will excrete his or her own weight in fecal bacteria each year.</p>	
<p>11. Course objective:</p> <p>The primary goal is to enhance communication between the community, teachers, students and parents. The Medical Microbiology courses will provide opportunities for students to develop and communicate an understanding of microorganism such as bacteria, viruses, fungus and other prokaryotic organisms. Concepts covered in this course include introduction to science of microbiology, classification, identification, pathogenesis, immunity and protection, the important medical microbes, soil microbes, natural water, sewage and atmosphere microbes, food and dairy products microbes, and industrial microbiology.</p>	

12. Student's obligation

The purpose of this course is to establish the student pharmacist's foundation in the principles of medical microbiology, immunology and virology that will build upon the knowledge and skills gained in the Pathophysiology and Patient Assessment course sequence. In order to successfully manage a patient with an infectious disease, the student pharmacist must first understand the role of the host's immunologic response and the burden of disease caused by clinically important pathogens. The content in this course will lay the foundation for the subsequent patient care series where the pharmacology and medicinal chemistry of anti-infective agents and pharmacotherapy of infectious diseases will be learned and applied to optimize the care of a patient

13. Forms of teaching

Different forms of teaching will be used to reach the objectives of the academic year. Power point presentation for the head titles, definitions, classification of materials and any other illustrations. Worksheets will be designed to let the chance for practicing on several aspects of the course in the class room. Furthermore, student will be asked to prepare research papers on selective topics and summaries articles content. There will be classroom discussions, solve, analyze and evaluate problem sets, and different issues discussed throughout the year. To get the best of the course, it is suggested that the student attend classes as much as possible.

The student will be advised to read the required lectures, teacher notes regularly as all of them are foundation for the course. Lecture notes are fore supporting and not for submitting the reading material including the hands-out. The students are directed to participate in class room discussions as much as possible, preparing the assignment given in the course.

14. Assessment scheme:

No.	Exam (Evaluation)	Marks
1	Student presence	1%
4	Lab Activities	1%
5	Mid-term Exam	13%
6	Total Scores	15%

15. Student learning outcome:

The purpose of this course is to establish the student pharmacist's foundation in the principles of medical microbiology, immunology and virology that will build upon the knowledge and skills gained in the Pathophysiology and Patient Assessment course sequence. In order to successfully manage a patient with an infectious disease, the student pharmacist must first understand the role of the host's immunologic response and the burden of disease because disease caused by clinically important pathogens. The content in this course will lay the foundation for the subsequent patient care series where the pharmacology and medicinal chemistry of anti-infective agents and pharmacotherapy of infectious diseases will be learned and applied to optimize the care of a patient

16. Course Reading List and References

Foundations in Microbiology by Talaro, K.P. 2008

- Klein`s Microbiology by Willey, J., and Woolverton, C. 2007
- Medical Microbiology and immunology (2012) wareen levinson.
- Microbiology (2009), Robert Bauman
- Medical Microbiology (2012), jawetz Kavanagh, K. (2005). Fungi Biology and Applications. John Wiley & Sons Ltd, the Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.
- Brooks, G. F.; Carroll, K. C.; Butel, J. S. and Morse, S.A. (2007). Jawetz, Melnick; and Adelberg`s Medical Microbiology, 24thed. McGraw-Hill Companies, U.S.A.
- Webster, J. and Weber R. W. S. (2007). Introduction to Fungi. 3ed ed. Published in the United States of America by Cambridge University Press, New York- USA.
- Hospenthal, D. R.and. Rinaldi, M. G. (2008). Diagnosis and Treatment of Human Mycoses. Humana Press Inc, USA.
- Rogres,K. (2011). Fungi, Algae, and Protists. Britannica Educational Publishing (a trademark of Encyclopadia Britannica in association with Rosen Educational Services), New York-USA.

17. The Topical Theory

1- A Brief Introduction to Microbiology

2- Microbial Interaction

3. Disease Transmission

4- Taxonomy (classifications of microorganism)

5-The Classification and Identification of Bacteria:

A. Bacterial shapes

B. Bacterial cell walls

C. Properties associated with bacterial cell walls the genetic makeup of bacteria

6-The Human Normal Flora in Health and Disease.

7-Microorganisms in Health and Disease.

8-The Growth, Survival, and Death of Microorganisms and Microbial Nutrition-Cultivation of Microorganisms

9-Antimicrobial Drugs----- Antiviral and anti-parasitic drugs

10-pathogenesis of Bacterial Infection

11-The Fungi and The Algae

12-Seasonal Examination.

13-Physical and Chemical Agents for Microbial Control

14-The viruses: major groups of viruses. Structure, replication, infection of host cell, outcome of viral infection, viral pathogenesis.

Practical Microbiology

1. Course overview

Microbiology involves the study of microscopic organisms - viruses, bacteria, fungi and protozoa. Microorganisms are everywhere - in our bodies, our food, the air, soil, and water. Because they're everywhere, they're involved in almost every aspect of our lives.

They are used in producing foods such as cheese, wine, and beer, as well as many pharmaceutical, chemical, and agricultural products. They are important for soil fertility and the decomposition of materials, but can cause major diseases in humans, animals, and plants.

This course will introduce the basic principles of Microbiology (especially bacteriology). The course related to basic principles of bacteria, detailed consideration of bacterial structures, and an integrative approach to understand how you can recognize bacteria to prevent from create and spreading of human diseases.

The first weeks of the course will address general and special rules, which make the insurance of the health of all students that participate in the work of all labs. We will next focus on tests and address topics in sterilization, instruments which used for this purpose, bacteria, shapes of it, colonies, media which used for culturing and store the bacterial isolates, bacterial counts to detect the normal flora in the source which take from it. The laboratory will cover the basic techniques and procedures commonly used in clinical bacteria. Student presentations during the last few weeks of the course will address special topics in Microbiology or all procedures, which related and perform in the bacterial labs.

2. Course objective

Upon the completion of the course, students will have

- Practical skills on handling, isolation, identification and enumeration of bacteria, yeast and molds.
- Advanced practical skills on molecular techniques to study microbial genetics.
- Advanced practical skills on immunological and serological techniques.

Microbial Structure and Physiology

Bacterial Morphology

- Microscopy and Staining

Microbial Physiology

- Measurement of bacterial growth and determination of bacterial growth curve in broth medium
- Enumeration techniques
- Effect of environmental factors on bacterial growth
- Temperature, pH, nutrients, water activity
- Biochemical identification of unknown bacteria (Gram positive, gram negative).
- Antimicrobial Susceptibility Test.

3. Student's obligation

The role of students and their obligations throughout the academic year include:

- Quizzes and daily activities
- 1st Theory Exam
- 2nd Theory Exam
- Lab Activities
- Practice and Lab. reports
- Practical Examination
- Final Theory Exam
- Final Practical Exam.

4. Forms of teaching

Teaching method used in our lab

- Data show and power point
- White board
- Paper of lectures

5. Assessment scheme

No.	Exam (Evaluation)	Marks
1	Student presence	1%
4	Lab Activities	4%
5	Mid-term Exam	30%
6	Total Scores	35%

6. Student learning outcome

A microbiology laboratory, or lab, is the primary place that a working microbiologist not in the field can be found. It is in the lab that most of the testing, culturing, and research that they do occurs. This location contains the supplies and equipment needed for these activities, as well as provide an extremely clean and sterile place to work.

In order to understand what occurs in a microbiology lab, what a microbiologist does should be understood. A microbiologist studies very small life forms, including bacteria, viruses, and fungi. These life forms live everywhere — in the soil, in the air, in the water, and even inside animals. Many of these life forms are so small that they cannot be seen by the unaided eye, and are called microorganisms. Often, a microbiologist will have to separate and grow the microorganisms in order to better see, study, and experiment on them. All of these activities occur in the lab.

Most look like any other biology or chemistry lab. They will probably have long lab benches where scientists can easily set up their equipment and work. Large, partially clear fume hoods will be present in order to keep the scientists safe from any dangerous experiments, though the fume hoods in a microbiology lab may contain special ultraviolet (UV) lights that hinder and kill some microorganisms.

1. Review of historical development of microbiology
2. Recognize types of microorganisms that cause infectious diseases.
3. Interpret diagnostic methods and laboratory findings to make the ultimate diagnosis.
4. Understanding principles and methods of sterilization relative to health care.
5. Using microscope perfectly and demonstrate slide preparation processes.

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6. The principles of chemotherapy through the use of appropriate antimicrobial agents and lab techniques.
7. Collecting clinical specimens and disposal of contaminated materials.
8. Introducing to the principles of body defence against infections.

Practical Topics

1st week

Sterilization

- Definition of sterilization
- Types of sterilization
- Methods and instruments that used in Sterilization

Aims of Sterilization

Knowing the types and methods used for killing of bacteria and which one is the best for this purpose.

2nd week:

Bacterial Culture Media

- Definition, sources and classification of Cultural Media
- Preparation of culture media

Aims of Culture Media

To determine and know the ingredient and chemical composition of culture media, using for what purpose and classification of culture media according of different style and also using the culture media for classification of bacteria.

3rd week

Bacteria

Definition, shapes, and colonies of Bacteria

Aims of this lab

Using the shape (morphological properties) and colonies (cultural characteristics) for classification of bacteria.

4th week

Establishing pure culture of bacteria

- Streaking method
- Patterns of Streaking method

Smears and Preparation

Types of Smears

Characteristics and Properties of Smear

Aims of Smear preparation

Prepare the bacteria to staining because without smear cannot do staining and see the bacterial cells under microscope except in negative stain which not require smear preparation (modified smear preparation).

5th week

Bacterial Staining Methods (Staining Methodology)

The Aims of Staining

Types of Stains in Microbiology

- Simple Stains
- Basic, Direct or Positive Stains
- Acidic, In – Direct or Negative Stains
- Differential or Compound Stains
- Gram Stains
- Acid Fast Stains
- Structural Stains
- Capsule Stain
- Spore Stain
- Cell Wall Stain
- Nuclear Stain

Simple Stains

- Basic, Direct or Positive Stains
- Acidic, In – Direct or Negative Stains

Aims of staining

See the bacterial shape, colour and arrangements of bacterial cells under oil lens of microscope, typing and classification depend upon of this case. In the other hand, compare between positive and negative stain to staining the bacterial cells and how can different between them.

6th week

- Gram Stain
- Components of Gram Stains
- Different between Bacteria according to Gram Stain

Aims of Gram Staining

Discrimination and differentiation of bacteria in to large groups (positive and negative bacteria) in response to take the colour of each stain which use in the method.

7th week

- Capsule Stain
- Definition, types, functions and methods of capsule staining

Aims of Capsule Staining

Staining the bacterial capsule cannot be accomplished by ordinary simple staining procedures. The problem with trying to stain capsules is that if you prepare a heat fixed smear of the organism by ordinary methods, you will destroy the capsule; and, if you do not heat fix the slide, the organism will slide off the slide during washing. In most of our bacteriological studies our principal concern is simply to demonstrate the presence or absence of a pronounced capsule. This can be easily achieved by combining negative and simple staining techniques. To learn about this technique, prepare a capsule “stained” slide of *Klebsiella pneumoniae*.

8th week

Endospore Stain

Definition, types, functions and methods of bacterial endospore staining

Aims of Endospore Staining

To differentiate between organisms that can produce endospores and those that cannot. Also allows differentiation based on the position of the endospore in the cell.

9th week:

Movement of Bacteria (Flagella Stain)

- What is mean by Bacterial Movement?
- Types of Bacterial Movement
- Structure of Flagella
- Classification of according to Presence (Number and Position) and Absence of Flagella
- Methods for Detection of Bacterial Movement

Aims of Bacterial Flagella staining

To determine bacterial motility.

10th week:

Total Number Count of Bacteria

What is (are) the Purpose (s) of the Bacterial Counting

Aims of Bacterial counting methods

1. To learn the different techniques used to count the number of microorganisms in a sample.
2. To be able to differentiate between different enumeration techniques and learn when each should be used.
3. To have more practice in serial dilutions and calculations.

11th week

Types of Bacterial Counting

Direct Method (Slide Method)

1. In-Direct Methods
Standard Plate Count.

12th week

2. In-Direct Methods

Optical Density method (Spectrophotometer).

13th week

2. In-Direct Methods
3. Most Probable Number (MPN).
A. Physiological Identification.

7. Examination

8. Question Bank:

1. Explain the following briefly

1. Insertion of Durham tube in MPN test.
2. If you have unknown bacterium, how you can identify this bacterium?

2. True or false type of exams: Put (T) in front of true sentences and (F) in front of false sentences

3. The first step in the identification procedure is to accumulate information that relates to the organisms' morphological, cultural, and physiological characteristics. True

3. Multiple choices: From the options, chose the correct one to complete the meaning of sentences.

1. Remove of microorganisms can be performed by.....:
A. Pasteurization. B. Thermal sterilization. C. Cooling. D. Centrifuge.

4. Write the differences between the following

1. Removes and Destruction of microorganisms in sterilization

5. Count only

1. Classification of culture media Based on consistency.

6. Correct the following false sentences

1. Endospore usually consists of polysaccharides, but can be composed of other materials.

7. Calculate if

A – Find the bacterial cells number in a 1 ml of distilled water, when you add 0.1 ml from the tubes into plates and the number of colonies in tubes number 1, 2, 3 and 4 from serial dilution were 300, 137, 39 and 25 respectively.

B – How you prepare 10 ml of a stock solution containing 1,000 µg/ml of 2 mg ampicillin antibiotic with a potency of 1000 µg/mg?

8. Choose the words or phrase from column B which fitted to the words in the column

- | | |
|-------------------------|---|
| 1. Intrinsic resistance | A. Optimum Temperature: ~10 °C |
| 2. Aims of Staining | B. applied to living tissue/skin to reduce the possibility of infection |

9. Review