



Course Handbook

Ministry of Higher Education and Scientific research

Salahaddin University- Erbil

College of Education/ Shaqlawa

Biology Department

Third Year: Second Semester

Subject: Microbiology

Academic Year: 2022-2023

Lecturer names:

Assist. Lec.: Sherko Muhammed Abdul-Rahman (Theory)

Assist. Lec: Iman Abdonafi Muhammad (Practical)

Course Book

1. Course name	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 iman.muhammad@su.edu.krd, Mob.: 00964 750 485 7761
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	EdB2307
8. Teacher's academic profile	<p><u>Education:</u></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><u>Thesis Title:</u></p> <p>Neonatal Sepsis: Bacteriological Profile, Molecular Detection and Antimicrobial Susceptibility Test Among Preterm Pediatric in Erbil City.</p> <p><u>Experiences & Qualifications:</u></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

- University. This included practical Biology (such as Zoology, and Pathogenic Bacteria, Physiology and Biochemistry) in the laboratories.
- 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.
 - He has three published researches from International Journals mostly around Microbiology as following:
 1. <https://zjms.hmu.edu.krd/index.php/zjms/article/view/767>
 2. https://scholar.google.com/scholar?q=Neonatal+sepsis:+Bacteriological+profile,molecular+detection+and+antimicrobial+susceptibility+test+among+pre-term+pediatrics+in+Erbil&hl=en&as_sdt=0&as_vis=1&oi=scholar
 3. https://scholar.google.com/scholar?q=Molecular+detection+of+%CE% B2-lactamase+genes+in+Klebsiella+pneumoniae+and+Escherichia+coli+isolated+from+different+clinical+sources&hl=en&as_sdt=0&as_vis=1&oi=scholar

Training course & conferences:

- 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.
- 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.

Membership of professional Bodies:

1. Member of Syndicate of Kurdistan Biological.
2. Member in Erbil Trading & Commercial Chamber.
3. Member in Kurdistan Journalists Syndicate.
4. Member in Kurdistan Teachers Union.

	<p>References:</p> <ol style="list-style-type: none"> 1. Prof. Dr. Badia Mohammed Najeeb, College of Nursing, Hawler Medical University, Erbil, Iraq. Mob.: 0750 488 80 59. 2. Prof. Dr. Adel Kamal Khedir, Department of Biology, College of Education, Salahaddin University- Erbil, Iraq. Mob.: 0750 447 29 08. 3. 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, Virus and Fungus
<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>	
<p>12. Student's obligation</p> <p>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</p>	

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 for 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. 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

15. 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.

- Hospenhal, 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 Encyclopaedia Britannica in association with Rosen Educational Services), New York-USA.

16. The Topical Theory

1. Sterility testing of all pharmaceutical products.
2. Microbial assays of antibiotics, vitamins & amino acids.
3. Immunity, primary and secondary, defensive mechanisms of body, microbial Resistance, interferon
4. Impact of infectious diseases, Koch's postulates, Host Response: Innate immunity, Host Response: Acquired Immunity (B cells), Host Response: Acquired Immunity (T cells)
5. Serum and vaccines
6. Microbiology of the water and sewage-- Microbiology of the Soil an Environmental and Applied Microbiology-
7. Microbiology of the atmosphere. An Industrial Microbiology of the food and dairy products.
8. Microbial Toxins-
9. Pathogens –Cholera -Enteric pathogens – Salmonella, Shigella, E. coli
10. Extracellular pathogens –Staphylococcus, Streptococcus
11. Facultative intracellular pathogens –Mycobacterium Obligat intracellular pathogens –Chlamydia, Rickettsia
12. Accidental pathogens – Pseudomonas, -Chronic pathogens – Helicobacter pylori
13. Sexually transmitted diseases –Gonorrhea, Syphilis Zoonoses – Borrelia burgdorferi-Bioterrorism – Anthrax
14. Viruses transmitted via air: Influenza, Rhinovirus, Viral diseases of childhood: Measles, Mumps- Viruses transmitted via food or water: Rotavirus, Polio, Hepatitis A, Oncogenic viruses: Human
15. Papillomavirus, KSHV, HTLV Latent viruses: HSV
16. Fungal pathogens

17. Examinations:

Seasonal Examination & Final Examination

18. Questions Bank Example:

Q/ Fill the following blanks:

1. Sterilization destroys or removes microorganisms on the external of an instrument or in a liquid.
2. Microscope an instrument which is used for viewing objects that are small to be seen easily by the naked eye
3. Hot air sterilization place objects in an oven, require 1 hour at 160oC or 180°C for for sterilization. Used to sterilize glassware.
4. In preparation of culture media, we should be pouring the medium into sterile empty petri dishes into each petri dish.
5. = ocular power X objective power
6. Oven is a machine which used for sterilization of medical instruments, especially glassware, glass syringes, as well as instruments (Forceps, Scissors, Swabs).
7. In microbiology..... is a technique used to isolate a pure strain from a single species of microorganism, often bacteria.
8. Endospores and some viruses are destroyed quickly by boiling.
9. Aims of pasteurization is reduce the number of viable pathogens in liquids, so they are unlikely to
10. Agar is a polysaccharide extracted from marine algae, it at 95oC.

Q/ Match the following items from (column A) to (column B).

Q/ Put (T) for true, (F) for false sentences, and Correct the false sentences.

1. Disinfection reducing the number of pathogenic microorganisms usually involves the removal of vegetative or non-endospore forming pathogens.
2. Cool the sterilized medium to 4.7 - 55°C. Take out the cotton plug and flame the mouth of the flask over a Bunsen burner.
3. Antiseptic chemical inhibits the growth of microorganisms and applied to living tissue.
4. Fine adjustment larger knob, moves the objectives slightly and allows for fine focusing.
5. Solid media (agar) most commonly used for morphology, pigmentation, hemolysis, such as Blood agar
6. Synthetic Medium prepared from pure chemical substances: e.g., peptone water (0.5% peptone + 1% NaCl in water)

7. Lawn culture are providing a uniform surface growth of the bacterium.
8. Ionizing radiation used mainly in industrial facilities e.g., sterilization of disposable plastic syringes, gloves, specimens' containers and petri dishes.
9. Ethylene oxide kill microorganisms by damaging RNA and protein, used to sterilize disposable medical devices.
10. Blood agar used to distinguish bacteria that destroy red blood cells and platelets (hemolysis).
11. Q1: Put (T) for true, (F) for false sentences, and Correct the false sentences. /24 Marks
12. The Kirby Bauer test is a qualitative assay whereby discs of paper are impregnated with a double concentration of different antibiotics. The discs are placed on the surface of an agar plate that has been inoculated with tested bacteria.
13. Many bacteria, including both gram-positive and gram-negative, may be surrounded by an outer polysaccharide containing layer termed the capsule.
14. During the procedure of bacterial smear preparation, spread the droplets over a circular area in the lateral of the slide, and allow the slide to dry
15. Catalase test is used to identify organisms that produce the enzyme catalase, this enzyme detoxifies oxygen peroxide by breaking it down into water and oxygen gas.
16. A good smear preparation should be a thick layer of cells so that individual cells can be observed.
17. Oxidase test is used to identify microorganisms containing the enzyme cytochrome oxidase. (use the dropper to add a drop of rabbit plasma to the bacteria on the filter paper, and look for the appearance of blue or purple spots, a positive result.
18. In Gram staining techniques, crystal violet acts as the primary stain, it may also be used as a complex stain because it dyes the cell wall of any bacteria.
19. Antimicrobial susceptibility testing (AST), is a widely-used method of evaluating non fastidious bacteria resistance and determining patient treatment plans in clinical settings.
20. Motility test is used to determine whether an organism is capable of distinguish away from a stab mark.
21. Staining is an auxiliary technique used in microscopy to enhance contrast in the microscopic image.
22. Streptococcus agalactiae produces a polysaccharide capsule of (9) antigenic types that all contain sialic acid (Ia, Ib, II, III, IV, V, VI, VII, VIII).

23. The cell wall of Gram-negative bacteria is more chemically complex, thinner and more compact.

Q/ Fill the following blanks

1. Capsules are usually composed of polysaccharides; however, they may also contain and polyamines.
2. The purpose of the diffusion susceptibility test is to determine the sensitivity or resistance of pathogenic aerobic and facultative anaerobic bacteria to various antimicrobial compounds in order to assist a physician in selecting treatment options for his or her patients.
3. A stain or dyes is a substance that adheres to a cell, giving the cell color, the of color gives the cells significant contrast so they are much more visible.
4. Differential stains use two or more stains and allow the cells to be categorized into various groups or types, both the techniques allow the observation of cell morphology, or shape, but differential staining usually provides..... information about the characteristics of the cell wall (Thickness).
5. The Oxidase test can be performed by plate method and wet filter paper method, e.g., Oxidase test negative: Escherichia coli and
6. Bacteria have the ability to develop resistance followingor sub clinical (insufficient) doses, so more advanced antibiotics and synthetic antimicrobials are continually required to overcome them.
7. Differentiation of bacteria into Gram positive and Gram negative is the step towards classification of bacteria in Gram staining technique.
8. Pass the slide slowly through the flame of a Bunsen burner 3-4 time to the bacteria to the slide.

Q / Multiple choice/ Choose the best answer.

1. The normal residents include an array of bacteria, fungi, protozoa, and, to a certain extent, viruses and
2. Micrococcus
3. Arthropods
4. Diphtheria
5. None of them

Q / Compositional: Explain the following briefly.

- Q / True or false type of exams: Put (T) in front of true sentences and (F) in front of false sentences.
- Q / Multiple choices: From the options, chose the correct one to complete the meaning of sentences.
- Q / Write the differences between the following.
- Q / Count only.
- Q / Correct the following false sentences.
- Q / Calculate if
- Q / Choose the words or phrase from column B which fitted to the words in the column A:

19. Assessment scheme:

No.	Exam (Evaluation)	Marks
1	Student presence	2%
4	Theory Activities	3%
5	Mid-term Exam	10%
6	Total Scores theory	15%
7	Total Scores practical	35%
8	Final Exam	50%

I do approve the content of this course-book. It does cover the general concepts of general virology. The topics are broad and are aimed to equip students with required knowledge to enable them to understand the viruses concept equipment in latter stages.

Assist. Lec. Sherko Muhammed Abdul-Rahman
MSc. in Microbiology

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

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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	5%
4	Lab Activities	10%
5	Mid-term Exam	20%
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.
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

Week 1

Antibiotics

Differences between Drugs and Antibiotics

Sources of Antibiotics

Mechanical Action of Antibiotics

Mechanisms of Bacterial Resistances against Antibiotics

Aims of antibiotics study

1. To utilize specific monitoring techniques to evaluate the susceptibility of a microbe to different antibiotics.
2. To distinguish the range of activity of an antibiotic.
3. To recognize and define advantages and limitations of two different susceptibility testing procedures.

Week 2

Methods of Antibiotic Susceptibilities

1. Disc Diffusion Methods
2. Dilution Method (MIC and MBC)
3. Agar Dilution Method

Methods of Antibiotic Susceptibilities

Week 3

Methods of Antibiotic Susceptibilities
Dilution Method (MIC and MBC)

Minimum Inhibitory Concentration and Minimum Bactericidal Concentration.

Week 4

- Methods of Antibiotic Susceptibilities
- Agar Dilution Method

Week 5

Environmental Factors Directly Affecting on Microbial Growth

1. Temperature
 2. Salinity and Osmosis
 3. Oxygen Requirement
 4. Effects of Antiseptics and Disinfectants on Bacterial Growth
- **Effect of temperature on the growth of bacteria**

Aims of Environmental Factors Directly Affecting on Microbial Growth

To detect the effect of some environmental factors on bacterial growth to choose the best one for inhibit and stop the bacterial growth around our environment and prevent the spread the diseases caused by bacteria.

Week 6

Environmental Factors Directly affecting on Microbial Growth

Week 7

- Effects of osmosis and water activity on bacterial growth
- Environmental Factors Directly affecting on Microbial Growth
- Effects of Oxygen on Bacterial Growth

Week 8

Environmental Factors Directly affecting on Microbial Growth
Effects of Antiseptics and Disinfectant on Bacteria Growth

Week 9

Environmental Factors Directly affecting on Microbial Growth
The effect of pH on the growth of bacteria.

Week 10

API System

- Types of API
- Analytical Profile Index 20 Enterobacteriaceae
- How We do the API 20E?

Aims of API System

- Learn how to perform and interpret the miniaturized, multi-test technique for bacterial identification.

Week 11

Bacteriological Test for Water

Detect the bacterial number in the tested water

1. Presumptive test
2. Confirmed test
3. Complement test

Aims of Bacteriological Test for Water

Evaluate the purity of water and determine the number and types of bacteria (if present) in the drinking water.

Week 12

Bacteriological Test for Water

Detect the bacterial type (fecal bacteria) in the tested water.

Week 13

Identification of Unknown Bacteria

Principle of identification and differentiation of Bacteria

- A. Direct Examination and Techniques
- B. Cultural Identification and Distinguishing of Human Pathogenic Bacteria

6. Examination

7. 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