

SIXTEEN WEEK TEACHING PLAN

Course& Course Code	Applied Microbiology ZOOL-4106
Credit Hours	3
Department	Life Sciences (Zoology)
Course Type:	Theory
Theory/Lab	Theory
Program	Zoology
Semester	Spring-2024
Course Instructor name/Designation	Dr. Ammara Riaz, Assistant Professor
Office	BSH building, 1 st floor
Office Hours/Counseling hours for students	8:00amto 4:00pm
Email ID:	ammara.riaz@kfueit.edu.pk

Note: For practical /lab work, a separate teaching plan can be prepared.

Week1	
Objectives	Course Objectives: The will provide: • Control of Microorganisms • General considerations in microbial control • Relative resistance of microbial forms • Terminology and methods of microbial control • What is microbial death? • How antimicrobial agents work: their mode of actions • Physical methods of control : Heat • Effects of temp on microbial activities • Effects of cold and desiccation • Physical methods : radiation and filtration • Chemical agents in microbial control
Learning Outcome	Students will be able to learn about : a) Microorganisms b) Their reduction in numbers or acitivity on microbial flora Eg. Skin , on surface and everywhere in environment. c) Control of microbes to prevent transmission of diseases d) To prevent deterioration or spoilage of materials by microbes e) Genral considerations in microbial control f) Two categories of control that comprises

	g) Physical and chemical controls h) Which method of control will be better? eg pasteurization is fine for milk, but insufficient for sterilizing surgical instruments (for which autoclaving would be a better method). i) Relative resistance of microbial forms that contaminating an area or causing infection: highest resistance, moderate resistance, least resistance j) Terminology and methods of microbial control k) What is microbial death? Environmental or physical factors that allow organisms to grow can also be used to prevent their growth. 1. Chemical agents can also be used to control or prevent the growth of microbes. 2. The number of microorganisms. The higher the cell count longer it will impact. The nature of the microbial population. Are resistant forms present? 3. The temperature and pH of the environment. 4. The concentration of the antimicrobial. 5. The mode of action means how something works on a bacterium. Does it act on the nucleic acids, the cell membrane, the cell wall, etc.? 6. The presence of solvents, interfering organic matter or inhibitors. How antimicrobial agents work Their mode of action by using physical or chemical agents that target their ; .cell wall .cell membrane .protein and nucleic acid synthesis .protein function i) Physical method of control ; heat ii) Its impact on microbial activity iii) The mode of action is protein denaturation: membrane disruption, and nucleic acid damage iv) Thermal death time refers to the shortest period of time to kill a suspension of bacteria: The two procedures employed for high heat are moist heat and dry heat. v) Moist heat that include : autoclaving, intermittent sterilization, boiling water and pasteurization vi) Dry heat that includes : Hot air sterilization and Incineration vii) The effects of cold and desiccation. viii) Physical method of control by radiation and filtration that UV rays ,x-rays, gamma rays and cathod rays ix) Filtration control of microbes that is generally used on liquids that are heat-sensitive x) Chemical agents in microbial control that comprises of different chemical agents eg. Halogens, phenols, alcohol and hydrogen peroxide
Contents/ SubContents	Control of microorganisms: Fundamentals of control by physical and chemical agents,
Appropriate Teaching Strategies / Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts

Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly
Others	Nil
Week2	
Objectives	1. Antibiotics and chemotherapeutic agents • Definition of an antibiotic • Types and examples of antibiotics • Antibiotic Efficacy (How well does the antimicrobial agent work?) 2. microorganisms and diseases 3. host microbe interactions
Learning outcomes	Students will be able to learn about : • Antibiotics and chemotherapeutic agents, its definition ,types, examples, broad and narrow spectrum of antibiotics ,antimicrobial mode of actions • Inhibition of Cell wall formation • Inhibition of Protein synthesis 2. microorganisms and diseases 3. host microbe interactions, causes and prevention diseases that cause by microorganisms: • Coliform Bacteria are mostly the cause of Urinary Tract Infections. • Food poisoning due to bacterial pathogens. • Cholera • Tetanus • Botulism • Anthrax • Tuberculosis • Cough • Vaginitis due to bacterial attacks.
Contents/ SubContents	Control of microorganisms: antibiotics and other chemotherapeutic agents. Microorganisms and diseases: Host-microbe interactions.
Appropriate Teaching Strategies/Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts
Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly

Others	Nil
Week3	
Objectives	Course Objectives: This will provide: 1. resistance and immunity 2. air, food, water borne human disease Types of airborne diseases: • Covid_19 • Common cold • Influenza • Chicken pox • Mumps • Measles • Whooping cough • Tuberculosis • diphtheria
Learning outcomes	Types of food diseases; • campylobacter • toxoplasma • salmonella Types of water- borne diseases; • dysentery • cholera • typhoid • hepatitis A (HAV) • poliomyelitis (polio) • desmodermus infection by algae students will be able to learn about ; The natural resistance with which a person is born. It provides resistance through several physical, chemical, and cellular approaches The creation of immunological memory after an initial response to a specific pathogen, leading to an enhanced response to subsequent encounters with that same pathogen. This process of acquired immunity is the basis of vaccination. Moreover students will be able to learn about different types of diseases that are air borne, food borne and water borne, they will know about the mode of spread of these diseases, their symptoms, treatments and adaptive prevention measures as well.
Contents/ SubContents	Control of microorganisms: Resistance and immunity. Air, food and water-borne human infections.
Appropriate Teaching Strategies/Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts
Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly
Others	Nil
Week4	

Objectives	Course objectives are : 1.Human contact diseases These diseases are as follow : • Ebola Virus Disease • Impetigo • Polio • Roseola • Rubella (German measles) • Tetanus 2. infectious diseases of animals These diseases includes • Tularemia • Inflammation and necrosis in check papillae • Anthrax • Dog skin diseases (pyoderma) • Swine vesicular diseases (SVD) • Bubonic plague • MRSA in dogs and cats • Rabies • conjunctiva • canine parvovirus infection
Learning out comes	students will be able to learn about : 1.human contact diseases 2.infectious diseases in animals • that they arise from different pathogens : viruses, bacteria, parasites • that they will spread infections in humans ,insects ,domestic, wild and aquatic animals • routes of transmission: direct contact, vectors, food and environment • different infectious diseases in animals • causes of these infections • symptoms • treatments • preventive meaures
Contents/ SubContents	Control of microorganisms: Human contact diseases. Infectious diseases of animals.
Appropriate Teaching Strategies/Methods	Using multimedia projector and Whitebord
Learning Material	Slides and Handouts

Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly

Contents/ SubContents	Control of microorganisms: Environmental microbiology: Microbiology of air. Aquatic microbiology. Soil microbiology.
Appropriate Teaching Strategies / Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts
Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly
Others	Nil
Week 6	

Others	Nil
Week 5	
Objectives	Course Objectives: This will provide: • environmental microbiology • its disciplines • air microbiology • soil microbiology • aquatic microbiology
Learning outcomes	students will be able to learn about the environmental microbiology and its disciplines that comprises of ; • air microbiology • soil microbiology • aquatic microbiology

Objectives	Course Objectives: This will provide: • microbiology of domestic water and sewage • pollution • contaminants that pollute the domestic water
Learning outcomes	students will be able to learn about: • microbiology of domestic water • microbiology of sewage • pollution • contaminations that pollute the domestic water • infections caused by microorganisms found in water such as; bacteria, viruses and retroviruses, protozoans eg Entamoeba, giardia
Contents/ SubContents	Control of microorganisms: Microbiology of domestic water and sewage..
Appropriate Teaching Strategies/Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts

Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly
Others	Nil
Week 7	
Objectives	Course Objectives: This will provide: 1. microbiology of food 2. microbiology of milk 3. microbiology of milk products
Learning outcomes	Students will be able to know about the: • microbiology of food • microbiology of milk and milk products • microorganisms that inhabit, create or contaminate the food • causing food spoilage: pathogens, microorganisms used to produce fermented foods such as cheese, yogurt, bread, beer and wine
Contents/ SubContents	Control of Microbiology: Microbiology of food, milk and milk products
Appropriate Teaching Strategies/Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts
Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly
Others	Nil
Week 8	
Objectives	Course Objectives: • microbiological insect control and human therapy • usage of microbial pesticides • types of microbial pest control • bacteria • fungi • algae • virus • protozoans

Learning outcomes	Students will be able to learn about microbial pest control and human therapy , types of microbial pesticides that includes bacteria, virus, fungi, algae and protozoans
Contents/ SubContents	IndustrialMicrobiology: control ofinsects,humantherapy,
AppropriateTeaching Strategies/Methods	UsingmultimediacprojectorandWhitebord
LearningMaterial	SlidesandHandoutes
AppropriateAssessment Tools	Assignment,PresentationandQuiz
AssessmentSchedule	Weekly
Others	Nil
Week9	
Objectives	Courses objectives include : • microbial petroleum • microrganisms that metabolize or alter petroleum products • HydrocarbonoclasticMicrorganisms • Methogenicarchea and some fungi • Alcanivoraxborkumensis • Bioremediation • Bioremediation of oil contaminated soils , marines and oily sludes
Learning outcomes	Students will be able to learn about the microbial petroleum, microrganisms that crude the petrol ,hydrocarbonclasticmicrobs, methogenicarchea and some types of fungi, Alcanivoraxborkumensis,bioremediation, oil contaminated soil and oily sluges
Contents/ SubContents	IndustrialMicrobiology: petroleumand bioremediation.
AppropriateTeaching Strategies/Methods	UsingmultimediacprojectorandWhitebord
LearningMaterial	SlidesandHandoutes
AppropriateAssessment Tools	Assignment,PresentationandQuiz
AssessmentSchedule	Weekly
Others	Nil
Week 10	
Objectives	Course objectives include : • Biotechnology and its role in modern human comforts • Usage of biotechnology in development of several innovative techniques • Biotechnology in environment • In human health and welfare

Learning outcomes	Students will be able to know the role of biotechnology in different fields of life specialty in medicine For the development of several innovative techniques to diagnose ,treatment and prevention of diseases. Biotechnology has brought humanity to its level of comfort ; • Bioproduction of sustainable chemicals • Genetically modified crops that increase food production • Zere waste bio processing • Regenerative medicine to create new organs • Rapid and precise manufacturing of medicine and vaccines • Biotech improvements to soil and water
Contents/ SubContents	IndustrialMicrobiology: Biotechnologyanditsroleinmodern human comforts.
AppropriateTeaching Strategies/Methods	UsingmultimediacprojectorandWhitebord
LearningMaterial	SlidesandHandoutes
AppropriateAssessment Tools	Assignment,PresentationandQuiz
AssessmentSchedule	Weekly
Others	Nil
Week 11	
Objectives	Course objectives :
Learning outcomes	• Microbial ecology • Microrginismsprenent in the nature • Their relationship with one another and to their environment • Domains of life : eukaryotes , archea, bacteria and viruses • Mutualism • Commensalism • Symbiosis • Amensalisim • Microbial activity • Meaurments of microbs Students will be able to learn about the: • Microbial ecology • Microrginismsprenent in the nature • Their relationship with one another and to their environment • Domains of life : eukaryotes , archea, bacteria and viruses • Microbial activity • Meaurments of microbs
Contents/ SubContents	MicrobialEcology: Microorganismsinnature,Microbialactivity measurements,

Appropriate Teaching Strategies / Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts
Appropriate Assessment Tools	Assignment, Presentation and Quiz

AssessmentSchedule	Weekly
Others	Nil
Week 12	
Objectives	Course objective includes; • Aquatic habitats of microbes • Aspects of aquatic microbial dynamics • Viruses • Prokaryotes • Deep sea microbiology • Eukaryotes in marine • Limnetic and brakish habitats
Learning Outcome	Students will be able to know about the auatic habitats ofmicrobs, aspects , their dynamic nature , aquatic viruses and prokaryotes,deep sea microbiology, eukaryotes in marine, limnetic and brakish habitats
Contents/ SubContents	MicrobialEcology: Aquatichabitats,Deep-seamicrobiology
AppropriateTeaching Strategies/Methods	UsingmultimediaprojectorandWhiteboard
LearningMaterial	SlidesandHandoutes
AppropriateAssessment Tools	Assignment,PresentationandQuiz
AssessmentSchedule	Weekly
Others	Nil
Week 13	
Objectives	Objectives of the course includes : • Terrestrialenvironments and their microbiology • Types of microbes present in that area • Microbs present in hydrothermal vents
Learning Outcome	Students will be able to learn about terrestrial and hydrothermal vents microrginisms.

Contents/ SubContents	Microbial Ecology: Terrestrial environments, Hydrothermal vents,
Appropriate Teaching Strategies/Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts
Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly
Others	Nil
Week 14	
Objectives/	• Objective of the course includes: • Rumen microbial ecosystem • Introduction • Humans herbivores • The ruminants • The rumen and its development • The functioning rumen • Rumen bacteria : ruminobacter, streptococcus bovis, clostridium species
Learning Outcome	Students will be able to learn about the : • Rumen microbial ecosystem, its introduction, human herbivores, the ruminants, functioning of rumen, types of rumen bacteria
Contents/ SubContents	Microbial Ecology: Rumen microbial ecosystem,
Appropriate Teaching Strategies/Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts
Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly
Others	Nil
Week 15	
Objectives	Course Objectives: • Microbial leaching • Microbs used for leaching ? • Types of microbes used for leaching • Thiobacillus thiooxidans • Thiobacillus ferrooxidans • Process of microbial ore leaching • Types of microbes leaching

Learning out comes	• Slope leaching • Heap leaching • In situ leaching • Examples of microbial ore leaching • Copper ore leaching • Uranium leaching • Biogeochemical cycles • Biosphere • Atmosphere • Hydrosphere • Lithosphere • Biogeochemical cycles for chemical elements such as calcium, carbon, phosphorus, selenium, nitrogen and oxygen Students will be able to learn about microbial leaching, types, process of leaching, examples of microbe leaching • They will know about biogeochemical cycles mainly calcium, carbon, phosphorus, selenium, nitrogen and oxygen
Contents/ SubContents	Microbial Ecology: Microbial leaching, Biogeochemical cycles
Appropriate Teaching Strategies/Methods	Using multimedia projector and Whiteboard
Learning Material	Slides and Handouts
Appropriate Assessment Tools	Assignment, Presentation and Quiz
Assessment Schedule	Weekly
Others	Nil
Week 16	

Objectives	Objectives includes : • Trace metals • Presence of trace metals in animals and plant cells • Trace metals within human body include :iron, cobalt nickle, copper, zinc ,chromium ,vanadium , molybdenum , manganese • Mercury • Compounds of mercury • Uses of mercury • Mercury as a toxicant • Biodegradation • Microbial biodegradation • Biodegradation of xenobiotics
Learning Outcome	Students will be able to learn about trace metals, their presence in animals and plant cells and within human body , kinds of trace metals, uses of these metals ,mercury, compunds of mercury, Uses of mercury, mercury as a toxicant, biodegradation of microbs , biodegradation of xenobiotics
Contents/ SubContents	MicrobialEcology: Tracemetalsandmercury,Biodegradationof Xenobiotics.
AppropriateTeaching Strategies/Methods	UsingmultimediaprojectorandWhitebord
LearningMaterial	SlidesandHandoutes
AppropriateAssessment Tools	Assignment,PresentationandQuiz
AssessmentSchedule	Weekly
Others	Nill

Curriculum Contents:

-
1. Fundamental control of microorganisms by physical and chemical agents
 2. Antibiotics and other chemotherapeutic agents.
 3. Microorganisms and diseases: Host-microbe interactions.
 4. Resistance and immunity for air, food and water-borne human infections.
 5. Human contact diseases, Infectious diseases of animals.
 6. Environmental microbiology
 7. Microbiology of air
 8. Aquatic microbiology
 9. Soil microbiology
 10. Control of insects, human therapy
 11. Microbiology of domestic water and sewage. Microbiology of food, milk and milk products.
 12. Biotechnology and its role in modern human comforts.
 13. Aquatic habitats, Deep-sea microbiology
 14. Terrestrial environments, Hydrothermal vents
 15. Rumen microbial ecosystem, Microbial leaching, Biogeochemical cycles
 16. Trace metals and mercury, Biodegradation of Xenobiotics.