

Department of Food Sciences
University of the Punjab, Lahore
Course Outline



Programme	B.Sc. (Hons.) Food Science & Technology	Course Code	MICR-301	Credit Hours	3(2-1)
Course Title	GENERAL MICROBIOLOGY AND IMMUNOLOGY				
Course Introduction					
<p>General microbiology is a comprehensive course that explores the world of microorganisms, including bacteria, viruses, and fungi. This course provides a foundational understanding of principles and concepts of microbiology including microbial structure, growth, metabolism and microbial applications in food, industry, medicines etc.</p>					
Learning Outcomes					
<p>On the completion of the course, the students will:</p> <ol style="list-style-type: none"> 1. Understand the diversity of microorganisms 2. Learn microbial cell structure, distinguish b/w prokaryotic cell and eukaryotic cell 3. Understand microbial growth, reproduction, genetics 4. Study microbial diseases, host microbe interactions 5. Learn about bacterial culture media and its types 					
THEORY					
Course Content			Assignments/Readings		
Week 1	Unit-I Introduction to microbiology				
	1.1 Introduction 1.2 Importance of microbiology 1.3 Brief historical background 1.4 Pioneers in science of microbiology 1.5 Categories of microbes (Acellular and cellular) 1.6 Major groups of microorganisms (Bacteria, viruses, fungi, protozoans, algae)				
	1.7 Cell structure 1.8 Difference b/w prokaryotic and eukaryotic cell 1.9 What is Host pathogen reaction 1.10 How the reaction occurs 1.11 Types of symbiosis (Commensalism, mutualism, parasitism)				

Week 2	Unit-II Historical background 2.1 Robert Hooke 2.2 Antony Van Leeuwenhoek 2.3 Louis Jablot 2.4 Louis Pasteur 2.5 Edward Jenner Robert Koch (Koch postulates)	
	2.6 Development of vaccines 2.7 Vaccination 2.8 Active and Passive immunization 2.9 Germ theory of disease	
Week 3	Unit-III Significance of microbes in water 3.1 History of microorganisms use in food 3.2 Bread production 3.3 Dairy products 3.4 Alcoholic drinks 3.5 Soy based products 3.6 Fermented fish and meat 3.7 Vegetables	Quiz#1 will be conducted
	3.8 Condiments and sauces 3.9 Mycoprotein 3.10 Chocolates	
Week 4	Unit-IV Significance of microbes in water 4.1 Aquatic environment 4.2 Role of microorganisms in aquatic environment 4.3 Planktonic environment, Phytoplankton, Zooplankton, Bacterioplankton 4.4 Particulate Organic Matter compounds, POM 4.5 Dissolved Organic Matter compounds, DOM 4.6 Primary and secondary production of microbes 4.7 Benthic habitat 4.8 Biofilm, biofilm formation, its advantages	
	4.9 Community for aquatic bacteria Fresh water environment and its types 4.10 Brackish water 4.11 Aquatic microbes	Assignments will be taken
Week 5	Unit-V General characteristics of bacteria 5.1 Introduction of bacteria 5.2 General characteristics, Size range 5.3 Beneficial bacteria, its examples 5.4 Pathogenic bacteria, its examples	

	Classification of bacteria (On the basis of morphology, Gram staining, Oxygen requirements, pH, Temperature)	
	5.5 Bacterial cell structure 5.6 Internal structures 5.7 Cytoplasm, nucleoid, chromosomes, plasmids, ribosomes 5.8 Cell envelope 5.9 Cell membrane and cell wall structure 5.10 Gram +ve and Gram -ve bacteria 5.11 External structures Flagella, pili	Quiz#2 will be conducted
Week 6	Unit-VI Viruses 6.1 What are viruses, their size range 6.2 Structural components (Nucleic acid core, capsid, envelope) 6.3 Naked and enveloped viruses 6.4 Viral classification on the basis of capsid 6.5 Helical, icosahedral and complex viruses	
	6.6 Viral classification on the basis of genomic composition 6.7 DNA viruses and RNA viruses 6.8 Host range of viruses 6.9 Viral specificity	
Week 7	Unit-VII Viral replication 7.1 General characteristics of viral replication	
	7.2 Adsorption, penetration, synthesis, maturation, release 7.3 Lytic cycle of bacteriophages	
Week 8	Unit-VIII Fungi-Yeasts and Molds 8.1 Introduction to fungi 8.2 Saprophytes, pathogenic fungi, dimorphic fungi 8.3 Morphology of yeast 8.4 Morphology of molds 8.5 Thallus, mycelium, hyphae, spores 8.6 Reproductive and vegetative mycelium	Presentations will be taken
	8.7 Thallus, mycelium, hyphae, spores 8.8 Reproductive and vegetative mycelium	
Week 9	Unit-IX Reproduction in fungi 9.1 Asexual reproduction of fungi (Budding, Binary fission, Fragmentation) 9.2 Types of asexual spores (Conidia, oidia, blastospores etc.)	Quiz#3 will be conducted

	9.3 Sexual reproduction (male gametangia, female gametangia)	
Week 10	<p align="center">Unit-X Microbial growth requirements</p> 10.1 What is microbial growth 10.2 Physical requirements and chemical requirements 10.3 Physical requirements for growth 10.4 Temperature: Psychrophiles, Mesophiles, Thermophiles 10.5 pH: Alkalophiles, Neutrophiles, Acidophiles 10.6 Osmotic pressure	
	10.7 Chemical requirements 10.8 Macro and micro nutrients 10.9 Carbon 10.10 Nitrogen, sulphur, phosphorus 10.11 Oxygen (Types on the basis of oxygen requirement) 10.12 Trace elements 10.13 Organic growth factors	
Week 11	<p align="center">Unit-XI Culturing and growth of bacteria</p> 11.1 What is culture media, characteristics 11.2 Physical forms of media: Agar and broth 11.3 Types of media 11.4 Selective, enriched, differential media	Presentations will be taken
	11.5 Some commonly used media 11.6 Applications of culture media	
Week 12	<p align="center">Unit-XII Microbial growth</p> 12.1 What is Microbial growth 12.2 Bacterial cell division-binary fission	Quiz#4 will be conducted
	12.3 Phases of bacterial growth (lag, log, stationary, death) 12.4 Bacterial growth curve	
Week 13	<p align="center">Unit-XIII Microbial metabolism</p> 13.1 Basic concept of metabolism	
	13.2 Anabolism, catabolism, oxidation, reduction	
Week 14	<p align="center">Unit-XIV Aerobic and anaerobic cellular respiration</p> 14.1 Aerobic cellular respiration; glycolysis, pyruvate oxidation, citric acid cycle, ETC and chemiosmosis	Presentations will be taken
	14.2 Anaerobic cellular respiration; glycolysis and fermentation (lactic acid, alcoholic)	

	14.3 Fats and proteins metabolism	
Week 15	Unit-XV Microbial genetics	
	15.1 Introduction	
	15.2 Vertical transmission of genetic material	
	15.3 Horizontal transmission of genetic material	
Week 16	Unit-XVI Conjugation, transduction, transformation	
	16.1 Bacterial conjugation, mechanism	
	16.2 Bacterial transduction, mechanism	
	16.3 Bacterial transformation, mechanism	
PRACTICAL		
Course Content		Assignments/Readings
Week 1	Basic laboratory equipments and their functions	
Week 2	Sterilization of glassware	
Week 3	Use of microscope, micrometry	
Week 4	Introduction to culture media (Agar and Broth)	
Week 5	Preparation of culture media	
Week 6	Pouring of media in plates	
Week 7	Serial dilution techniques and pipetting	
Week 8	Spreading	
Week 9	Streaking	
Week 10	Bacterial isolation	
Week 11	Bacterial growth curve	
Week 12	Bacterial growth measurement by using spectrophotometer	
Week 13	Bacterial growth measurement by plate count method	
Week 14	Morphological characteristics of bacterial colonies	
Week 15	Gram staining introduction	
Week 16	Gram staining procedure, microorganisms structure	
Textbooks and Reading Material		
I. Tortora, G.J., Funke, B.R. & Case, C.L. (2009). Microbiology: An Introduction. The Benjamin/Cummings Pub. Co, Redwood City, California, USA.		

II. Frazier, W.C. & Westhoff, D.C. (2008). Food Microbiology. McGraw Hill Book Co, New York, USA.

III. Awan, J.A. & Rahman, S.U. (2005). Microbiology Manual. Unitech Communications, Faisalabad, Pakistan.

IV. Banwart, G.J. (2004). Basic food microbiology, 2 nd ed. CBS Publishers and Distributors, New Delhi, India.

Teaching Learning Strategies

1. Class lectures
2. Discussion
3. Presentation
4. Quiz
5. Assignment

Assignments: Types and Number with Calendar

1. Physical and Chemical requirements of microorganisms
2. Role of bacteria in nutrient cycling
3. Food spoilage microbes
4. Different types of host microbe interactions
5. Bacterial pathogenicity and human diseases
6. Viral infections and diseases of human body
7. Different sterilization methods and disinfection techniques

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.