National Curriculum of Pakistan
2022-23

TECHNICAL EDUCATION

MEDICAL TECHNOLOGY

Microbiology

Grades 11-12

NATIONAL CURRICULUM COUNCIL SECRETARIAT
MINISTRY OF FEDERAL EDUCATION AND
PROFESSIONAL TRAINING, ISLAMABAD
GOVERNMENT OF PAKISTAN

بسم الله الرحمن الرحيم

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It is with great pride that we, at the National Curriculum Council Secretariat, present the first core curriculum in Pakistan's 75-year history. Consistent with the right to education guaranteed by Article 25-A of our Constitution, the National Curriculum of Pakistan (2022-23) aspires to equip every child with the necessary tools required to thrive in and adapt to an ever-evolving globalized world.

The National Curriculum is in line with international benchmarks, yet sensitive to the economic, religious, and social needs of young scholars across Pakistan. As such, the National Curriculum aims to shift classroom instruction from rote learning to concept-based learning.

Concept-based learning permeates all aspects of the National Curriculum, aligning textbooks, teaching, classroom practice, and assessments to ensure compliance with contemplated student learning outcomes. Drawing on a rich tapestry of critical thinking exercises, students will acquire the confidence to embark on a journey of lifelong learning. They will further be able to acknowledge their weaknesses and develop an eagerness to build upon their strengths.

The National Curriculum was developed through a nationwide consultative process involving a wide range of stakeholders, including curriculum experts from the public, private, and non-governmental sectors. Representatives from provincial education departments, textbook boards, assessment departments, teacher training departments, *deeni madaris*, public and private publishers, private schools, and private school associations all contributed their expertise to ensure that the National Curriculum could meet the needs of all Pakistani students.

The experiences and collective wisdom of these diverse stakeholders enrich the National Curriculum, fostering the core, nation-building values of inclusion, harmony, and peace, making the National Curriculum truly representative of our nation's educational aspirations and diversity.

I take this opportunity to thank all stakeholders, including students, teachers, and parents who contributed to developing the National Curriculum of Pakistan (2022-23)

Dr. Mariam Chughtai
Director
National Curriculum Council Secretariat
Ministry of Federal Education and Professional Training

Medical Technology

Microbiology

Grades 11-12

Progression Grid

Domain A: Introduction to Microbiology

Standard: Develop a keen understanding of the historical milestones, discoveries, importance of Microorganism and its application in scientific, healthcare and community.

Grade 11	Grade 12
Benchmarks: Students should be able to • Identify and communicate the significance of Microbiology, historical events, contributions of important scientists in the development of microbiology as a scientific discipline. • Explain how these discoveries have influenced current microbiological knowledge and practices	
Student Learning Outcomes	

Introduction to Microbiology **Student will be able to:** [SLO:MB-11-A-01]: Recall and identify key milestones and contributors in the history of Microbiology. [SLO:MB-11-A-02]: Study the role of historical figures in; Discovery era, transition era, Golden era and Modern era, Given historical contexts of Microbiology. [SLO:MB-11-A-03]: Define importance of microbiology and learn the applied areas of microbiology	

Domain B: Microscope

Standard: Exhibit comprehensive knowledge in the history, Basic components, types, applications, limitations of Microscopes and effectively use microscopes to analyze specimens

Grade 11	Grade 12
Benchmark : Students will be able to: Demonstrate the ability to describe the milestones in the history of development of microscopes, identify and explain accurately the functions of microscope components	

Distinguish between different microscope types and comprehending their applications and limitations in scientific contexts Analyze specimens using microscopes to differentiate and describe various microscopic structures.	
Student Learning Outcomes	
Microscope **Students will be able to:** [SLO:MB-11-B-01]: Recall brief history of Microscope [SLO:MB-11-B-02]: Identify and describe the basic components of a microscope and their functions. [SLO:MB-11-B-03]: Differentiate between various types of microscopes (Compound, Fluorescent, Dark field, microscope Phase contrast, Electron microscope) and understanding their applications and limitations specific scientific contexts **Practical:** Analyze specimens using microscopes to differentiate between various microscopic structures.	**Microbiology II** **Practical:** Students will: Perform Microscopy on different settings of Microscopy • Wet Preparation (Unstained slide) • Stain slide settings

Domain C: Sterilization and Disinfection

Standard: Students will be able to comprehend and describe differences between sterilization and disinfection and different methods and quality control practices to achieve sterilization in healthcare settings, industries and communities.

Grade 11	Grade 12
Benchmarks: After completion student will be able to: 1. Demonstrate and explain significance of Sterilization and Disinfection 2. List methods of sterilization and disinfection	**Benchmarks:** 1. Apply sterilization techniques while working in Laboratory work
Student Learning Outcomes	
Students will be able to: [SLO:MB-11-C-01]: Define sterilization and disinfection.	**Students will be able to:** [SLO:MB-12-C-01]: Discuss the application of X-rays and gamma rays in non-ionizing radiation techniques.

[SLO:MB-11-C-02]: Differentiate between the principles of sterilization and disinfection. [SLO:MB-11-C-03]: Describe the physical methods used for sterilization. [SLO:MB-11-C-04]: Explain the process of moist heat sterilization. [SLO:MB-11-C-05]: Describe the function and operation of an autoclave. [SLO:MB-11-C-06]: Explain the concept and application of flash sterilization. [SLO:MB-11-C-07]: Describe the sterilization process involving boiling. [SLO:MB-11-C-08]: Explain the procedure and benefits of dry heat sterilization. [SLO:MB-11-C-09]: Discuss the functioning and applications of a hot air oven. [SLO:MB-11-C-10]:	[SLO:MB-12-C-02]: Describe the chemical methods utilized for sterilization. [SLO:MB-12-C-03]: Explain the principles and application of gaseous sterilization using ethylene oxide, formaldehyde, nitrogen oxide, and ozone. [SLO:MB-12-C-04]: Discuss the process and uses of liquid sterilization involving hydrogen peroxide, Glutaraldehyde, and hypochlorite. [SLO:MB-12-C-05]: Define and understand the process of filtration, inspissation, and the red heat method. [SLO:MB-12-C-06]: Describe the tests used to evaluate the efficiency of sterilization (biological, chemical, and mechanical). [SLO:MB-12-C-07]: Define and understand the terms antiseptic, bacteriostatic, and bactericidal, as applied to the destruction of bacteria.

Explain the incineration method for sterilization. [SLO:MB-11-C-11]: Discuss the application and principles of the red heat method. [SLO:MB-11-C-12]: Describe sterilization techniques involving radiation. [SLO:MB-11-C-13]: Explain the principles and uses of infrared and ultraviolet radiation in sterilization.	

Domain D: Microbial Culture Media

Standard: Students will demonstrate proficiency in understanding the fundamental concepts of culture media in Microbiology, including their classification, nutritional components, applications, and practical utilization, enabling them to effectively select and apply appropriate culture media based on classification and specific microbial requirements.

Grade 11	Grade 12
Benchmark : After completion student will be able to: Classify and describe various types of culture media based on consistency, nutritional components, and application, showcasing	

their understanding by selecting an appropriate culture media to cultivate and identify microbial specimens in laboratory settings.	
Student Learning Outcomes	
Microbial Culture media: **Students will be able to:** [SLO:MB-11-D-01]: Define Culture Media: Explain the concept and purpose of culture media in microbiology. [SLO:MB-11-D-02]: Classify Culture Media: Describe the various types of culture media based on consistency, including solid, semi-solid, and liquid media. [SLO:MB-11-D-03]: Differentiate between simple, complex, and synthetic media based on their nutritional components. [SLO:MB-11-D-04]: Classify on the basis of application/Chemical Composition: [SLO:MB-11-D-05]:	

Outline the diverse classifications of culture media such as basal, enriched, selective, enrichment, differential, transport, antimicrobial testing, and storage media. [SLO:MB-11-D-06]: Differentiate between aerobic and anaerobic culture media, highlighting their significance in microbial growth. [SLO:MB-11-D-07]: Discuss the practical applications of culture media in microbiology, emphasizing their role in microbial cultivation and identification. Practical: [SLO:MB-11-D-08]: Identify and select different types of Culture Media On the basis of Classification and requirement. [SLO:MB-11-D-09]: Explain important composition of Media	

Domain E: Microbial Staining Techniques

Standard: Students will demonstrate proficiency in understanding staining techniques in microbiology, including the principles and procedural steps of Gram staining, Acid Fast Staining; Ziehl-Neelsen stain (Heat method), and Kinyoun stain (Cold method), enabling them to accurately describe the importance and application of these techniques in microbial identification.

Grade 11	Grade 12
Benchmark: Student will be able to: Classify and identify Gram positive and Gram negative organisms on the basis of Gram staining. Describe steps of Gram staining Technique Describe Acid fast staining technique steps	
Student Learning Outcomes	
Staining and Techniques Students will be able to: [SLO:MB-11-E-01]: Explain the importance of staining and the techniques utilized in microbiology. [SLO:MB-11-E-02]: Define the principle of the Gram stain. [SLO:MB-11-E-03]: Outline the steps involved in Gram staining.	

[SLO:MB-11-E-04]: Describe the principle of Acid Fast Staining. [SLO:MB-11-E-05]: Explain the procedural steps of the Ziehl-Neelsen stain (Heat method). [SLO:MB-11-E-06]: Elucidate the steps involved in the Kinyoun stain (Cold method). **Practical:** Observe and identify stain slides of Gram positive and Gram negative organisms.	

Domain F: Classification of bacteria on the basis of Gram reaction and Morphology

Standard: Students will demonstrate competence in categorizing bacteria based on Gram reaction and Morphology into Gram-positive and Gram-negative categories, listing examples of Gram-positive cocci and bacilli, Gram-negative cocci, and bacilli, and comprehending terminology related to bacterial characteristics.

Grade 11	Grade 12
Benchmark: **Student will be able to:** 1. Students will proficiently classify bacteria based on Gram reaction and Morphology, list specific examples of Gram-positive and Gram-negative bacteria also apply this knowledge in practical, 2. Demonstrate understanding of bacterial characteristics by defining terms such as Hemolysis, Aerobic, Anaerobic, Obligate Aerobic, Obligate Anaerobic, Fastidious, Aerotolerant, and Microaerophilic.	
Student Learning Outcomes	

Student will be able to: [SLO:MB-11-F-01]: Classify Bacteria based on Gram reaction and Morphology into Gram-positive bacteria and Gram-negative bacteria. [SLO:MB-11-F-02]: Enumerate examples of Gram-positive cocci. [SLO:MB-11-F-03]: Enumerate examples of Gram-positive bacilli. [SLO:MB-11-F-04]: Enumerate examples of Gram-negative cocci. [SLO:MB-11-F-05]: Enumerate examples of Gram-negative bacilli. [SLO:MB-11-F-06]: Define and comprehend the terms Hemolysis, Aerobic, Anaerobic, Obligate Aerobic, Obligate Anaerobic, Fastidious, Aerotolerant, and Microaerophilic. Practical: Observe Bacterial culture on culture media and under microscope.	

Domain G: Identification of Bacteria

Standard: Students will learn the principles of key microbiological tests, such as Catalase, Coagulase, Mannitol Fermentation, Dnase, Lactose Fermentation, Oxidase, and Antimicrobial testing using the Kirby-Bauer disc diffusion method, demonstrating their ability to explain these principles effectively.

Grade 11	Grade 12
Benchmark: Explain the fundamental principles of various microbiological tests demonstrating their skill in explaining the Catalase, Coagulase, Mannitol Fermentation, Dnase, Lactose Fermentation, Oxidase, and Antimicrobial testing using the Kirby-Bauer disc diffusion method.	
Student Learning Outcomes	

Student will be able to: [SLO:MB-11-G-01]: Explain the principles underlying the Catalase test. [SLO:MB-11-G-02]: Describe the principle behind the Coagulase test. [SLO:MB-11-G-03]: Outline the principle of Mannitol Fermentation Test. [SLO:MB-11-G-04]: Define the principle of the Dnase Test. [SLO:MB-11-G-05]: Explain the principle of Lactose Fermentation. [SLO:MB-11-G-06]: Discuss the principle of Oxidase Test. [SLO:MB-11-G-07]:	

Explain the process of Antimicrobial testing using the Kirby-Bauer disc diffusion method. Practical: [SLO:MB-11-G-08]: Observe Lactose fermentation on selective agar [SLO:MB-11-G-09]: Observe catalase, Coagulase and oxidase test.	

Domain H: Virology

Standard: Students will state general concepts of virology explain structure of viruses and classification of Viruses.

Grade 11	Grade 12
Benchmark: **Student will be able to:** ● Explain Viruses structure and general characteristics of Viruses ● Demonstrate knowledge of Viruses classification. ● Construct chart or diagram clarifying classification of viruses	
Student Learning Outcomes	
Students will be able to: [SLO:MB-11-H-01]: Define Virology outlining its fundamental concepts [SLO:MB-11-H-02]: Describe general characteristics of Viruses [SLO:MB-11-H-03]: Describe structure of Viruses [SLO:MB-11-H-04]: Learn classification of Viruses **Practical**	

Draw labeled diagram of structure of Viruses	

Domain I: Parasitology

Standard: The standard enables students in defining key parasitic infection terminologies and applying this knowledge to comprehend transmission factors and propose preventive measures. It ensures a strong understanding of parasitology for effective disease prevention.

Grade 11	Grade 12

	Benchmark: Student will be able to: 1. Demonstrate their understanding of general terminologies and the risks associated with parasitic infections 2. Define key terms such as vectors, hosts, reservoirs, and zoonosis. 3. Analyze factors that contribute to the transmission of parasitic infections and propose effective preventive measures, focusing on sanitation, hygiene practices, and strategies for vector control.Top of Form
	Student Learning Outcomes

	Introduction to Medical Parasitology Students will be able to: [SLO:MB-12-I-01]: Recall general terminologies and risk and prevention of Parasitic Infections: [SLO:MB-12-I-02]: Define key terminologies related to parasitic infections, including vectors, hosts, reservoirs, and zoonosis. [SLO:MB-12-I-03]: Describe the factors contributing to the transmission of parasitic infections and identify preventive measures, such as sanitation, hygiene, and vector control strategies.

Domain J: Introduction to Medical Parasitology

Standard: Students should be able to classify parasites by morphological characteristics, distinguishing between protozoa, helminths, and ectoparasites. They must precisely identify parasites based on structural features like shape, size, locomotion, and reproduction.

Grade 11	Grade 12
	Benchmark: Student will be able to: 1. Classify parasites by their morphological attributes. 2. Differentiate between protozoa, helminths, and ectoparasites.
	Student Learning Outcomes

	Students will be able to: [SLO:MB-12-J-01]: Classify parasites based on morphological characteristics, distinguishing between protozoa, helminths, and ectoparasites. [SLO:MB-12-J-02]: Identify and categorize parasites according to their structural features, such as shape, size, locomotion, and reproduction.

Domain K : Protozoa

Standard: Acquire comprehensive knowledge of life cycles and transmission pathways of significant protozoan parasites (e.g., Entamoeba histolytica, Entamoeba coli, Giardia lamblia, Trichomonas vaginalis and Balantidum coli) with well-defined stages (e.g., cysts, trophozoites), enabling a clear understanding and identification through visually accurate and informative illustrations.

Grade 11	Grade 12

	Benchmark: Student will be able to: 1. Explain diagrams or charts, showing the life cycles of essential protozoan parasites (e.g., Entamoeba histolytica, Entamoeba coli, Giardia lamblia, Trichomonas vaginalis, and Balantidum coli), highlighting their specific stages (e.g., cysts, trophozoites) 2. Describe transmission pathways, ensuring accurate and detailed representations for easy comprehension and identification.Top of FormTop of Form
	Student Learning Outcomes
	Protozoa **Students will be able to:** [SLO:MB-12-K-01]: Explain the life cycles of significant pathogenic protozoan parasites, specifically Entamoeba histolytica and Entamoeba coli, emphasizing their distinct stages (e.g., cysts, trophozoites) and routes of transmission. [SLO:MB-12-K-02]: Describe the life cycles of notable pathogenic protozoan parasites, such as Giardia lamblia and Trichomonas vaginalis, emphasizing their different stages (e.g., cysts, trophozoites) and modes of transmission.

	[SLO:MB-12-K-03]: Explain the life cycle of a significant pathogenic protozoan parasite, Balantidium coli, focusing on its various stages (e.g., cysts, trophozoites) and pathways of transmission. **Practical :** Prepare Stool slide Wet Preparation and Iodine preparation for screening of Parasite (Trophozoite, cyst ova and worms)

Domain L: Arthropod

Standard: Students will describe the life cycles of Mosquito, House fly and outline distinctive features of life and explain preventive measures to avoid spreading of Mosquitoes and House flies.

Grade 11	Grade 12

	Benchmark: **Student will be able to:** 1. Explain the comprehensive understanding of the different stages of the Anopheles Mosquito and House fly with the help of diagram 2. Extend measures to prevent the house flies and mosquito spread.
	Student Learning Outcomes
	Arthropod: **Students will be able to:** [SLO:MB-12-L-01]: Explain the life cycle of Anopheles mosquitoes Mosquito. [SLO:MB-12-L-02]: Describe the life cycle of House fly. [SLO:MB-12-L-03]: Describe measures of prevention for Mosquitoes and Houseflies

Domain M: Helminths

Standard: Students will successfully describe the life cycles of Enterobius vermicularis, Trichuris trichiura, Ascaris lumbricoides, Ancylostoma duodenale, Taenia solium / saginata, Echincoccus granulosus, and Hymenolepis nana, and outline distinctive features and life cycles of Trematodes like Fasciola hepatica and Schistosoma..

Grade 11	Grade 12
	Benchmark: Student will be able to: 1. Explain the life cycles of prominent pathogenic helminths and distinguish the unique characteristics of Trematodes, demonstrating comprehensive understanding. 2. Explain stool concentration method procedure.
Student Learning Outcomes	
	Helminths: **Students will be able to:** [SLO:MB-12-M-01]: Describe the life cycles of significant pathogenic Helminths, including Enterobius vermicularis, Trichuris trichiura, Ascaris lumbricoides, Ancylostoma duodenale, Taenia solium / saginata, Echincoccus granulosus, and Hymenolepis nana. [SLO:MB-12-M-02]:

	Outline the distinct features and life cycles of Trematodes, such as Fasciola hepatica and Schistosoma." **Practical:** Study stool concentration methods

Domain N: Mycology

Standard: Students will demonstrate comprehension of the general characteristics, terminologies, classification, differences from bacteria, and morphology of fungi. They will also illustrate the application of staining techniques and the creation of precise diagrams to effectively identify fungal structures.

Grade 11	Grade 12
	Benchmark: Student will be able to: 1. Identify five general characteristics of fungi in an assessment. 2. Define ten fungal terminologies accurately. 3. Categorize fungi classification in a chart. 4. Compare five distinguishing features of fungi and bacteria. Illustrate mold and yeast dimorphism in fungi using diagramsTop of Form

	Student Learning Outcomes
	Mycology **Student will be able to:** Students will be able to: [SLO:MB-12-N-01]: Recall the general characteristics of fungi. [SLO:MB-12-N-02]: Define key fungal terminologies. [SLO:MB-12-N-03]: Explain the classification of fungi. [SLO:MB-12-N-04]: List the distinguishing characteristics of fungi compared to bacteria. [SLO:MB-12-N-05]: Describe the morphology of fungi, focusing on mold and yeast dimorphism.

	Practical: [SLO:MB-12-L-06]: Draw diagrams of Fungi (highlighting morphological features) [SLO:MB-12-L-07]: Learn KOH (Potassium hydroxide) preparation [SLO:MB-12-L-08]: Learn lactophenol cotton blue staining Technique

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