

Syllabus template

Semester: 1	
Course : Major	
Paper Title: Basic Microbiology	
Paper code: C1MB230121P	Credits: 4
Hours/week : 4	
Category: Core/MDC/SEC/VAC : Core	
Theory / Practical / Composite : Practical	
No of Modules : No modules	
<p>Course Overview: This practical course is designed to provide students with fundamental laboratory skills and hands-on experience in microbiology. It emphasizes laboratory safety, aseptic techniques, microbial cultivation, staining methods, and microscopic examination of microorganisms. The course integrates theoretical principles with practical applications to build competency in handling microbiological specimens and equipment.</p>	
<p>Course Outcome: By the end of this practical course, students will be able to:</p> <ul style="list-style-type: none"> • Follow biosafety and laboratory protocols effectively. • Operate and maintain basic microbiology laboratory instruments. • Prepare and sterilize culture media. • Isolate and maintain pure microbial cultures. • Perform staining procedures accurately. • Identify common fungi, algae, and protozoa microscopically. • Quantitatively estimate microbial growth using CFU methods. <p>This course builds a strong foundation in microbiological techniques essential for advanced studies and research in life sciences, biotechnology, and medical microbiology.</p>	
<p>(CO1): Remember</p> <ul style="list-style-type: none"> • Define Good Laboratory Practices (GLP) and biosafety. • List parts of a bright field microscope. • List components of Nutrient Agar (NA) and Nutrient Broth (NB). • Recall sterilization temperatures (e.g., autoclave 121°C, hot air oven 160–180°C). • Name different staining techniques (Simple, Gram, Capsule, Endospore). • Identify organisms: <ul style="list-style-type: none"> ○ Rhizopus ○ Penicillium ○ Aspergillus ○ Spirogyra ○ Chlamydomonas ○ Volvox ○ Amoeba ○ Entamoeba ○ Paramecium ○ Plasmodium • State types of culture media (simple, enriched, selective, differential) 	

(CO2): Understand

- Explain principles of:
 - Biological Safety Cabinet
 - Incubator
 - Hot air oven
 - pH meter
- Explain principle of:
 - Gram staining
 - Capsule staining
 - Endospore staining
- Describe preparation of:
 - Nutrient Agar
 - Nutrient Broth
- Explain difference between:
 - Slant, stab, and plate cultures
 - Selective and differential media
- Explain CFU calculation formula.

(CO3): Apply

Students should be able to:

- Prepare Nutrient Agar and Nutrient Broth.
- Adjust pH using pH meter.
- Prepare slants, stabs, and plates.
- Perform:
 - Streak plate method
 - Pour plate method
 - Spread plate method
- Perform staining techniques.
- Expose agar plates to air and incubate.
- Operate and focus specimen using bright field microscope.
- Calculate CFU from colony counts.
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(CO4): Analyze

Students should be able to:

- Differentiate Gram-positive and Gram-negative bacteria.
- Compare:
 - Rhizopus, Penicillium, Aspergillus
 - Spirogyra, Chlamydomonas, Volvox
 - Amoeba and Paramecium
- Analyze colony morphology after air exposure.

- Interpret staining results.
- Examine microbial growth patterns in slant vs stab vs plate.

(CO5): Evaluate

Students should be able to:

- Differentiate Gram-positive and Gram-negative bacteria.
- Compare:
 - Rhizopus, Penicillium, Aspergillus
 - Spirogyra, Chlamydomonas, Volvox
 - Amoeba and Paramecium
- Analyze colony morphology after air exposure.
- Interpret staining results.
- Examine microbial growth patterns in slant vs stab vs plate.

(CO6): Create

Students should be able to:

- Design an experiment to isolate pure culture.
- Prepare different types of media based on requirement.
- Formulate procedure to estimate bacterial load in a sample.
- Design a contamination control protocol.
- Prepare complete laboratory reports with interpretation.
- Develop improved aseptic handling workflow for microbiology lab.

Prerequisites: *Basic knowledge about any prior course*

SYLLABUS

UNIT/Module	CONTENT	HOURS or NUMBER OF CLASSES	CO Mapping	COGNITIVE LEVEL
I.	Microbiology: Good Laboratory Practices and Biosafety.		CO1	K1
II.	Study of the principle and applications of important instruments (biological safety cabinets, incubator, hot air oven, pH meter) used in the microbiology laboratory.	6	CO1	K1

III.	Preparation of culture media – Nutrient Agar and Nutrient Broth for bacterial cultivation.	6	CO1,CO2	K2,K2
IV.	Preparation of slants, stab and plate with NA.	6	CO1,CO3	K1,K3
V.	Working and care of bright field microscope.	12	CO1, CO3,	K1, K3,
VI.	Demonstration of the presence of microflora in the environment by exposing nutrient agar plates to air.	8	CO3,CO4,CO5	K3,K4,K5
VII.	Study of Rhizopus, Penicillium, Aspergillus using temporary mounts		CO4,CO5	K4,K5
VIII.	Study of the following protozoans using permanent mounts/photographs: Amoeba, Entamoeba, Paramecium and Plasmodium.		CO4,CO5	K4,K5
IX.	Staining: Simple, Negative, Grams, Capsule, Endospore staining		CO1,CO2,CO4	K1,K2,K4
X.	Media Preparation: Different types of media preparation		CO1,CO2,CO3,CO5	K1,K2,K3,K5
XI.	Pure culture: Pour plate, streak plate and spread plate		CO3,CO6	K3,K6
XII.	Estimation of bacterial growth: CFU count.		CO2,CO3,CO4,CO5	K2,K3,K4,K5
Text Books				
1. Cappucino J and Sherman N. (2010). Microbiology:				
2. A Laboratory Manual. 9th edition. Pearson Education Limited 10. Practical manual of Microbiology Mitra & Sarkar.				
Suggested readings				

1.
2.
3.
Web Resources
1. Advanced Microbiology online MOOC course by Dr Arup Kumar Mitra https://onlinecourses.swayam2.ac.in/cec22_bt20/preview
2.
3.
4.
Evaluation: Theory CIA: 80 Semester Exam:20
Paper Structure for Practical Semester Exam Module :

Course outcomes (COs) and Cognitive Level Mapping

COs	CO Description	Cognitive levels
CO1	<p>Remember</p> <ul style="list-style-type: none"> • Define Good Laboratory Practices (GLP) and biosafety. • List parts of a bright field microscope. • List components of Nutrient Agar (NA) and Nutrient Broth (NB). • Recall sterilization temperatures (e.g., autoclave 121°C, hot air oven 160–180°C). • Name different staining techniques (Simple, Gram, Capsule, Endospore). • Identify organisms: <ul style="list-style-type: none"> ○ Rhizopus ○ Penicillium ○ Aspergillus ○ Spirogyra ○ Chlamydomonas ○ Volvox ○ Amoeba ○ Entamoeba ○ Paramecium ○ Plasmodium 	K1
CO2	<p>Understand</p> <ul style="list-style-type: none"> • Explain principles of: <ul style="list-style-type: none"> ○ Biological Safety Cabinet ○ Incubator ○ Hot air oven ○ pH meter • Explain principle of: 	K2

	<ul style="list-style-type: none"> ○ Gram staining ○ Capsule staining ○ Endospore staining • Describe preparation of: <ul style="list-style-type: none"> ○ Nutrient Agar ○ Nutrient Broth • Explain difference between: <ul style="list-style-type: none"> ○ Slant, stab, and plate cultures ○ Selective and differential media • Explain CFU calculation formula. 	
CO3	<p>Apply</p> <p>Students should be able to:</p> <ul style="list-style-type: none"> • Prepare Nutrient Agar and Nutrient Broth. • Adjust pH using pH meter. • Prepare slants, stabs, and plates. • Perform: <ul style="list-style-type: none"> ○ Streak plate method ○ Pour plate method ○ Spread plate method • Perform staining techniques. • Expose agar plates to air and incubate. • Operate and focus specimen using bright field microscope. • Calculate CFU from colony counts. 	K3
CO4	<p>Analyze</p> <p>Students should be able to:</p> <ul style="list-style-type: none"> • Differentiate Gram-positive and Gram-negative bacteria. • Compare: <ul style="list-style-type: none"> ○ Rhizopus, Penicillium, Aspergillus ○ Spirogyra, Chlamydomonas, Volvox ○ Amoeba and Paramecium • Analyze colony morphology after air exposure. • Interpret staining results. • Examine microbial growth patterns in slant vs stab vs plate. 	K4
CO5	<p>Evaluate</p>	K5

	<p>Students should be able to:</p> <ul style="list-style-type: none"> • Differentiate Gram-positive and Gram-negative bacteria. • Compare: <ul style="list-style-type: none"> ○ Rhizopus, Penicillium, Aspergillus ○ Spirogyra, Chlamydomonas, Volvox ○ Amoeba and Paramecium • Analyze colony morphology after air exposure. • Interpret staining results. • Examine microbial growth patterns in slant vs stab vs plate. 	
CO6	<p>Create</p> <p>Students should be able to:</p> <ul style="list-style-type: none"> • Design an experiment to isolate pure culture. • Prepare different types of media based on requirement. • Formulate procedure to estimate bacterial load in a sample. • Design a contamination control protocol. • Prepare complete laboratory reports with interpretation. • Develop improved aseptic handling workflow for microbiology lab. 	K6