



## Second Semester Courses in BSc Microbiology (November 2024 onwards)

- **Core Courses:**

- USMIC4502CR1 Elements of Microbial Nutrition, Growth and Control
- USMIC4502CR1PR Elements of Microbial Nutrition, Growth and Control Practical

- **Vocational Skill Course:**

- USMIC4502VS1 Bacterial Staining Techniques

- **Evaluation and Assessment guidelines**

**APPROVED SYLLABUS**



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<b>BSc in Microbiology</b>		
<b>Course Title: Elements of Microbial Nutrition, Growth and Control</b>		
<b>Course Code: USMIC4502CR1</b>		
Credits 3: Theory (3) = 45 hr Number of lectures: 45		
<b>No.</b>	<b>Course Objectives</b>	
1.	Introduce students to the basic concepts of microbial nutrition, growth and its measurement	
2.	Facilitate understanding of the principles and basic methods involved in the study and control of microbes	
3.	Develop analytical and problem-solving skills	
<b>CO</b>	<b>Course Outcomes</b> <b>On completing the course, the learner will be able to</b>	<b>Bloom's Taxonomy Level (BT level)</b>
1.	State nutritional requirements of microorganisms, give examples of nutritional types of microbes and give examples of microbes that fall in each type.	Remember
2.	Compare various strategies for preservation of microbes.	Analyze
3.	Describe bacterial growth curve and its phases, explain and illustrate different methods of microbial growth measurement; describe factors influencing bacterial growth	Understand
4.	Analyze and predict bacterial growth based on the growth curve data	Apply
5.	Explain and discern physical and chemical methods in microbial control; distinguish between terms such as disinfection, sterilization and sanitation.	Apply
6.	Choose a suitable method for control of microorganisms and justify its use.	Evaluate



<b>UNIT I</b>	<b>MICROBIAL NUTRITION</b>	<b>(15)</b>
A.	<b>Nutritional requirements- Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulphur and Growth factors</b>	<b>(2)</b>
B.	<b>Chemical analysis of cell contents – chemical composition of a Gram positive and a Gram-negative organism</b>	<b>(1)</b>
C.	<b>Nutritional types of microorganisms</b>	<b>(3)</b>
D.	<b>Nutrient uptake mechanisms</b>	<b>(3)</b>
E.	<b>Influence of environmental factors on growth</b>	<b>(3)</b>
F.	<b>Preservation of microorganisms</b>	<b>(3)</b>
<b>UNIT II</b>	<b>MICROBIAL GROWTH</b>	<b>(15)</b>
A.	<b>Definition of growth, Mathematical expression, Growth curve</b>	<b>(3)</b>
B.	<b>Measurement of growth</b>	<b>(6)</b>
	1. Direct Microscopic count- Breeds, Petroff-Hausser counting chamber, Haemocytometer	
	2. Viable count- Spread plate and Pour plate technique, Membrane filtration	
	3. Electronic Counting	
	4. Measurement of cell mass	
	5. Turbidity measurements- Nephelometer and spectrophotometer techniques	
	6. Measurements of cell constituents.	
C.	<b>Synchronous growth, Continuous growth (chemostat and turbidostat), Diauxic growth, Growth Yield (definition of terms)</b>	<b>(2)</b>
D.	<b>Microbial growth in natural environments, and viable non-culturable organisms</b>	<b>(2)</b>
E.	<b>Quorum sensing</b>	<b>(2)</b>
<b>UNIT III</b>	<b>CONTROL OF MICROORGANISMS</b>	<b>(15)</b>
A.	<b>Definitions of frequently used terms</b>	<b>(1)</b>
B.	<b>Pattern/Rate of microbial death</b>	<b>(1)</b>
C.	<b>Conditions influencing the effectiveness of antimicrobial agents</b>	<b>(1)</b>
D.	<b>Physical Methods of Microbial Control</b>	<b>(5)</b>



1. Heat: Moist and Dry
  2. Low temperature
  3. Filtration
  4. High pressure
  5. Desiccation
  6. Osmotic pressure
  7. Radiations
- E. **Chemical methods of Microbial Control** (4)
1. Phenolics
  2. Biguanides – chlorhexidine
  3. Alcohols
  4. Halogens
  5. Heavy Metals
  6. Quaternary ammonium compounds
  7. Surface active agents
  8. Aldehydes
  9. Sterilizing gases
  10. Peroxygens
  11. Chemotherapeutic agents
- F. **Biological control of microorganisms** (1)
- G. **Evaluation of effectiveness of antimicrobial agents** (2)

**References:**

1. Madigan, M., Bender, K., Buckley, D., & Stahl, D. (2018). *Brock Biology of Microorganisms* (15th edition). Pearson International Edition.
2. Talaro, K. P., & Chess, B. (2020). *Talaro's Foundations in Microbiology* (11th edition). McGraw-Hill
3. Willey, J. M., Prescott, L. M., Sandman, K. M., & Wood, D. H. (2020). *Prescott's microbiology* (11th edition). McGraw-Hill Education.
4. Willey, J. M., Sandman, K., Wood, D. H., & Prescott, L. M. (2023). *Prescott's microbiology* (12th edition, international student edition). McGraw Hill.

**Evaluation (Theory, USMIC4502CR1): Total marks per course - 100.**

Formative Assessment for Learning

(continuous internal assessment - CIA to improve learning).

**CIA – 40 marks**

CIA 1: Written test – 20 marks

CIA 2: Written assignment – 20 marks

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Summative Assessment of Learning (focus on outcomes, quantitative data for outcomes of instruction).

**End Semester Examination – 60 marks**

One question from each unit for 20 marks, with internal choice.

Total marks per question with a choice of 25 - 30 marks.

**Distribution of Bloom's Taxonomy levels for the course assessment**

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
Percentage	15-25%	25-35%	25-35%	25-35%	10-20%	-

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<b>BSc in Microbiology</b>		
<b>Course Title: Elements of Microbial Nutrition, Growth and Control Practical</b>		
<b>Course Code: USMIC4502CR1PR</b>		
Credits: 1      Practical (1)		
Number of hours: 30		
<b>No.</b>	<b>Course Objectives</b>	
1.	Facilitate understanding of the nutritional requirements of microorganisms, including macronutrients and micronutrients as well as growth factors; principles of microbial growth, including different growth phases	
2.	Equip students with skills to determine bacterial density and the factors influencing microbial growth, such as temperature and pH	
3.	Develop proficiency in applying physical and chemical methods for controlling microbial growth, including sterilization and disinfection	
4.	Guide students to conduct basic experiments to control microbial growth.	
<b>CO</b>	<b>Course Outcomes</b> On completing the course, the learner will be able to	<b>Bloom's Taxonomy Level (BT level)</b>
1.	Apply their knowledge of microbial nutrition and growth to practical laboratory experiments and design media for bacterial growth	Apply
2.	Perform experiments to generate growth curves and analyze the data to determine growth parameters and growth-influencing factors	Analyze
3.	Determine bacterial and yeast density using different methods	Apply
4.	Preserve bacterial cultures and choose an appropriate method based on the requirements	Apply
5.	Analyze data from experiments, interpret results, and draw conclusions about microbial growth and control.	Analyze, Evaluate



**S. No. Name of the Practical**

1. Determination of optimum growth conditions of bacteria
2. Design of bacterial growth media
3. Preservation of cultures
4. Enumeration of bacteria
5. Microscopic cell count (Haemocytometer, Breed's Count)
6. Brown's opacity tubes
7. Viable count (Pour plate and Surface spread)
8. Growth curve of *E. coli* and determination of generation time
9. Control of microorganisms
  - Physical methods: Heat, Filtration, UV-Rays, Desiccation, Osmotic pressure
  - Chemical methods: Dyes, Phenolics, cetrimide, chemotherapeutics, Oligodynamic action

**References:**

1. Cappuccino, J. G., & Sherman, N. (2014). *Microbiology: A laboratory manual* (10th edition). Pearson
2. Talaro, K. P., & Chess, B. (2020). *Talaro's foundations in microbiology* (11th edition). McGraw-Hill
3. Willey, J. M., Sandman, K., Wood, D. H., & Prescott, L. M. (2023). *Prescott's microbiology* (12th edition, international student edition). McGraw Hill.

**Evaluation (Practical, USMIC4502CR1PR): Total marks practical course - 50**

**CIA - 20 marks**

**End Semester Practical Examination - 30 marks**

Continuous practical evaluation will be done based on the completion of the hands-on practical sessions.

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**Distribution of Bloom's Taxonomy levels for the practical assessment**

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
Percentage	-	-	45-60%	40-60%	5-10%	-

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<b>BSc in Microbiology</b>		
<b>Course Title: Bacterial staining techniques</b>		
<b>Course Code: USMIC4502VS1</b>		
Credits 2:      Theory (1) = 15 hr Practical (1) = 30 hr		
<b>No.</b>	<b>Course Objectives</b>	
1.	Facilitate understanding of the principles of bacterial staining methods	
2.	Equip students with skills in preparing bacterial samples for staining	
3.	Identification of different bacterial structures and characteristics under the microscope	
4.	Develop skills in interpreting and analyzing stained bacterial slides	
<b>CO</b>	<b>Course Outcomes</b> <b>On completing the course, the learner will be able to</b>	<b>Bloom's Taxonomy Level (BT level)</b>
1	Describe the principles of bacterial staining methods	Understand
2	Explain the differences between various staining techniques	Apply
3	Interpret the results of bacterial staining procedures as well as compare and contrast different bacterial structures observed under the microscope	Apply
4	Analyze stained bacterial slides to identify specific structures and characteristics.	Analyze

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<b>UNIT I</b>	<b>STAINING TECHNIQUES FOR BACTERIA</b>	<b>(15)</b>
A.	Introduction to bacterial staining methods	(2)
B.	Preparation of bacterial samples for staining	(1)
C.	Dyes and stains used to stain bacteria	(2)
D.	Principle and procedure of -	(9)
	1. Monochrome staining technique	
	2. Acid-fast staining technique	
	3. Endospore staining technique	
	4. Capsule staining technique	
	5. Cell wall staining technique	
	6. Lipid granule staining technique	
	7. Volutin granule staining technique	
	8. Flagella staining technique	
	9. Spirochaete staining	
E.	Interpretation of stained bacterial slides	(1)

**References:**

1. Cappuccino, J. G., & Sherman, N. (2014). *Microbiology: A laboratory manual* (10th edition). Pearson
2. Wiley, J. M., Prescott, L. M., Sandman, K. M., & Wood, D. H. (2020). *Prescott's microbiology* (11th edition). McGraw-Hill Education

**S. No. Name of the Practical**

1. Monochrome staining
2. Acid-fast staining technique (*M. smegmatis*)
3. Endospore staining technique
4. Capsule staining technique
5. Cell wall staining technique
6. Lipid granule staining technique
7. Volutin granule staining technique
8. Flagella staining technique



9. Spirochaete staining from tooth tartar

**Evaluation (USMIC4502VS1): Total marks per course – 50**

Formative Assessment for Learning

(continuous internal assessment - CIA to improve learning).

**CIA - 20 marks**

Summative Assessment of Learning

(focus on outcomes, quantitative data for outcomes of instruction)

**End Semester Examination - 30 marks**

**Distribution of Bloom's Taxonomy levels for the assessment**

Learning Levels	Remember	Understand	Apply	Analyze	Evaluate	Create
Percentage	-	20%	35-45%	35-45%	-	-

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