



Eklavya University, Damoh, MP

B.Sc. II YEAR

Industrial Microbiology

Session 2022-23 onwards

NEP-2020

School of Basic & Applied Science

Class	B.Sc. Microbiology		
Semester / Year	II Year		
Subject & Subject code	Industrial Microbiology- EUS2-INMB1T		
Paper	Application of Industrial Microbiology (Paper-I)		
Max. Marks	70 (ETE) + 30 (I) = 100		
Credit	Total Credits		
L	T	P	4
3	1	0	

Course Objectives:

This module gives us detailed knowledge about the growth and metabolism of bacteria. A major goal of Microbial Physiology and Metabolism is to assist scientists in rapidly communicating their research results to other scientists through an open, free-access platform, free from some of the restrictions.

Course Outcome:

On successful completion of the course, the student shall be able to:

1. On successfully completing the module, students will be able to demonstrate a knowledge and understanding of: Basic fermentation processes, design of various fermenters and their types.
2. Different separation techniques and application of fermentation in waste treatment.
3. Students will be able to select industrially important microbes for economical use.
4. Finally students will learn the economics of the fermentation for the total cost of production.

Student Learning Outcomes (SLO):

On successful completion of the course, the student shall be able to:

1. Demonstrate the Winogradsky column.
2. Describe the procedure of sterilization.
3. Describe the process of preparation of basic culture media.
4. Demonstrate the basic concept of cultivation of microorganisms
5. Analyse the growth curve of bacteria
6. Describe the effect of environmental factor
7. Learn about the microbial taxonomy, the basics of microbes, microbial growth, microbial diversity its importance and application in day to day life and beneficial versus harmful microorganisms.

Unit	Syllabus	Periods
UNIT - I	General concept of industrial microbiology and its applications, history & scope. Exploitation of microorganisms and their product, screening, strain development strategies, inoculum preparation, fermentation media, raw material used in media production, antifoaming agents, immobilization methods, buffers, downstream processing. सूक्ष्मजीव विज्ञान के सामान्य सिद्धांत एवं अनुप्रयोग, इतिहास एवं व्यापकता, सूक्ष्मजीव एवं उनके उत्पादों का समुपयोजन, छानवीन, स्ट्रेन विकास रणनीतियां, संरोप तैयार करना, किन्दवन माध्यम, माध्यम उत्पादन में इस्तेमाल होने वाले कच्चा माल, एंटीफोमिंग कार स्थिरीकरण की विधियां, बफर, अनुप्रवाह प्रसंस्करण।	15

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UNIT - II	<p>Fermentation equipment and its uses, fermenter design, Types of fermenters and fermentations- single, batch, continuous, multiple, surface, submerged and solid state. Scale up and scale down process. Harvesting and recovery of intracellular and extracellular product.</p> <p>किण्वन उपकरण और उसके उपयोग, बनावट, प्रकार, किण्वन के प्रकार, एकल, बैच, निरंतर, विभिन्न, सतही, जलमग्न, ठोस अवस्था किण्वन, उचित अनुपात में बड़ा-छोटा करने की प्रक्रिया, अंतरकोशकीय एवं बाह्य कोशकीय उत्पादों की हार्वेस्टिंग।</p>	10
UNIT - III	<p>Industrial products from microorganism- antibiotics: production of penicillin, streptomycin, Enzymes from microbes: amylase, protease, lipase. Organic acids: citric acid, acetic acid, amino acids: glutamic acid, lysine.</p> <p>सूक्ष्मजीवों के औद्योगिक उत्पाद- प्रतिजैविक: पेनिसिलिन एवं स्ट्रेप्टोमाइसिन का उत्पादन सूक्ष्मवों के एंजाइम: एमिलेज प्रोटीएस लाइपेज का उत्पादन, कार्बोनिक अम्ल: सिट्रिक एसिड, एसिटिक एसिड का उत्पादन, एमिनो अम्ल: ग्लूटामिक एसिड, ग्लाइसिन का उत्पादन।</p>	10
UNIT - IV	<p>Production of interferon, vaccines, hormones, vitamins. Production of alcoholic beverages: Beer and wine, Bioflus: ethanol, methane, Biogas Biosurfactants.</p> <p>इंटरफेरॉन, वैक्सीन, हॉर्मोन, विटामिन्स का उत्पादन, अल्कोहलिक पेय का उत्पादन बियर और वाइन, जैवईंधन: इथेनॉल, मीथेन, बायोगैस, बायोसर्फेक्टन्स।</p>	10
UNIT - V	<p>Ethics and law of industrial production: standard operating procedure(SOP), Good manufacturing practices (GMP), patent and copyrights, environmental hazard from fermentation industry, industrial waste management procedure and environmental safety measures, sewage Treatment</p> <p>औद्योगिक उत्पादन के नीतिक एवं नियम: मानक संचालन प्रक्रिया, अच्छा विनिर्माण अभ्यास, पेटेन्ट और कॉपीराइट, किण्वन उद्योग से होने वाली पर्यावरण हानि। औद्योगिक अपशिष्ट प्रबंधन की प्रक्रिया और पर्यावरण सुरक्षा के उपाय, सीवेज उपचार।</p>	15

Reference Books-

- 1 A.H. Patel. Industrial Microbiology, Laxmi Publications; Second edition.
- 2 K.R. Aneja. A Textbook of Basic and Applied Microbiology, new Age International.
- 3 Whitaker and Stanbury Principles of Fermentation Technology.
- 4 Casida. Industrial Microbiology. Tata McGraw Hill.
- 5 Industrial Microbiology, Prescott SC & Dunn CG, 4th Edition (Agrobios Publication, Jodhpur)
- 6 Industrial Microbiology: An Introduction, Waites MJ, Margan NL, Rockey JS, Histon G, 1st Edition.

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Class		B.Sc. Microbiology	
Semester / Year		II Year	
Subject & Subject code		Industrial Microbiology - EUS1-INMB1P	
Paper		Exercises in application of industrial microbiology	
Max. Marks		70 (E) + 30 (I) = 100	
Credit		Total Credits	
L	T	2	
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Course Outcome:

On completion of this course, learners will be able to:

Screen and identify organism of potential industrial importance, to understand working of a fermenter and to produce several biomolecules by fermenter.

Unit	Topic	Periods
	<ol style="list-style-type: none"> 1. Isolation and screening of antibiotic producing microorganism. 2. Screening of amylase producing microorganism. 3. Screening of protease producing microorganism. 4. Screening of Cellulase producing microorganism. 5. Screening of Organic Acid producing microorganism. 6. Screening of methane producing microorganism. 7. Production of enzyme amylase. 8. Production of enzyme protease. 9. Production of enzyme cellulase 10. Production of ethanol. 11. Production of citric acid. 12. Demonstration of working fermentor. 	

Reference Books-

- 1 Practical Microbiology, Dr RC Dubey Dr. DK Maheshwari S Chand Publications.

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Class		B.Sc. Microbiology	
Semester / Year		II Year	
Subject & Subject code		Industrial Microbiology- EUS2-INMB2T	
Paper		Physiology and Biochemistry of Microbes (Paper-II)	
Max. Marks		70 (ETE) + 30 (I) = 100	
Credit		Total Credits	
L	T	P	4
3	1	0	

Course Objectives:

Explain the processes behind mutations and other genetic changes. identify and distinguish genetic regulatory mechanisms at different levels. solve theoretical and practical problems in genetic analysis particularly concerning genetic mapping and strain construction. Molecular biology deals with nucleic acids and proteins and how these molecules interact within the cell to promote proper growth, division, and development. It is a large and ever-changing discipline. This course will emphasize the molecular mechanisms of DNA replication, repair, protein synthesis etc.

Course Outcome:

At the end of the course, learners will be able to:
On successfully completing the module students will be able to demonstrate a knowledge and understanding of: The basic principle of biochemistry including important molecules their economic and scientific importance inside the cell. the students will be able to understand the biochemical pathways of synthesis and degradation of these molecules and the transport of different metabolites generated with application in industrial processes. In addition, the students will have comprehensive knowledge of the microbial physiology and biochemistry.

Student Learning Outcomes (SLO):

Students will:

1. Apply the knowledge to understand the microbial physiology and to identify the microorganisms.
2. Understand the regulation of biochemical pathway and possible process modifications for improved control over microorganisms for microbial product synthesis.
3. Explain principles/concept of Prokaryotic and Eukaryotic genetics, Viral genetics and application in research.
4. Mutagenesis, Mutation and mutants and their significance in microbial evolution.
5. Application of bacterial and eukaryotic plasmids in research.

Unit	Syllabus	Periods
UNIT - I	Biochemistry of Microbes: Chemical composition of cell, molecules of living systems, pH and pK, Buffers Structure and classification of carbohydrates, lipids, proteins, DNA and RNA.	12
	सूक्ष्मजीव जैवरसायन:- कोशिका की रासायनिक संरचना, जीवनतंत्र के अणु, पीएच और पीक मान एवं बफर। कार्बोहाइड्रेट, लिपिड, प्रोटीन, डीएनए और आरएनए की संरचना तथा घर्गीकरण।	

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	Enzymes and their classification, Enzyme kinetics, allosteric enzymes, Michaelis Menten equation, coenzyme, isozyme, enzyme inhibition and regulation. Vitamins: Classification and function. Lock and key hypothesis.	
UNIT - II	सूक्ष्मजीव जैवरसायन:- एंजाइम और उनका वर्गीकरण, एंजाइम बलगतति, अपररथली एंजाइम, माइकलिस मेटेन समीकरण, सहएन्जाइम, आइसोएन्जाइम, एन्जाइम संदमन और विनियमन। विटामिन: वर्गीकरा और कार्य, ताला चाबी परिकल्पना।	12
UNIT - III	Microbial growth, phases of growth, conditions of growth, measurement of growth, growth curyes, generation time, effect of temprature, pH, salinity and oxygen on growth. Bacterial sporulation and germination, binary fission. Chemostate. सूक्ष्मजीव जैवरसायन:- सूक्ष्मजीवीय वृद्धि, वृद्धि प्रावस्थाएं, वृद्धि परिस्िीतियां, वृद्धि आकलन, वृद्धि वक्र, जनन काल, वृद्धि पर तापमान, पीएच, लवणता और ऑक्सीजन का प्रभाव। जीवाणु बीजाणुजनन और अंकरण, बाइनरी विखंडन, कीमोस्टेट।	12
UNIT - IV	Biosynthesis of bacterial cell wall, Difference in eubacterial and archaebacterial cell wall transport across membrane, mechanism of flagellar and cilliary motion and its function. Physiological types of bacteria: Thermophiles, Halophiles, Acidophiles, Psychrophiles, Barophiles. Quorun sensing in bacteria.	
	जीवाणु कोशिका भित्ति का जैवसंश्लेषण, सुजीवाणु और आद्यजीवाणु कोशिका भित्तिपरिवहन एवं झिल्ली में अंतर, कशाभिका एवं रोमक गति क्रियाविधि और कार्य। जीवाणु के कार्यािक प्रकार: तापरागी, लवणरागी, अम्लरागी, शीतरागी, दावरागी। जीवाणु में कोरम संवेदन।	12
UNIT - V	Microbial Photosynthesis, Photosynthetic apparatus in pro and eukaryotes, anoxygenic and oxygenic photosynthesis (cyanobacteria and algae). Light and dark reactions. Microbial respiration: Anaerobic and Aerobic mode of respiration, glycolysis, homo and hetero fermentive pathways. Energy transduction in archaebacterial membrane.Kreb's cycle. सूक्ष्मजैविक प्रकाश संश्लेषण:- अकेन्द्रिक और सुकेद्रक प्रकाश संश्लेषण उपकरण, एनोक्सीजेनिक और ऑक्सीजनिक प्रकाश संश्लेषण, प्रकाश अभिक्रिया और अदीप्त अभिक्रिया। सूक्ष्मजैविक श्वसन : श्वसन की अवायवीय और वायवीय प्रणाली, ग्लोइकोलाइसिस, होमो और हेटेरो किण्वक पथ। आद्यजीवाणु कोशिका झिल्ली में ऊर्जा पारगमन, क्रेब चक्र।	12

Reference Books-

- 1 Lehninger. Principles of Biochemistry, Nelson and Cox.
- 2 J L Jain, Biochemistry. S. Chand.
- 3 A G Moat, JW Foster and M P Spector. Microbial Physiology. Wiley.
- 4 RC Dubey and DK Maheshwari. A Textbook of Microbiology. S.Chand
- 5 Readdy SR. and Reddy SM. Microbial Physiology. Scientific Publishers India.
- 6 Pelczar MJ, Chan ECS and Krieg NR. Microbiology, McGraw Hill Book Company.

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Class		B.Sc. Microbiology	
Semester / Year		II Year	
Subject & Subject code		Industrial Microbiology- EUS2-INMB2P	
Paper		Exercises in Biochemistry and Physiology of Microbes	
Max. Marks		70 (E) + 30 (I) = 100	
Credit		Total Credits	
L	T	P	2
0	0	2	

Course Outcome:

On completion of this course, learners will be able to:

Enumerate microbial population, follow bacterial growth in culture in various conditions, isolation and culture of anaerobes, estimate protein, carbohydrates and lipids.

Unit	Topic	Periods
	1. Enumeration of microbial population. 2. Measurement of bacterial growth spectrophotometrically. 3. Measurement of effect of temperature on bacterial growth. 4. Measurement of effect of pH on bacterial growth. 5. Measurement of effect of oxygen on bacterial growth 6. Measurement of effect of salinity on bacterial growth. 7. Isolation and cultivation of anaerobes. 8. Checking the motility of bacteria by hanging drop method. 9. Estimation of Protein. 10. Estimation of glucose 11. Estimation of Lipids. 12. Enzyme assays- amylase, gelatinase, catalase, lipase etc.	

Reference Books-

- 1 Practical Microbiology, Dr RC Dubey Dr. DK Maheshwari .
- 2 Introduction to practical Biochemistry by David Plummer. Mc Graw Hill.

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