



Eklavya University Damoh MP

B.Sc. I Semester

Industrial Microbiology

Session 2023-24

NEP-2020

School of Basic & Applied Science

Class		B.Sc. Microbiology	
Semester		I Semester	
Subject & Subject code		Industrial Microbiology & 23S11NMB1T	
Paper		Tools & Techniques in Industrial Microbiology	
Max. Marks		60 (ESE) + 40 (I) = 100	
Credit		Total credits	
L	T	P	4
4	0	0	

Course Objectives:

The candidate will gain knowledge about the structure of bacteria, fungi, algae, protozoa and viruses along with the basic principles of microscopy. Control of microbial growth by physical and chemical methods plus the use of antibiotics and their efficacy testing are emphasized. Cultivation of microbes is discussed.

Course Outcome:

At the end of the course, learners will be able to:

- 1: Gain knowledge on various classes of microorganisms; their structure, extracellular and intracellular components, cultural characteristics and their growth conditions.
- 2: Know about the different parts and working mechanisms of basic light microscope up to electron microscopes with deep knowledge of the sample preparation and staining techniques.
- 3: Acquire knowledge on sterilization techniques with adequate information on sterile and aseptic conditions.
- 4: Know about different classes of antibiotics and their mode of actions, treatment strategies and detection of resistant forms of bacteria from clinical settings.
- 5: Know about microbial culture media and pure culture techniques for aerobic and anaerobic cultivation methods of bacteria.

Student Learning Outcomes (SLO):

Students will learn about:

1. Nature of Science and Scientific Inquiry Microbiology majors should make observations, develop hypotheses, and design and execute experiments using appropriate methods. They should be able to explain how the nature of science is applied to every day problems.
2. Laboratory Skills: Microbiology students should master the following laboratory skills: aseptic and pure culture techniques, preparation of and viewing samples for microscopy, use appropriate methods to identify microorganisms, estimate the number of microorganisms in a sample, and use common lab equipment. They should practice safe microbiology, using appropriate protective and emergency procedures.
3. Communication Skills: Microbiology majors will demonstrate competence in written and oral communication.
4. Cooperation/Social Responsibility: Microbiology majors should understand and appreciate the value of cooperating and working effectively with peers and be able to demonstrate a commitment to the process of developing such skills.
5. Values: Microbiology majors should identify and discuss the ethical issues and responsibilities of doing science.

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Unit	Syllabus	Periods
UNIT - I	Microscopy and Microscopic Techniques - Principle and application of light microscopy, dark field microscopy, phase contrast microscopy. Fluorescence Microscopy, Confocal microscopy, Electron Microscopy, Scanning & Transmission, AFM atomic force microscopy. Micrometry, Camera Lucida, Software in microscopy	12
	माइक्रोस्कोपी एवं सूक्ष्म तकनीक:- माइक्रोस्कोपी के सिद्धांत एवं उपयोग, लाइट माइक्रोस्कोपी, डार्कफिल्ड माइक्रोस्कोपी, फेस कंट्रास्ट माइक्रोस्कोपी, फ्लोरोसेंट माइक्रोस्कोपी, कन्फोकल, माइक्रोस्कोपी, इलेक्ट्रॉन माइक्रोस्कोपी, स्कैनिंग इलेक्ट्रॉन माइक्रोस्कोपी एटॉमिक फोर्स माइक्रोस्कोपी। माइक्रोस्कोपी, कैमरा लुसिडा, माइक्रोस्कोपी में सॉफ्टवेयर।	
UNIT - II	Chromatography & Electrophoresis - Principle, applications and affinity of paper chromatography(including 2-D & descending chromatography Thin layer chromatography – column packing & fraction collection Gel Filtration chromatography and ION exchange chromatography GLC & HPLC principle and application Principle and application of native polyacrylamide gel electrophoresis SDS – polyacrylamide gel electrophoresis 2D gel electrophoresis, isoelectric focusing Zymogram preparation, agarose gel electrophoresis	12
	क्रोमेटोग्राफी एवं इलेक्ट्रोफोरेसिस- 1. क्रोमेटोग्राफी के सिद्धांत, उपयोग एवं पेपर क्रोमेटोग्राफी, 2 डी एवं डिसेन्डिंग क्रोमेटोग्राफी। 2. थिन लेयर क्रोमेटोग्राफी-कॉलम पैकिंग एवं फ्रैक्शन कलेक्शन। 3. जेल फिल्ट्रेशन क्रोमेटोग्राफी, आयन एक्सचेंज क्रोमेटोग्राफी। 4. एचपीएससी एवं जीएलसी का सिद्धांत एवं उपयोग। 5. नेटिव पॉली एक्रालमाइड जेल एलएक्ट्रोफोरेसिस सिद्धांत एवं उपयोग, एसडीएस पॉलीएक्रालमाइड जेल इलेक्ट्रो फोरेसिस, जोग्राफ का निर्माण एगरोसाजेल इलेक्ट्रोफोरेसिस।	
UNIT - III	Spectrophotometry, Colorimetry, ?Turbidometry and Centrifugation - Principle and use of absorption spectra of biomolecules. Their analysis using UV and visible range. Principle and use of colorimetry, Principle and use of turbidometry, Principle and types of analytical centrifugation, RCF and sedimentation co-efficient, ultra centrifugation and Types of Gradient, Centrifugation and Types of Gradient, PH meter, Autoclave, hot air oven, incubator, BOD incubator and laminar air flow. colony counter.	12
	स्पेक्ट्रो फोटोमिटर, कोलोरिमिटर, टर्बिडोमिटर एवं सेंट्रिफुगेशन - 1. बायोमोलेक्यूल के अवशोषण स्पेक्ट्र के सिद्धांत एवं उपयोग, अल्ट्रावायलेट यूवी एवं दृश्य क्षेत्र द्वारा इनका विश्लेषण। 2. कोलोरिमिटर का सिद्धांत एवं उपयोग। 3. टर्बिडोमिटर का सिद्धांत एवं उपयोग। 4. विश्लेषणात्मक सेंट्रिफुगेशन का सिद्धांत एवं उपयोग आरसीएफ, एवं सेडीमेंटेशनकोफिसिएंट, अल्ट्रा सेंट्रीफुगेशन एवं विभिन्न ग्रेडिएंट, कॉलोनी काउन्टर।	

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	<p>Culture Techniques - Culture media, preparation types- defined, differential and selective and enrichment culture media. Isolation techniques- pour plate, spread plate, streak plate, serial dilution method. Pure culture, enrichment culture, broth culture and micromanipulator Maintenance and preservation of pure microbial cultures, Lyophilisation, Cryopreservation.</p>	
UNIT - IV	<p>कल्चर तकनीक - 1. कल्चर मीडिया के नाम प्रकार एवं इसे बनाने की विधि, डिफरेंशियल, सलेक्टिव एवं इनरिचमेन्ट कल्चर मीडिया। 2. कल्चर की प्रथककरण तकनीक, पोर प्लेट, स्प्रेड प्लेट, एवं स्ट्रेक प्लेट, सीरियल डिल्यूशन विधि,। 3. प्योर कल्चर, इनरिचमेन्ट कल्चर, ब्रोथ कल्चर एवं माइक्रोमैनिपुलेशन। 4. सूक्ष्म जैविक प्योज कल्चर का परिरक्षण एवं रखरखाव।</p>	12
	<p>Sterilization and Staining Techniques - Sterilization – Principle & methods of sterilization, physical and chemical agents of sterilizations, Disinfectants, antiseptics, phenol coefficient. Nature of dyes, physical and chemical theories of staining. Principle, procedure and application of simple staining, negative staining, differential staining. Study of Aseptic techniques, preparation of cotton plug for test tube and pipettes, wrapping of petri plates and pipettes. Flagella staining</p>	
UNIT - V	<p>निर्जमीकरण एवं रंजक तकनीक - 1. निर्जमिकरण के सिद्धांत एवं विधि, निर्जमीकरण के भौतिक एवं रासायनिक कारक। 2. निरसक्रमक, रोगाणुरोधक, फिनोल कॉफिसिएंट। 3. रंजक पदार्थ की प्रकृति, एवं इसके भौतिक एवं रासायनिक सिद्धांत। 4. सरल रंजक सिद्धांत विधि एवं उपयोग, ऋणात्मक स्टैनिंग डिफरेंशियल स्टैनिंग तकनीक एवं रोगाणुरोधक तकनीक का अध्ययन, कॉटन प्लग बनाना, पेट्रीडिश एवं पिपेट आदि को कवर करना। फ्लैजिला स्टैनिंग।</p>	12

Text Books –

- 1 Microbiology by Pelczar, Chan and Kreiz
- 2 General Microbiology by Stainier Ingharam, Wheelis and Painter.
- 3 Biology of microorganism by Brook and Madigan.
- 4 Fundamental Principles of Bacteriology by A.J.Salle.
- 5 Introduction of Microbiology by Ingraham and Ingraham.
- 6 Tools and techniques in Microbiology by Nath and Ingraham.

Reference Books –

- 1 Prescott, M.J., Harley, J.P. and Klein, D.A. Microbiology. 5th Edition WCB Mc Graw Hill, New York, (2002).
- 2 Tortora, G.J., Funke, B.R. and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore, (2004).
- 3 Alcomo, I.E. Fundamentals of Microbiology. VI Edition, Jones and Bartlett Publishers. Sudbury. Massachusetts, (2001).
- 4 Black J.G. Microbiology-Principles and Explorations. John Wiley & Sons Inc. New York, (2002).

Suggested equivalent online courses:

- 1 [https://netel.ac.in/courses/104/104/104104066/analytical methods](https://netel.ac.in/courses/104/104/104104066/analytical%20methods)
- 2 [https://netel.ac.in/courses/102/107/102107028/techniques tools](https://netel.ac.in/courses/102/107/102107028/techniques%20tools)

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Class		B.Sc. Microbiology	
Semester		I Semester	
Subject & Subject code		Industrial Microbiology & 23S1INMB1P	
Paper		Techniques in Industrial Microbiology	
Max. Marks		60 (E) + 40 (I) = 100	
Credit		Total Credits	
L	T	P	2
0	0	2	

Course Outcome:

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

To be able to understand role and use of different tools and firrerent modern techniques in the study's of Industrial microbiology.

Unit	Topic	Periods
	<ol style="list-style-type: none"> 1. Study of fluorenscent micrographs to visualize bacterial cells. 2. Ray diagram of phase contrast microscopy & electron microscopy. 3. Separation of mixture in by paper / thin layer chromatography. 4. Demonstration of column packing in any form of column chromatography. 5. Separation of protein mixture by any form of chromatography. 6. Separation of protein mixture by polyacrylamide Gel Electrophoresis page. 7. Determination of Lamda max for an unknown sample and calculation of extinction coefficient. 8. Separation of components of a given mixture using a laboratory scale centrifuge. 9. Understand densitygradient centrifugation with help of pictures. 10. To study the principle and applicatoin of important instruments-colony counter, autoclave, incubator, hot air oven, pH meter, laminar air flow. 11. Preparation of culture media for bacterial cultivation. 12. Sterilization of medium by using autoclave and assessment for sterility. 13. Sterilization of glass ware using hot air oven and assessment for sterility. 14. Sterilization of heat sensitive material by membrane filtration and assessment for sterility. 15. Demonstration of the presence of micro flora in the environment by exposing nutrient agar plats to air. 16. Simple staining, Gram staining, methylene blue staining. 17. Pure culture Techniques, pour, streak & spread. Use of inoculation loop and needle, demonstration. 18. To study the principle and application of incubators, centrifuge. Different types of filter and colony counter, colorimeter and spectrophotometer. 	

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Assessment and Evaluation

Suggested Continous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction/Quiz	10	Viva Voce on Practical	10
Attendance	10	Practical Record File	10
Assignment (Charts/Model Seminar/Rural Service/ Technology Dissemination/ Report of Excursion/Lab Visits/ Survey/ Industrial Visit)	20	Table Work/Experiments	40
Total	40		60

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Eklavya University Damoh MP

B.Sc. II Semester

Industrial Microbiology

Session 2023-24

NEP-2020

School of Basic & Applied Science

Class		B.Sc. Microbiology	
Semester / Year		II Semester	
Subject & Subject code		Industrial Microbiology & 23S2INMB2T	
Paper		Fundamentals of Industrial Microbiology	
Max. Marks		60 (ESE) + 40 (I) = 100	
Credit		Total Credits	
L	T	P	4
4	0	0	

Course Objectives:

This course deals with characteristics, properties and biological significance of the biomolecules of life. In depth knowledge of the energetic and regulation of different metabolic processes in microorganisms. The candidate will gain knowledge about Immunity, organs of immunity and cells involved. Types of antigens and immunoglobulins. Antigen- antibody reactions and assays. MHC and its significance.

Course Outcome:

At the end of the course, learners will be able to:

1. Grasp the basic understanding of carbohydrates.
2. Grasp the information on carbohydrate metabolism.
3. Gain the basic knowledge on protein.
4. Obtain knowledge on structure, classification & biological roles of proteins.
5. Obtaining in-depth information on lipids and their classification.
6. Assimilate knowledge on biosynthesis and metabolism of lipids.
7. Grasp the basic knowledge on DNA & RNA and their biosynthesis.
8. Differentiate the humoral and cell mediated immune mechanisms.
9. Know how MHC functions in the immune system.
10. Gain knowledge on vaccines, toxoids and immunotherapy.

Student Learning Outcomes (SLO):

Students will:

1. Be able to describe a standard carbohydrate and the different bonding patterns that lead to different attributes or uses.
2. Be able to describe the four classes of lipids and how each is used in a biological system.
3. Be able to explain how protein denaturation is performed, describe the structure-function relationship of a protein, and how this relates to the ability to catalyze reactions as an enzyme.
4. Study the properties of carbohydrates, proteins, lipids, cholesterol, DNA, RNA, glycoproteins and glycolipids and their importance in biological systems.
5. Understand the methods of determination of amino acid and nucleotide sequence of proteins and DNA respectively.
6. Demonstrate a thorough knowledge of the intersection between the disciplines of Biology and Chemistry.
7. Compare and contrast innate and adaptive immunity.
8. Describe which cell types and organs present in the immune response.

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Unit	Syllabus	Periods
UNIT - I	<p>History and Scope :- Development of Industrial Microbiology, Germ theory of disease. theory of spontaneous generation. Scope and applications of Industrial Microbiology in human welfare. Contribution of :- A.V. Leeuwenhoek, Alexander Fleming Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister Development of various Microbiological techniques and Golden Era of Industrial Microbiology.</p> <p>इतिहास एवं क्षेत्र:- औद्योगिक सूक्ष्मजैविकी का विकास, जर्मथ्योरी का सिद्धांत। स्वतः जनन सिद्धांत। मानव कल्याण के लिए औद्योगिक सूक्ष्मजैविकी का कार्यक्षेत्र एवं उपयोग, निम्न का योगदान: ए व्ही ल्यूवेन हॉक, एलेक्जेंडर फ्लेमिंग, लुइस पाश्चर, रॉबर्ट कोच, एडवर्ड जेनर एवं जोसेफ लिस्टर। विभिन्न सूक्ष्मजीवी तकनीक का विकास तथा औद्योगिक सूक्ष्मजैविकी का स्वर्णयुग।</p>	10
UNIT - II	<p>Microbial Diversity A :- Systems of Classification- Binomial Nomenclature Whittaker's five Kingdom Carl Woese's three domain Classification systems and their utility. VIRUS: Classification, General characteristics, Structure and Reproduction of viruses, Viroids and Prions. Life Cycle of RNA and DNA Viruses, Lytic cycle, Lysogeny, Bacteriophage General characteristics, Classification, Ultra structure and Reproduction of Bacteria. Role of Bacteria in Industries.</p> <p>सूक्ष्मजीवियों में विविधता ए :- वर्गीकरण प्रणाली – द्वि नामकरण, क्लिटेकर का पांच किंगडम कार्ल वूज के तीन किंगडम वर्गीकरण प्रणाली तथा उनका उपयोग। विषाणु विज्ञान : वर्गीकरण, सामान्य लक्षण, संरचना तथा प्रजनन। वाइराइस एवं प्रिआन्स, आर एन ए तथा डी एन ए विषाणुओं का जीवनचक्र लायटिक लाइसोजेनिक चक्र, जीवाणु विज्ञान: सामान्य लक्षण, जीवाणुभोजी। वर्गीकरण परासंरचना एवं प्रजनन, उद्योगों में जीवाणुओं की भूमिका।</p>	14
UNIT - III	<p>Microbial Diversity B :- Bacteria with unusual properties: General characteristics, occurrence reproduction and economic importance of the following- Cyanobacteria, Mycoplasma, Rickettsia and Actinomycetes. Beneficial and harmful microbes and their role in daily life. Archaea-habit and general morphological characters. Important Representative of Archaea-Methanogens and thermophiles.</p> <p>सूक्ष्मजीवियों में विविधता बी :- असामान्य गुण युक्त जीवाणुओं का समुदाय :- सामान्य लक्षण, उपस्थिति तथा प्रजनन, एवं आर्थिक महत्व: सायनो बैक्टीरिया, माइकोप्लाज्मा, रिकेट्सिया एवं एक्टिनोमाइसिटीज। उपयोगी एवं हानिकारक सूक्ष्मजीव एवं उनका हमारी दिनचर्या में उपयोग। आर्किया: प्रवृत्ति तथा सामान्य अकारिकीय लक्षण। आर्किया के महत्वपूर्ण प्रतिनिधि: मिथेनोजेन्स एवं थर्मोफाइल्स।</p>	14
UNIT - IV	<p>Microbial Diversity C :- Morphological features, classification and characteristics of Myxomycetes(Slime Mould) Some microbiologically important Micro fungi-Rhizopus, Mucor, Neurospora, Aspergillus, Penicillium and Yeasts. Agaricus, General account of Microbiologically Important Algae. Role of Fungi in Medicine and in Industries.</p>	12

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	<p>सूक्ष्मजीवियों में विविधता सी :- अकारकीय लक्षण, वर्गीकरण एवं मिक्सोमाइसिटीज के लक्षण। सूक्ष्मजैविकी में उपयोगी कवक: राइजोपस, म्यूकर, न्यूरोस्पोरा, एस्परजिलस, पेनीसिलियम यीस्ट एवं अगेरिकस। सूक्ष्मजैविकी में उपयोगी शैवाल का सामान्य परिचय। दवाइयों एवं उद्योगों में कवक की भूमिका।</p>	
	<p>Application of Microbes in Industrial Microbiology :- Applications of Microbes in Industrial Microbiology: Application in human therapeutics, Agriculture (biofertilizers, Mycorrhizae). Environmental and Food Technology. Use of Prokaryotic and eukaryotic microorganisms in Biotechnological Application. Genetically engineered microbes for Industrial Applications. Alternative Sources of Energy.</p>	
UNIT - V	<p>औद्योगिक सूक्ष्मजैविकी में सूक्ष्मजीवों की उपयोगिता : मानव रोगों के उपचार में उपयोगिता, कृषि, पर्यावरण एवं खाद्य तकनीकी में उपयोगिता प्रोकैरियोटिक एवं यूकैरियोटिक सूक्ष्मजीवों की जैव तकनीक में उपयोगिता जिनटिकली रूपान्तरित सूक्ष्मजीवों की उपयोगिता, ऊर्जा के वैकल्पिक स्रोत।</p>	10

Text Books-

1. Principles of Biochemistry by A.L. Lehninger.
2. Fundamental of Biochemistry by J.L. Jain
3. Biochemistry by Voet and Voet.
4. Microbial Genetics by Freifelder
5. Textbook of microbiology by Dubey and Maheshwari

Reference Books-

1. Tortora, G.J., Funke, B.R and Case, C.L. Microbiology: An Introduction. Pearson Education, Singapore. (2004).
2. Stanbury, Biochemistry.
3. Voet. Fundamentals of biochemistry Wiley.
4. M.M. Cox, D. L. Nelson. Lehninger's principles of biochemistry. W H Freeman.
5. Stryer. Biochemistry W H Freeman.
6. A Biologists guide to principles and techniques of practical biochemistry, K.W. KH Goulding, ELBS edition, 1986.

Suggested equivalent online courses:

- 1 [https://netel.ac.in/courses/102/103/102103044/technique tools](https://netel.ac.in/courses/102/103/102103044/technique%20tools)
- 2 <https://netel.ac.in/courses/104/105/104105102/techniques>

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Class		B.Sc. Microbiology	
Semester / Year		II Semester	
Subject & Subject code		Industrial Microbiology & 23S2INMB2P	
Paper		Basic Exercises in Industrial Microbiology	
Max. Marks		60 (E) + 40 (I) = 100	
Credit		Total Credits	
L	T	P	2
0	0	2	

Course Outcome:

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

To stain and identify bacteria and understand the working of various instruments used in basic study of bacteria.

Unit	Topic	Periods
	<ol style="list-style-type: none"> 1. Safety measures in Laboratory. 2. Cleaning and sterilization of glassware's. 3. Use of Microscope. 4. Study of Aseptic Techniques - Preparation of cotton plug for test tubes, wrapping of petri plates. 5. Staining of Bacteria, Metachromatic staining, cell wall staining, spore staining, staining of fungi and algae. 6. Microscopic examination of living microorganisms. 7. Use of micrometer and camera lucida. 8. Preparation of bacterial smear. 9. Study of Rhizopus, Mucor, Penicillium, Aspergillus, and yeasts. 10. Slide culture techniques for studying morphology of moulds. 11. Microscopic observation of VAM Infection and Cyanobacteria. 12. Study of mushroom and types. 	

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Assessment and Evaluation

Suggested Continous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction/Quiz	10	Viva Voce on Practical	10
Attendance	10	Practical Record File	10
Assignment (Charts/Model Seminar/Rural Service/ Technology Dissemination/ Report of Excursion/Lab Visits/ Survey/ Industrial Visit)	20	Table Work/Experiments	40
Total	40		60

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