



Karmaveer Bhaurao Patil University, Satara

Syllabus for

B. Sc. II (Microbiology)

Under

Faculty of Science and Technology

(As per NEP 2020)

With effect from Academic Year 2025-2026

Syllabus for Bachelor of Science (B. Sc.) Part – II Microbiology

PREAMBLE:

The B.Sc. Microbiology course under the autonomy framework will be introduced in the academic year 2025-2026. It has been designed to meet the specific needs of B.Sc. Microbiology students in accordance with the NEP 2020 guidelines. The curriculum has been developed to reflect the expanding scope of biological sciences. The focus is on equipping students with up-to-date knowledge while maintaining a strong foundation in classical Microbiology. This approach will enable students to understand and appreciate contemporary interdisciplinary methods in Microbiology and their contributions to societal development. The course also includes new practical exercises, providing students with hands-on experience with the latest techniques currently in use. Additionally, the course is intended to inspire students to pursue higher studies in Microbiology, become entrepreneurs, and seek employment in Microorganisms-based industries.

GENERAL OBJECTIVES OF THE COURSE:

1. To provide students with a solid foundation in field of Microbiology.
2. To foster a scientific mindset, encouraging students to be open-minded, critical, and curious.
3. To develop practical skills in conducting experiments and working with laboratory materials.
4. To help students understand scientific terms, concepts, facts, phenomena, and their interrelationships.
5. To raise students' awareness of natural resources and environmental issues.
6. To equip students with knowledge of Microorganisms and related subjects, enabling them to better understand nature and the environment for the benefit of humanity.
7. To empower students to apply their knowledge to enhance industry, agriculture and related fields, promoting self-reliance.

PROGRAMME OUTCOMES

After completing the B.Sc. program, graduates will:

1. Possess a strong foundation of knowledge in their chosen field of study.
2. Develop a scientific mindset, becoming open-minded, critical, and curious, which will support their entry into research and innovation.
3. Be skilled in practical work, experiments, and the use of laboratory materials.
4. Be eligible to pursue higher studies in their field, both in India and abroad.
5. Qualify to appear for examinations for jobs in government organizations.
6. Meet the minimum eligibility requirements for various science-related job opportunities.
7. Be prepared to establish their own entrepreneurial ventures.

8. Enhance critical thinking, develop a scientific attitude, solve problems, improve practical skills, boost communication abilities, and strengthen social interactions.

PROGRAMME SPECIFIC OBJECTIVES

The B.Sc. (Microbiology) programme aims to:

1. Provide comprehensive knowledge of microorganisms, their diversity, classification, physiology, genetics, immunology, molecular biology, and their significance in health, agriculture, industry, and the environment.
2. Develop practical and analytical skills in microbiological techniques, laboratory practices, microbial identification, molecular methods, and experimental design for scientific investigation and problem-solving.
3. Promote application-oriented learning by enabling students to utilize microbiological principles for environmental management, industrial processes, healthcare, agriculture, food safety, and biotechnology.
4. Prepare competent professionals and lifelong learners capable of pursuing higher education, research, entrepreneurship, and careers in academia, research organizations, healthcare, and microbiology-based industries while adhering to ethical and professional standards.

PROGRAMME SPECIFIC OUTCOMES

After completing the B.Sc. (Microbiology) program, students will:

1. Explain applications of microorganisms in various field such as agriculture, environment, industries such as food and dairy industries, distilleries, pharmaceutical, industries, immunology and medical microbiology etc.
2. Describe the characteristics of different types of microorganisms and methods of their classification, methods of visualizing microorganisms, controlling growth of microorganisms, isolation and maintenance of bacterial cultures immunological concepts with reference to infection and immunity.
3. Apply subject knowledge to solve issues like bioremediation, waste management and diagnostics or to design and execute experiments related to Microbiology, immunology, molecular Biology, recombinant DNA technology, microbial genetics etc.
4. Pursue higher studies in different branches of Microbiology like Medical Microbiology, Industrial Microbiology, Virology, Marine Microbiology, Food Microbiology, etc.
5. Take up a suitable position in myriad sectors like academia, research and development, government sector or in industries like pharmaceuticals, food and beverages, bakery, winery, water testing and treatment, etc.

1. TITLE: Microbiology

2. YEAR OF IMPLEMENTATION: 2025-2026

3. DURATION: 01 year

4. PATTERN: Semester examination

5. MEDIUM OF INSTRUCTION: English

6. BATCH SIZE: 16 Students per batch

7. ELIGIBILITY OF THE STUDENT: As per guidelines obtained from university by following rules and regulations regarding reservations by Govt. of Maharashtra

8. ELIGIBILITY OF THE CORE FACULTY:

As per the rules and regulations of the university Grants Commission (UGC) and the Government of Maharashtra.

9. STRUCTURE OF COURSE:

As per NEP_2020 (2.0)

Sem (Level)	Courses			OE	VSC/ SEC	AEC/ VEC/ IKS	OJT/ FP/ CEP/ CC/ RP	Total Credits	Degree/ Cum. Cr. MEME
	Course I	Course II	Course III						
	Major	Minor	-						
Sem III (5.0)	Major V (2) Major VI (2) Major P III (2)	Minor V (2) Minor VI (2) Minor P III (2)	-	OE III (2)	VSC I (2) (P) (Major specific) SEC I (2)(P)	AEC I (2) (English) IKS II (2) (Major Specific)	-	22	UG Diploma: 88
Sem IV (5.0)	Major VII (2) Major VIII (2) Major P IV (2)	Minor VII (2) Minor VIII (2) Minor P IV (2)	-	OE IV (2)	VSC II (2)(P) (Major specific) SEC II (2) (P)	AEC II (2) (English) VEC II (2) (Environ- mental studies)	-	22	
Credits	12	12	-	04	08	08	-	44	Exit option: 4 Cr. NSQF/ Internship /Skill Courses

10. COURSE TITLE**1) Third Semester**

Sr. No.	Subject	Theory				Practical		
		Course No. & Course Code	Title of Paper	No. of lectures per week	Credits	Course No. & Course Code	No. of Practical Per week	Credits
1.	Course I Major	BMiT 231	Microbial Physiology and Metabolism	2	2	BMiP 233	4	2
2.		BMiT 232	Applied Microbiology	2	2			
3.	Course II Minor	BMiT 234	Agricultural and Environmental Microbiology	2	2	BMiP 236	4	2
4.		BMiT 235	Applied Microbiology I	2	2			
5.	OE					BMiP OE III	2	2
6.	VSC		Fermentation Technology			BMiP VSC I	4	2
7.	SEC		Basic of Biostatistics			BMiP SEC I	4	2
9	AEC	BMiT AEC 1	English for Communication Course-I	2	2			
10	IKS	BMiT IKS 2	Introduction to Vedic Microbiology	2	2			

2) Semester IV

Sr. No.	Subject	Theory				Practical		
		Course No. & Course Code	Title of Paper	No. of lectures per week	Credits	Course No. & Course Code	No. of Practical Per week	Credits
1.	Course I Major	BMiT 241	Bacterial Genetics	2	2	BMiP 243	4	2
2.		BMiT 242	Basics in Medical Microbiology and Immunology	2	2			
3.	Course II Minor	BMiT 244	Basics in Medical Microbiology and Immunology	2	2	BMiP 246	4	2
4.		BMiT 245	Applied Microbiology II	2	2			
5.	OE					BMiP OE IV	4	2
5.	VSC		Analytical Techniques and Instrumentation			BMiP VSC II	4	2
6.	SEC		Fundamentals of Bioinformatics			BMiP SEC II	4	2
7.	AEC	BMiT AEC II	English for Communication Course-I	2	2			
8.	VEC 2	BMiT VEC II	Environmental Studies	2	2			

11. EVALUATION STRUCTURE:

- Semester III

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE- I	CCE- II	CCE- III			
Major	T	BMiT 231	10	10	10	30	50	02
	T	BMiT 232	10	10	10	30	50	02
	P	BMiP 233	20			30	50	02
Minor	T	BMiT 234	10	10	10	30	50	02
	T	BMiT 235	10	10	10	30	50	02
	P	BMiP 236	20			30	50	02
OE	P	BMiPOE	20			30	50	02
VSC	P	BMiPVSC I	20			30	50	02
SEC	P	BMiPSEC I	20			30	50	02
AEC I	T	BMiTAEC I	10	10	10	30	50	02
IKS II	T	BMiTIKS II	10	10	10	30	50	02
Total							550	22

Semester IV

Course	Course Category	Course Code	Internal Evaluation			ESE	Total Marks	Credits
			CCE-I	Mid - Semester	CCE-II			
Major	T	BMiT 241	10	10	10	30	50	02
	T	BMiT 242	10	10	10	30	50	02
	P	BMiP 243	20			30	50	02
Minor	T	BMiT 244	10	10	10	30	50	02
	T	BMiT 245	10	10	05	30	50	02
	P	BMiP 246	20			30	50	02
OE	P	BMiPOE	20			30	50	02
VSC	P	BMiPVSC II	20			30	50	02
SEC	P	BMiPSEC II	20			30	50	02
AEC II	T	BMiTAECEC II	10	10	10	30	50	02
VEC II	T	BMiTVECEC II	10	10	10	30	50	02
Total							550	22

12. OTHER FEATURES:

A) LIBRARY:

Reference books, Textbooks, journals, and Periodicals are available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

B) EQUIPMENT:

1. Computer, LCD projector, visualizer, smart board
2. Laboratory Equipment:
 - a. Analytical Balance,
 - b. Autoclave,
 - c. Centrifuge,
 - d. Colony Counter,
 - e. Deep Freezer,
 - f. Homogenizer,
 - g. Hot plate,
 - h. Electrophoresis Power Supply Unit,
 - i. Mini Horizontal Electrophoresis,
 - j. Incubator shaker,
 - a. Laminar Air Flow/ Laminar Hood,
 - b. Magnetic Stirrer,
 - c. Microscope,
 - d. pH Meter,
 - e. UV Spectrophotometer,
 - f. Vortex Mixture/ Vortexer,
 - g. Water Bath,
 - h. Double Distillation water unit,
 - i. Anaerobic Culture Jar,
 - j. Vacuums Pump,

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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester- III
	Type : Major	Marks: 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BMiT 231 Microbial Physiology and Metabolism		
Course Objectives: By the end of the course, students should be able to: - recall bacterial cell structures like wall structure with variations in gram positive and gram-negative bacteria. - understand different environmental factors influencing microbial growth - explain the transport mechanism in bacterial cells. - study various energy-yielding pathways in microorganisms.		
Course Outcomes: By the end of the course, students will be able to: - differentiate gram positive and gram-negative bacteria based on their cell wall. - classify the microorganisms based on environmental conditions required for growth. - illustrate transport system of nutrients and role of siderophores in iron uptake in microorganisms. - explain the concept of energy change and metabolic pathways in bacteria.		
Module	Title and Contents	Hrs
Module -1:	Bacterial cell structure 1.1 Structural components of Gram-positive and Gram-negative bacterial cell wall with their variations and their functions 1.2 Bacterial Endospore- Ultrastructure, Sporulation and Germination 1.3 Flagella- Mechanism of movement, tactic behavior	07
Module -2:	Effect of Environment on Microbial Growth Microbial growth in response to environment 2.1 Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermoduric, psychrotrophic) Thermal destruction of bacteria- D, F, Z value TDP and TDT 2.2 pH (acidophiles, alkaliphiles) 2.3 Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe) 2.4 Osmotic pressure- Isotonic, Hypertonic, Hypotonic environment, Water activity Xerophiles, halophiles 2.5 Effect of UV and Heavy metals	08
Module -3:	Nutrient uptake and Transport 3.1 Transport properties of transport proteins, Structure and function of membrane transport proteins.	08

	3.2 Passive and facilitated diffusion ii) Primary and secondary active transport, concept of uniport, symport and antiport. 3.3 Group translocation 3.4 Iron uptake	
Module -4:	Chemoheterotrophic Metabolism 4.1 Concept of free energy, High energy compounds 4.2 Concept of metabolism, catabolism, anabolism, respiration (aerobic and anaerobic respiration) and fermentation-Homofermentation and Heterofermentation. 4.3 Sugar degradation pathways i.e. EMP, TCA cycle 4.4 Electron transport chain: components of respiratory chain	07

Reference Books:-

- 1) Berg, Jeremy M., John L. Tymoczko, Gregory J. Gatto Jr., and Lubert Stryer. Biochemistry. 9th ed. New York: W.H. Freeman and Company, 2019. Willey, J., Sherwood, L., Woolverton, C. "Prescott's Microbiology". New York: McGraw-Hill Education, 2020
- 2) Lehninger, Albert L., David L. Nelson, and Michael M. Cox. Lehninger's Principles of Biochemistry. New York: Macmillan, 2005.
- 3) Madigan, Michael T., John M. Martinko, David A. Stahl, and David P. Clark. Brock Biology of Microorganisms. Pearson International Edition. Boston: Pearson, 2010.
- 4) Powar, C. B., and H. F. Dagainawala. General Microbiology, Vol. I. Mumbai: Himalaya Publishing House, 2010.
- 5) Willey, Joanne M, Linda M. Sherwood, and Christopher J. Woolverton. Prescott, Harley, and Klein's Microbiology. New York: McGraw-Hill, 2008

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks):

- CCE-I: 10 Marks: Assignment/ Class Tests
- CCE-II: 10 Marks: Case study/ Seminar/ Field Work
- CCE-III: 10 Marks: Multiple Choice Questions

(Best of two marks will be considered for the final mark entry)

End Semester Examination (30 Marks):

- Q.1) Solve the following questions. [5X2=10]
- Q.2) Attempt any two questions. [2X10=20]
- Q.3) Attempt any four questions. [4X5=20]

Note: Conversion of 50 marks of ESE evaluation to 30 marks

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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester- III
	Type : Major	Marks: 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BMiT 232 Applied Microbiology		
Course Objectives: By the end of the course, students should be able to: 1. recall the basic concepts of air microbiology 2. understand methods of microbiological analysis of water. 3. learn the preservation techniques of food and basics of milk microbiology. 4. know basic concept of fermentation with respect to fermenter design, fermentation media and concept of primary and secondary metabolites.		
Course Outcomes: By the end of the course, students will be able to: 1. explain microbial infections transmitted through air and water. 2. perform microbiological analysis of air and water samples. 3. explain the food preservative methods and pasteurization of milk. 4. discuss the design of fermentation processes and compare primary and secondary screening procedures.		
Module	Title and Contents	Hrs
Module - 1:	Applied Microbiology 1.1 Air flora - Transient nature of air flora - Droplet, droplet nuclei, and aerosols 1.2 Air pollution: Chemical pollutants, their sources in air and effects on human health 1.3 Methods of Air sampling and types of air samplers - Impaction on solids, Impingement in liquid, Sedimentation, Centrifugation Precipitation, Thermal Precipitation 1.4 Air borne infections–Tuberculosis (Causative agent, transmission, symptoms and treatment)	07
Module - 2:	Water Microbiology 2.1 Sources of microorganisms in water. 2.2 Fecal pollution of water, Indicators of fecal pollution of water – <i>E. coli</i> 2.3 Routine Bacteriological analysis of water. 2.3.1 Standard Plate Count 2.3.2 Tests for coliforms- a) Qualitative-Detection of coliforms- Presumptive test, Confirmed test, Completed test b) Differentiation between coliforms - IMViC test, Eijkman test. 2.3.3 Quantitative - MPN, Membrane filter technique 2.4 Water borne infection- Cholera (Causative agent, transmission symptoms and treatment)	08

Module - 3:	Food and Milk Microbiology 3.1 Food Microbiology - Introduction, Classification of food based on stability, General principles and methods of food preservatives- Asepsis, Removal of Microorganisms, Dehydration, Use of Heat, Irradiation, anaerobiosis, Use of chemical Preservatives 3.2 Food poisoning- Staphylococcal food poisoning (Causative agent, transmission, symptoms and treatment) 3.3 Milk microbiology - Definition and composition of milk, sources of microbial contamination in milk, Microbial examination of milk: Standard plate count, Dye reduction test, Direct microscopic count, Pasteurization of milk: methods, efficiency of pasteurization - phosphatase test. 3.4 Milk borne infections-Brucellosis (Causative agent, symptoms, transmission, treatment and preventive measures)	08
Module - 4:	Industrial Microbiology 4.1 Fermenter: Definition, Typical Fermenter design – Parts and their functions Concept of metabolism, catabolism, anabolism, respiration (aerobic and anaerobic respiration) and fermentation-Homofermentation and Heterofermentation. 4.2 Fermentation Media-Water, carbon source, nitrogen source, precursors, growth factors, antifoam agents and chelating agents. 4.3 Types of fermentations – Batch, continuous, dual and multiple. 4.4 Factors affecting fermentation process. 4.5 Primary and secondary screening of industrially important organisms	07
Reference Books:- 1) Casida, L. E. Industrial Microbiology. 2nd ed. New Delhi: New Age International Publishers, 2007. 2) Dubey, R. C., and D. K. Maheshwari. A Textbook of Microbiology. New Delhi: S. Chand & Company Ltd., 2013. 3) Frobisher, M., R. D. Hinsdill, K. V. Crabtree, and C. R. Goodheart. Fundamentals of Microbiology. 9th rev. ed. Philadelphia: W. B. Saunders Company, 1974. 4) Mahanta, K. C. Dairy Microbiology. New Delhi: Omsons Publications, 1997. 5) Miller, B. M., and W. Litsky. Industrial Microbiology. New York: McGraw-Hill, 1976. 6) Modi, H. A. Fermentation Technology. Vols. I and II. Jaipur: Pointer Publishers, 2009. 7) Patel, A. H. Industrial Microbiology. Delhi: Trinity Press, 2016. 8) Powar, C. B., and H. F. Dagainawala. General Microbiology. Vol. I. Mumbai: Himalaya Publishing House, 2010. 9) Prescott, L.M, John P. Harley, and Donald A. Klein. Microbiology. 6 th ed. New York: McGraw-Hill Companies, Inc., 2005.		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation (20 Marks): - CCE-I: 10 Marks: Assignment/ Class Tests - CCE-II: 10 Marks: Case study/ Seminar/ Field Work		End Semester Examination (30 Marks): Q1) Solve the following questions. [5X2=10] Q2) Attempt any two questions. [2X10=20] Q3) Attempt any four questions. [4X5=20]

• CCE-III: 10 Marks: Multiple Choice Questions (Best of two marks will be considered for the final mark entry)	Note: Conversion of 50 marks of ESE evaluation to 30 marks
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Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Microbiology

Programme: B.Sc.

Semester- III

Type : Major

Marks : 50

Credits : 2

From: A. Y. 2025-26

Name of the Course: BMiP 233 : Practical Course

Course Objectives: Student should be able to,

- 1) study staining techniques of different bacterial organelles like flagella, endospore and nucleus.
- 2) understand the effect of various environmental factors on growth of microorganisms.
- 3) learn microbial analysis of air and water
- 4) know the techniques of primary screening of industrially important microorganisms.

Course Outcomes: Student will be able to,

- 1) perform staining procedure to observe different bacterial organelles like flagella, endospore, nucleus under microscope by staining techniques.
- 2) determine the effect of various environmental factors on growth of microorganisms.
- 3) apply the different techniques for microbial analysis of air and water.
- 4) screen industrially important microorganisms by primary screening techniques.

Module	Name of the Practical	Hrs
1	Endospore staining by Dorner's method.	60
2	Flagella staining by Bailey's method.	
3	Nucleus staining by Giemsa's method using yeast cells.	
4	Effect of temperature on growth of microorganisms.	
5	Effect of pH on growth of microorganisms.	
6	Effect of salt concentration on growth of microorganisms.	
7	Effect of heavy metals on growth of microorganisms.	
8	Microbial analysis of air- Determination of diversity index.	
9	Microbial analysis of air- Determination of Simpson index and settling velocity.	
10	Microbiological analysis of water by qualitative tests by Presumptive test.	
11	Microbiological analysis of water by qualitative tests by Confirmed test	
12	Microbiological analysis of water by qualitative tests by Completed test.	

13	Determination of Most Probable Number (MPN) of coliform bacteria.	
14	Indole test	
15	Methyl red test	
16	Voges Proskauer's test	
17	Citrate utilization test	
18	Microbiological analysis of milk by performing Methylene Blue Reduction Test (MBRT)	
19	Determination of efficiency of Pasteurization by performing Phosphatase test	
20	Primary Screening of Antibiotic producing microorganisms – crowded plate technique	
21	Primary Screening of industrially important enzyme producing microorganisms: Amylase producers	

Reference Books:-

- 1) Arora B. and Arora D. R. Practical Microbiology. CBS Publishers and Distributors, New Delhi, India. 2020..
- 2) Atlas R. M. Handbook of Microbiological Media. Ukraine: Taylor and Francis, 2010..
- 3) Baker F. J. Bacteriological techniques, Butterworth Publishers Ltd., 1967.
- 4) Cruick S.R., Dugaid, J.P., Marmion, B.P. and Swain, R.H. Medical Microbiology, Churchill Livingstone Publishing, Edinburgh, Vol. 1 & 2, 12th Edition. 1980
- 5) Dubey R. C. and Maheshwari D. K. Practical Microbiology. S. Chand and Company Limited, New Delhi, India, 2002.
- 6) Goldman E., and Green L. Practical Handbook of Microbiology, Taylor & Francis, 2008.
- 7) Gunasekaran P. Laboratory Manual in Microbiology. New Age International Private Limited, New Delhi, India 2007.
- 8) Mukherjee K. L. Medical Laboratory Technology. Second Edition. Volume III. McGraw-Hill Companies, India, 2013.
- 9) Patel R. Experimental Microbiology. Aditya Book Centre 5th edition, Vol. I and Vol. II. 2009.
- 10) Sexena J., Baunthiyal M. and Ravi I. Laboratory Manual of Microbiology, Biochemistry and Molecular Biology. Scintific Publishers, New Delhi, India 2015

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation: 20 M

- Student Performance/ Attendance -10 M
- Journal Record / Viva-Voce -10 M

End Semester Examination: 30 M

- Q.1 Major- 14 M
Q.2 Minor 1- 08 M
Q.3 Minor 2- 08 M

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	Yashavantrao Chavan Institute of Science, Satara		
	Board of Studies in Microbiology		
	Programme: B.Sc.		Semester- III
	Type : Minor		Marks : 50
	Credits : 2		From: A. Y. 2025-26
	Name of the Course: BMiT 234 Agriculture and Environmental Microbiology		
Course Objectives: students should be able to: 1. recall the role of microorganisms in recycling of carbon and nitrogen in soil. 2. learn various microorganisms that can be used in production of biofertilizers and biopesticides. 3. understand the different types of microbial interactions with plants and animals. 4. know role of microorganisms in environment sustainability and bioremediation			
Course Outcomes: students will be able to: 1. explain the role of microorganisms in recycling of carbon and nitrogen in soil. 2. isolate the various microorganisms for production of biofertilizers and biopesticides. 3. describe the different types of microbial interactions with plants and animals. 4. use microorganisms in environment sustainability and bioremediation			
Module	Title and Contents		Hrs
Module - 1:	Soil Microbiology 1.1 Soil- Definition, formation, texture, composition and types 1.2 Soil microorganisms and their activities 1.3 Groups of microorganisms and reactions occurring in soil biogeochemical cycles- Carbon, and Nitrogen		08
Module - 2:	Biofertilizers and Biopesticides 2.1 Introduction production and applications of biofertilizers – Azofertilizer, Rhizofertilizer, Trichoderma 2.2 Introduction to biopesticides- Microbial Pesticides, Genetically Modified Organisms		07
Module - 3:	Microbial Interactions 3.1 Types of interactions: Mutualism, synergism, commensalism, competition, amensalism, parasitism, predation 3.2 Microbe-Plant interaction: Symbiotic and non-symbiotic interaction 3.3 Microbe-animal interaction: Microbes in ruminants		08
Module - 4:	Environmental monitoring and Bioremediation 4.1 Environmental monitoring- Routine EM programme in industries- Ex. pharmaceutical industries 4.2 Bioremediation - Approaches, types and applications 4.3 Environmental Impact assessment – Concept and Brief introduction		07

Reference Books:-

1. Kumar, Ram. Environmental Chemical Hazards. New Delhi: Swarup and Sons, 1998.
2. Pareek, R. P., and N. Pareek. Agricultural Microbiology. Jodhpur, Rajasthan, India: Scientific Publishers, 2018.
3. Powar, C. B., and H. I. Dagainawala. General Microbiology, Vol. 1. Pune, India: Himalaya Publishing House Private Limited, 2005.
4. Subba Rao, N. S. Soil Microbiology. 4th ed. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd., 2005.
5. Sylvia, David M., Jeffry J. Fuhrmann, Peter G. Hartel, and David A. Zuberer. Principles and Applications of Soil Microbiology. 2nd ed. Upper Saddle River, NJ: Pearson Prentice Hall, 2005.
6. Trivedy, R. K. Environmental Impact Assessment. 2nd ed. New Delhi: S. Chand & Company, 2003.
7. Vyas, S. C., and M. C. Vyas. *Soil Microbiology*. Jaipur: RBD Publishing House, 2000.

Evaluation Pattern:**Total Marks: 50****Internal Continuous Evaluation (20 Marks):**

- CCE-I: 10 Marks: Assignment/ Class Tests
- CCE-II: 10 Marks: Case study/ Seminar/ Field Work
- CCE-III: 10 Marks: Multiple Choice Questions

(The best of two marks will be considered for the final mark entry)

End Semester Examination (30 Marks):

- Q.1) Solve the following questions. [5X2=10]
- Q.2) Attempt any two questions. [2X10=20]
- Q.3) Attempt any four questions. [4X5=20]

Note: Conversion of 50 marks of ESE evaluation to 30 marks

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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester- III
	Type : Minor	Marks : 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BMiT 235 Applied Microbiology I		
Course Objectives: by the end of the course, students should be able to: 1. understand the microflora of air and air sampling methods for microbiological analysis of air. 2. learn the microbiological analysis of water. 3. know the sources of microorganisms in milk and details of milk pasteurization. 4. study the analytical techniques used for purification, separation of biomolecules		
Course Outcomes: by the end of the course, students will be able to: 1. describe the air sampling methods for microbiological analysis of air. 2. perform routine bacteriological analysis of water testing. 3. identify the sources of microorganisms in milk and explain milk pasteurization process 4. demonstrate working of electrophoresis and uv spectrophotometric techniques		
Module	Title and Contents	Hrs
Module 1:	Air Microbiology 1.1 Microflora of air: Sources, distribution, Number, and kinds of microorganisms in air. 1.2 Air as a carrier of microorganisms. Droplet, droplet nuclei, Dispersal of Microorganisms in air. 1.3 Techniques for microbiological analysis of air (air sampling) 1.4 Significance of air flora in human health, hospitals, industries. 1.5 Air borne infections – Tuberculosis (Causative agent, transmission, symptoms and treatment)	08
Module 2:	Water microbiology 2.1 Sources of microorganisms in water. 2.2 Faecal pollution of water, Indicators of fecal pollution of water –E. coli 2.3 Routine Bacteriological analysis of water. i. Standard Plate Count ii. Tests for coliforms - a. Qualitative-Detection of coliforms - Presumptive test, b. Confirmed Test, Completed test. c. Differentiation between coliforms - IMViC test, Eijkman test d. Quantitative - MPN, Membrane filter technique 2.4. Water borne infection- Cholera (Causative agent, transmission, symptoms and treatment)	07

Module 3:	Milk Microbiology 3.1 Definition and composition of milk, sources of microbial contamination in milk, Microbial spoilage of milk. 3.2 Microbial examination of milk: Standard plate count, Dye reduction test, Direct microscopic count 3.3 Pasteurization of milk: methods, efficiency of pasteurization - phosphatase test. 3.4 Milk borne infections-Brucellosis (Causative agent, symptoms, transmission, treatment and preventive measures)	08
Module 4:	Analytical Techniques - I 4.1 UV - visible spectroscopy 4.2 Gel Electrophoresis -Agarose gel electrophoresis 4.3 SDS-PAGE	07

Reference Books:-

1. Aithal, S. C., and N. S. Kulkarni. Water Microbiology: An Indian Perspective. 1st ed. Mumbai: Himalaya Publishing House. ISBN 9789352021291.
2. Bullock, D. Dairy Microbiology. E-book. London: ED-Tech Press, 2019.
3. Dubey, R. C., and D. K. Maheswari. Textbook of Microbiology. New Delhi: S. Chand Publishing. ISBN 978812191803.
4. Frazier, W. C., D. C. Westhoff, and N. M. Vanitha. Food Microbiology. 5th ed. India: McGraw Hill Education, 2017.
5. Ingraham, John L., and Catherine A. Ingraham. Introduction to Microbiology. United Kingdom: Brooks/Cole. ISBN 9780534552244.
6. Maharashtra Pollution Control Board (MPCB), Central Pollution Control Board (CPCB), Bureau of Indian Standards (BIS), and World Health Organization (WHO). Guidelines for Drinking Water Quality.
7. Pawar, C. B., and H. F. Daginawala. General Microbiology. Volume I. 2nd ed. Mumbai: Himalaya Publishing House, 2019. ISBN 9789350240892.
8. Salle, A. J. Fundamental Principles of Bacteriology. New York and London: McGraw-Hill Book Company, 1973.
9. Tortora, Gerard J., Berdell R. Funke, and Christine L. Case. Microbiology: An Introduction. 12th ed. Boston: Pearson, 2016. ISBN 9780321929150.
10. Wilson, Keith, and John Walker. Principles and Techniques of Biochemistry and Molecular Biology. 7th ed. Cambridge: Cambridge University Press, 2010

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks):

- CCE-I: 10 Marks: Assignment/ Class Tests
- CCE-II: 10 Marks: Case study/ Seminar/ Field Work
- CCE-III: 10 Marks: Multiple Choice Questions

(The best of two marks will be considered for the final mark entry)

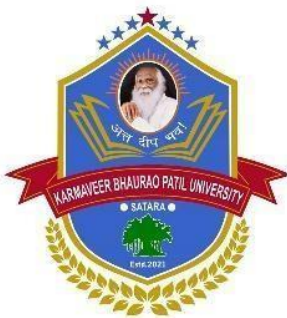
End Semester Examination (30 Marks):

- Q.1) Solve the following questions. [5X2=10]
- Q.2) Attempt any two questions. [2X10=20]
- Q.3) Attempt any four questions. [4X5=20]

Note: Conversion of 50 marks of ESE evaluation to 30 marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester- III
	Type : Minor	Marks : 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BMiP 236: Practical Course		
Course Objectives: By the end of the course, students should be able to: 1. get acquainted with the instruments used in microbiology laboratory 2. learn the methods for isolation of different microorganisms from soil samples that enhance soil fertility. 3. study microbiological analysis of air, water and milk samples by suitable techniques. 4. know the dimensions of microbial cells by micrometric techniques		
Course Outcomes: By the end of the course, students will be able to: 1. observe different bacterial organelles like flagella, endospore, nucleus under microscope by staining techniques. 2. determine the effect of various environmental factors on growth of microorganisms. 3. apply the different techniques for microbial analysis of air and water. 4. screen industrially important microorganisms by primary screening techniques.		
Module	Title and Contents	Hrs
1.	Study of lab instruments: Colorimeter and UV Spectrophotometer	30
2.	Isolation of microbes from soil samples at different temperatures.	
3.	Isolation of <i>Azotobacter</i> from soil.	
4.	Isolation of <i>Rhizobium</i> from root nodules of leguminous plants	
5.	Isolation of phosphate solubilizing bacteria from soil.	
6.	Isolation of pesticide degrading microorganisms from soil.	
7.	Microbial analysis of air- Determination of Microbial Diversity index.	
8.	Microbial analysis of air- determination of Simpson index and settling velocity	
9.	Microbiological analysis of water by Presumptive test	
10.	Microbiological analysis of water by Confirm test	
11.	Microbiological analysis of water by Completed test	
12.	Determination of Most Probable Number (MPN) of coliform bacteria	
13.	Indole test	
14.	Methyl red test	
15.	Voges Proskauer's test	
16.	Citrate utilization test	
17.	Microbiological analysis of milk by performing Methylene Blue Reduction Test (MBRT)	
18.	Determination of efficiency of Pasteurization by performing Phosphatase test	

19.	Measurement of cell dimensions by Micrometry technique.	
20.	Demonstration of working of membrane filter assembly	
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation: 20 M		End Semester Examination: 30 M
• Student Performance/ Attendance - 10 M • Journal Record / Viva-Voce -10 M		Q.1 Major- 14 M Q.2 Minor 1- 08 M Q.3 Minor 2- 08 M

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester- III
	Type : VSC	Marks : 50
	Credits : 2	From: A. Y. 2025-26
	Name of the Course: Vocational Skill Course (VSC) BMiPVSC 1: Fermentation Technology	
Course Objectives: By the end of the course, students should be able to: 1. describe the basics of fermentation technology and construction of laboratory scale fermenter. 2. acquire skill for isolation of industrially important microorganisms by primary and secondary screening. 3. apply the protocol for production of industrially important products like fermented dairy products alcohol, organic acid, single cell protein etc. 4. perform downstream processes for recovery of products.		
Course Outcomes: By the end of the course, students will be able to: 1. operate laboratory scale fermenter. 2. perform primary and secondary screening methods for isolation of industrially important organisms. 3. demonstrate production of industrially important products like fermented dairy products alcohol, organic acid, single cell protein etc. 4. illustrate downstream processes for recovery of products.		
Module	Title and Contents	Hrs
1.	Study of laboratory scale fermenter	
2.	Primary screening for organic acid producing microorganisms	
3.	Secondary screening of antibiotics producing microorganisms	
4.	Preservation of microbes with glycerol, soil grain and oil overlay method	
5.	Preparation of starter cultures of Lactic acid bacteria for fermented milk products.	
6.	Production of fermented milk product by using starter culture	
7.	Microbiological analysis of Raw materials by Standard plate count.	
8.	Scale-up of a process for the production of alcohol by <i>Saccharomyces cerevisiae</i>	
9.	Scale-up of a process for the production of organic acid	
10.	Single cell protein biomass production at flask level - Spirulina	
11.	Production of wine from grapes at laboratory level	
12.	Alcohol fermentation of fruit juice by yeast at laboratory level.	
13.	Downstream processing of product by filtration/centrifugation/distillation	
14.	Quantitative estimation of ethanol produced during yeast fermentation	
15.	Separation of amino acids by paper chromatography	
16.	Separation of sugars by paper chromatography	
17.	Separation of amino acids by thin layer chromatography	

18	Separation of sugars by thin layer chromatography	
19.	To check quality control for microbial products - Sterility test	
20.	Visit to fermentation industry	

Reference Books:

- 1) Aiba, S., Humphrey, A.L. and Milles, N.F. Biochemical Engineering (2nd edition), Academic Press, New York, 1973
- 2) Bioreactors - Design Operation and Novel Applications WILEY-CH Edited by Carl- Fredrik Mandenius
- 3) Cappuccino, J. G. and N. Sherman. Microbiology. A laboratory manual Pearson Education, 2004.
- 4) Casida, L.E., Industrial Microbiology. Wiley Eastern, New Delhi 2. I. P. / B. P. / U. S. P., 1984.
- 5) Chellapandi, P. Laboratory Manual in Industrial Biotechnology. Jaipur: Pointer Publishers, 2000.
- 6) Dubey, R. C., and D. K. Maheshwari. Practical Microbiology. 1st ed. New Delhi: S. Chand and Company Pvt. Ltd., 2007.
- 7) McNeil, B. and Harvey L.M. (Eds.) Fermentation, A Practical Approach. IRL Press, Oxford.
- 8) Peppler, H.J. (Ed), Microbial Technology, Vols I and II, A. P, 1979.
- 9) Prescott, S.C. and Dunn, C.G., Industrial Microbiology, Reed G. (Ed.). AVI Tech books, 1983.
- 10) Stanbury, P. F., A. Whitaker, and S. J. Hall. Principles of Fermentation Technology. Oxford: Butterworth-Heinemann, 1997

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation: 20 M		End Semester Examination: 30 M	
• Student Performance/ Attendance -10 M • Journal Record / Viva-Voce -10 M		• Q.1 Major- 14 M • Q.2 Minor 1- 08 M • Q.3 Minor 2- 08 M	

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	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester- III
	Type : SEC	Marks : 50
	Credits : 2	From: A. Y. 2025-26
	Name of the Course: Skill Enhancement Course (SEC) BMiPSEC I Basics of Biostatistics	
Course Objectives: By the end of the course, students should be able to: 1. collect, classify and organize biological data using appropriate sampling techniques. 2. use microsoft excel and statistical software for data entry, organization, visualization and analysis. 3. apply descriptive statistical methods to analyze microbiological and biological data. 4. interpret statistical results for solving problems in microbiology, biotechnology and environmental sciences.		
Course Outcomes: By the end of the course, students will be able to: 1. design suitable sampling methods for microbiological investigations. 2. prepare frequency tables and graphical presentations of biological data. 3. calculate measures of central tendency and dispersion using manual and computer-based methods. 4. perform basic statistical analysis using Microsoft Excel and statistical software.		
Module	Name of the practical	Hrs
1.	Introduction to Biostatistics and its applications in Microbiology	60
2.	Methods of collection of biological data	
3.	Random sampling techniques (Simple, Systematic and Stratified Sampling)	
4.	Preparation of sampling plan for microbial analysis of water/soil/food samples	
5.	Preparation of data sheets using Microsoft Excel	
6.	Classification of biological data and frequency distribution tables	
7.	Construction of Bar diagrams using Excel	
8.	Construction of Histograms using Excel	
9.	Construction of Pie charts and interpretation of biological data	
10.	Calculation of Arithmetic Mean (Manual and Excel)	
11.	Calculation of Median (Manual and Excel)	
12.	Calculation of Mode (Manual and Excel)	
13.	Comparison of Mean, Median and Mode using microbiological datasets	
14.	Calculation of Range and Variance	
15.	Calculation of Mean Deviation	
16.	Calculation of Standard Deviation and Coefficient of Variation	
17.	Calculation of Standard Deviation and Coefficient of Variation	

Reference Books:

1. Daniel, W.W. *Biostatistics: A Foundation for Analysis in the Health Sciences*, 10th Edition, Wiley.
2. P.S.S. Sundar Rao and J. Richard. *An Introduction to Biostatistics*, PHI Learning.
3. P.N. Arora and P.K. Malhan. *Biostatistics*, Himalaya Publishing House.
4. Robert R. Sokal and F. James Rohlf. *Introduction to Biostatistics*, Dover Publications.
5. Irfan Ali Khan and Atiya Khanum. *Fundamentals of Biostatistics*, Ukaaz Publications.
6. Bhaskarrao T. *Methods of Biostatistics*, Paras Publications.
7. Dixit J.V. *Principles and Practicals of Biostatistics*.

Evaluation Pattern:**Internal Continuous Evaluation: 20 M**

- Student Performance/ Attendance -10 M
- Journal Record / Viva-Voce -10 M

End Semester Examination: 30 M

- Q.1 Major- 14 M
- Q.2 Minor 1- 08 M
- Q.3 Minor 2- 08 M



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Microbiology

Programme: B.Sc.

Semester- III

Type : IKS

Marks : 50

Credits : 2

From: A. Y. 2025-26

Name of the Course: Indian Knowledge System

BMiTIKS 2 Introduction to Vedic Microbiology

Course Objectives: By the end of the course, students should be able to:

1. study the concept of veda.
2. know contribution of rishis or gurus in vedic microbiology.
3. understand microbiological phenomenon explained in vedas.
4. learn scientific approach behind traditional Indian Knowledge

Course outcomes: By the end of the course, students will be able to:

1. explain vedic knowledge in microbiology.
2. recall the contribution of vedic rishis in microbiology.
3. evaluate different traditional methods for control of microorganisms.
4. describe Vedic mantras describing microorganisms

Module	Title and Contents	Hrs
Module -1:	Vedic Microbiology 1.1 Introduction of Vedic Microbiology 1.2 Vedas: Types and features 1.3 Origin of earth with reference to Vedas	08
Module -2:	Gurus of Vedic Microbiology 2.1 Term Rishi and Guru. 2.2 Vedic Rishies pertaining to Microbiology: Agastya, Rishi Kanv, Rishi Badrayani, Rishi Charak, Maharishi Susruta	07
Module -3:	Microbiology in Vedas 3.1 Different terms used for Microorganisms in Vedas 3.2 Concept of Fermentation in Vedas 3.3 Methods for control of microorganisms as described in Vedas - Effect of 'Agnihotra' on microorganisms	08
Module -4:	Vedic Mantras Pertaining to Microbiology 4.1 Sukta and its importance 4.2 Different Sukta describing microbiology and their role	07

Reference Books:-

1. Anjista C.F. Kurup S. Vedic Microbiology: Gurus of Vedic Microbiology Indian foundation for Vedic science, Rohtak 2007.
2. Dubey R.C., Vedic Microbiology: A Scientific View. India: Motilal Banarasidass 2021
3. Friend, Chakradhar, and Shriji Kurup. *Vedic Microbiology*. New York: Dilip and Dipika Doctor International Vedic Vision, in association with the Indian Foundation for Vedic Science, 2007.

4. Jakhmola, R. K. "Micro-organisms in Vedas." *AYU* 31, no. 1 (2010): 114–120.
<https://doi.org/10.4103/0974-8520.68188>
5. Deogade, Meena Shamrao, and Shiva Rama Prasad Kethamakka. "Krumi (Microorganisms) in Ayurveda: A Critical Review." *International Journal of Ayurvedic Medicine* 10, no. 4 (2019).

Evaluation Pattern:	
Total Marks: 50	
Internal Continuous Evaluation (20 Marks): • CCE-I: 10 Marks: Assignment/ Class Tests • CCE-II: 10 Marks: Case study/ Seminar/ Field Work • CCE-III: 10 Marks: Multiple Choice Questions (The best of two marks will be considered for the final mark entry)	End Semester Examination (30 Marks): • Q.1) Solve the following questions. [5X2=10] • Q.2) Attempt any two questions. [2X10=20] • Q.3) Attempt any four questions. [4X5=20] Note: Conversion of 50 marks of ESE evaluation to 30 marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology		
	Yashavantrao Chavan Institute of Science, Satara		
	Board of Studies in Microbiology		
	Programme: B.Sc.		Semester- IV
	Type : Major		Marks : 50
	Credits : 2		From: A. Y. 2025-26
	Name of the Course: BMiT 241 Bacterial Genetics		
Course Objectives: By the end of the course, students will be able to: 1) Know basic structure of DNA and concepts of genetics. 2) Learn different types of mutation and role of mutagens in microorganisms. 3) Understand the structure, properties and types of plasmids and DNA repair mechanisms 4) Study the concept of recombination and different modes of gene transfer in bacteria			
Course Outcomes: By the end of the course, students should be able to: 1) describe the different forms of dna, including A, C, D, and Z DNA 2) recall properties and significance of plasmid and compare the DNA repair mechanisms functioning in bacteria. 3)determine the modes of genetic recombination and transfer of genetic material in bacteria 4) differentiate types of mutations and role of mutagens in damaging bacterial DNA.			
Module	Title and Contents		Hrs
Module -1:	Basic concepts of Genetics 1.1 Discovery of transforming material (hereditary material): Griffith's experiment 1.2 Concept of gene, genome, genotype, phenotype, mutagen, recon, muton, cistron, Split genes. 1.3 Forms of DNA - A, C, D, and Z 1.4 DNA sequence with unusual structure, Palindromic, hairpin or cruciform mirror repeat, triplex DNA, Tetraplex and H-DNA 1.5 Genetic code - Introduction and properties of genetic code.		08
Module -2:	Mutation 2.1 Definition, Basic Concept of mutation 2.2 Types of Mutation 2.2.1 Spontaneous mutation –Definition and basic concept 2.2.2 Induced mutations- Physical and chemical mutagens 2.2.3 Base pair substitutions, frame shift, missense, nonsense, neutral, silent, suppressor mutations 2.3 Mechanism of mutagenesis by physical and chemical mutagens: 2.3.1 Base analogues: 5-Bromouracil and 2-amino purines 2.3.2 Mutagens modifying nitrogen bases- Nitrous acid, Hydroxylamine, Alkylating agents 2.3.3 Mutagens that distort DNA – a. Acridine dyes b. UV light		07

Module -3:	Plasmid and DNA repair 3.1 Plasmids 3.1.1 Natural – Properties, types, structure and applications 3.1.2 Artificial – pBR 322- structure and applications. 3.2 DNA repair mechanisms: 3.2.1 Photoreactivation 3.2.2 Dark repair mechanism (Excision repair)	08
Module -4:	Module -4: Genetic recombination and gene transfer in bacteria 4.1 Genetic recombination -Concept and mechanism of genetic recombination 4.2 Modes of gene transfer: Transformation Conjugation, Transduction	07

Reference Books:-

- 1) Brooker, Robert J. Genetics: Analysis and Principles. 4th ed. New York: McGraw-Hill, 2012.
- 2) Frobisher, Michael, et al. Fundamentals of Microbiology. 9th rev. ed. Philadelphia: W. B.
- 3) Gardner, Eldon J., Michael J. Simmons, and D. Peter Snustad. Principles of Genetics. 8th ed. Hoboken, NJ: John Wiley & Sons, 2006.
- 4) Madigan, Michael T., John M. Martinko, David A. Stahl, and David P. Clark. Brock Biology of Microorganisms. 12th ed. Upper Saddle River, NJ: Pearson Education, 2009.
- 5) Pelczar, Michael J., and E. C. S. Chan. Microbiology. 5th ed. New York: McGraw-Hill, 1993.
- 6) Maneshwari, R., and D. K. Dubey. A Textbook of Microbiology. New Delhi: S. Chand & Co. Ltd., 2013.
- 7) Stanier, R. Y., John L. Ingraham, Mark L. Wheelis, and Page R. Painter. General Microbiology. 5th ed. London: Macmillan, 1999.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks): • CCE-I: 10 Marks: Assignment/ Class Tests • CCE-II: 10 Marks: Case study/ Seminar/ Field Work • CCE-III: 10 Marks: Multiple Choice Questions (The best of two marks will be considered for the final mark entry)	End Semester Examination (30 Marks): Q.1) Solve the following questions. [5X2=10] Q.2) Attempt any two questions. [2X10=20] Q.3) Attempt any four questions. [4X5=20] • Note: Conversion of 50 marks of ESE evaluation to 30 marks
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	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester- IV
	Type : Major	Marks : 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BMiT 242: Basics in Medical Microbiology and Immunology		
Course Objectives: By the end of the course, students should be able to: 1. learn the basic concepts regarding host-pathogen interactions. 2. know the types of infections, modes of transmission, and process of disease development in host. 3. understand the immune system and defense mechanisms of the host. 4.study the properties and types of antigens and antibodies and mechanisms of Ag-Ab reactions		
Course Outcomes: By the end of the course, students will be able to: 1.classify the communicable and noncommunicable diseases based on occurrences, severity or duration and understand modes of disease transmissions. 2. discuss diagnosis, prevention, and control of microbial infections. 3. describe the defense mechanisms of human body. 4. explain the concept of antigen-antibody types and mechanisms of Ag-Ab reactions.		
Module	Title and Contents	Hrs
Module -1:	Host Pathogen Interaction 1.1 Definitions: Host, Parasite, Commensal, etiological agent, Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Signs of disease, symptoms, syndrome, sequelae infections 1.2 Classification of disease: Occurrence (Epidemic, Endemic,Pandemic, Sporadic), severity or duration (Acute, Chronic),Extent of host involvement, Infectious (Communicable), non-infectious (Noncommunicable). 1.3 Types of Infections: Opportunistic infections, Nosocomial infections, Primary, Reinfection, secondary, focal, Cross, Iatrogenic, In apparent, Latent, Inherited, congenital, Local, Generalized, Covert, overt, Simple, Mixed, Pyogenic 1.4 Sources and modes of transmission of infection: Exogenous and Endogenous (Patient, Carrier: types of carriers, Animals, insects, soil, water, food, Reservoirs of infection), Fomites 1.5 Modes of Transmission of disease: Transmission by air, water and food, contact transmission, Vector borne transmission 1.6 Disease Process: How bacteria Cause Disease: Entry and Exit of Organisms: Portal of entry, preferred entry Virulence: Adherence, Attachment, colonization, Invasiveness, Enzymes and Toxin produced.	08
Module -2:	Infection and Disease	07

	2.1 Stages of infectious disease: Incubation period, Prodromal phase, invasive phase, decline phase, 2.2 Laboratory Diagnosis: Sample collection, transport, culturing of clinical samples 2.3 Causative agent, spread, pathogenesis, symptoms, microbiological diagnosis, prevention and control of Enteric fever, 2.4 General principles of prevention and control: Isolation, Quarantine, Immunization, Vector control	
Module -3:	Host defense mechanism 3.1 Cells of the immune system: Monocytes, Macrophages, Granulocytes, Mast cells, Dendritic cells, Lymphocytes - NK cells, B and T cells 3.2 Organs and tissues of the immune system: Structure and functions of - i. Primary lymphoid organs- Bone marrow, Thymus ii. Secondary lymphoid organs - Spleen, Lymph node, Mucosa Associated Lymphoid tissues. 3.3 Types of Immunity: Active and Passive i. First line of defense: Physical, Chemical and Biological barriers ii. Second line of defense: Antimicrobial substances present in blood and tissue fluids, Phagocytosis, Inflammation and fever. iii. Third line of defense (Specific defense mechanism) - Antibody mediated and cell mediated immunity	08
Module -4:	Antigen and Antibodies 4.1 Antigens: Chemical nature, Immunogenicity and antigenicity, types – Heterophile, Autoantigens, Isoantigens, Soluble antigens, Particulate antigens, T dependent and T independent Ags, factors affecting antigenicity, Adjuvants 4.2 Antibodies: Basic structure, properties and types 4.3 Primary and Secondary immune responses 4.4 Antigen - Antibody reactions - precipitation and agglutination	07
Reference Books:- 1. Champoux J. J., Neidhardt F. C., Drew W. L. and Plorde J. J.. Sherris Medical Microbiology: An Introduction to infectious diseases. 4th edition. 2. Ryan K. J and Ray C. G (editors) McGraw-Hill Companies. DOI:10.1036/0838585299. 2004 3. Dey N. C., Dey T. K. and Sinha D. (2013). Medical Bacteriology Including Medical Mycology and AIDS. 17th Edition. New Central Book Agency(P)Ltd (Publisher) India. 4. Frobisher et al., Fundamentals of Microbiology, W. B. Saunders company. 9th revised edition, 1977. 5. Madigan, Martinko, Dunlap, Clark Michael Madigan, Martinko John. Brock Biology of 6. Maneshwari D. K. S. Chand, A Textbook of Microbiology Dubey Co. Ltd. Ramnagar New Delhi 110055. 2013 Microorganisms. 12th edition. Pearson International edition. 7. Pelczar and Reid. Microbiology, McGraw Hill publication., 5th edition. 1993. 8. Roitt E., Brostoff J. and Male D. (1993) Immunology. 6th Ed. Mosby and Co. London. 9. Ronald M. Principles of microbiology., Atlas, Mosby publications 2nd edition 1996.		

10. Stainer R.Y. General Microbiology. Macmillan and CO., 5th edition 1999.	
Evaluation Pattern:	
Total Marks: 50	
Internal Continuous Evaluation (20 Marks): • CCE-I: 10 Marks: Assignment/ Class Tests • CCE-II: 10 Marks: Case study/ Seminar/ Field Work • CCE-III: 10 Marks: Multiple Choice Questions (The best of two marks will be considered for the final mark entry)	End Semester Examination (30 Marks): Q.1) Solve the following questions. [5X2=10] Q.2) Attempt any two questions. [2X10=20] Q.3) Attempt any four questions. [4X5=20] • Note: Conversion of 50 marks of ESE evaluation to 30 marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology		
	Yashavantrao Chavan Institute of Science, Satara		
	Board of Studies in Microbiology		
	Programme: B.Sc.		Semester- IV
	Type : Practical		Marks : 50
	Credits : 2		From: A. Y. 2025-26
	Name of the Course: Practical Course BMiP 243 based on BMiT 241 & 242		
Course Objectives: By the end of the course, students should be able to: 1. learn the techniques for the isolation of mutants of <i>e.coli</i> e.g. lac negative mutants. 2. study of growth phase of <i>e.coli</i> by turbidometric method. 3. acquire skill for isolation of pathogens like <i>salmonella</i> and <i>proteus spp</i> from the clinical sample. 4. known mechanisms of serological reactions			
Course Outcomes: By the end of the course, students will be able to: 1. isolate lac negative mutants of <i>e. coli</i> by using replica plate technique. 2. demonstrate the separate growth phases of <i>e.coli</i> by turbidimetric method. 3. examine clinical sample to detect pathogens like <i>salmonella</i> and <i>proteus spp</i> for diagnosis of infections. 4. perform and interpret serological tests e.g. Widal test results to diagnose enteric fever			
Module	Title and Contents	Hrs	
Module - 1:	1. Study of growth curve of <i>E.coli</i>	30	
	2. Study of effect of U. V. light on growth of bacteria.		
	3. Isolation of lac negative mutants of <i>E. coli</i> by suitable method.		
	4. Determination of thermal death time of given bacterial culture		
	5. Determination of decimal reduction time of <i>E.coli</i> .		
	6. Phenyl alanine deamination test		
	7. Hugh Leifson's test		
	8. Nitrate reduction test		
	9. Urea hydrolysis test		
	10. Gelatin hydrolysis test		
	11. Oxidase test		
	12. Lipase test		
	13. Coagulation Test		
	14. Isolation of causative agent of enteric fever : <i>Salmonella spp</i>		
	15. Isolation of causative agent of urinary tract infection: <i>Proteus spp</i>		
	16. Determination of blood groups- ABO and Rh blood groups by agglutination test		
	17. Study of Immunodiffusion by Ouchterlony precipitation test		
	18. Serological diagnosis of Enteric fever: Widal test (Qualitative)		
	19. Rapid Plasma Reaction Test for Syphilis.		

Reference Books:-

1. Baker, F. J. Bacteriological Techniques. London: Butterworth Publishers Ltd., 1967.
2. Cruickshank, R., J. P. Dugdall, B. P. Marmion, and R. H. Swain. Medical Microbiology. Vols. 1 & 2. 12th ed. Edinburgh: Churchill Livingstone, 1980.
3. Godkar, Praful D. Textbook of Medical Laboratory Technology. New Delhi: Bhalani Publishing House, 2003.
4. Goldman, Emanuel, and Lorrence Green. Practical Handbook of Microbiology. Boca Raton: Taylor & Francis, 2008.
5. High Media Manual: Media Preparation. 2nd ed.
6. Mukherjee, Kanai L. Medical Laboratory Technology. 2nd ed., Vol. 3. New Delhi: McGraw-Hill Companies, 2013.
7. Patel, Rakesh. Experimental Microbiology. 5th ed., Vol. 1. Delhi: Aditya Book, 2009.
8. Senthil Kumar, B., and Zothansanga. Practical Microbiology Laboratory Manual. New Delhi: Panima Publishing Corporation, 2018.

Evaluation Pattern:**Total Marks: 50****Internal Continuous Evaluation: 20 M**

- Student Performance/ Attendance -10 M
- Journal Record / Viva-Voce -10 M

End Semester Examination: 30 M

- Q.1 Major- 14 M
- Q.2 Minor 1- 08 M
- Q.3 Minor 2- 08 M

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester- IV
	Type : Minor	Marks : 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BMiT 244: Basics in Medical Microbiology and Immunology		
Course Objectives: By the end of the course, students should be able to: 1. learn the basic concepts regarding host-pathogen interactions. 2. know the types of infections, modes of transmission, and process of disease development in host. 3. understand the immune system and defense mechanisms of the host. 4. study the properties and types of antigens and antibodies and mechanisms of Ag-Ab reactions		
Course Outcomes: By the end of the course, students will be able to: 1. classify the disease and understand modes of disease transmissions. 2. apply the knowledge in diagnosis, prevention, and control of disease. 3. illustrate the defense mechanisms of human host. 4. explain the concept of antigen-antibody types and reactions and their applications in serology.		
Module	Title and Contents	Hrs
Module -1:	Host Pathogen Interaction 1.1 Definitions: Host, Parasite, Commensal, etiological agent, Infection, Invasion, Pathogen, Pathogenicity, Virulence, Toxigenicity, Signs of disease, symptoms, syndrome, sequelae infections. 1.2 Classification of disease: Occurrence (Epidemic, Endemic, Pandemic, Sporadic), severity or duration (Acute, Chronic), Extent of host involvement, Infectious (Communicable), non-infectious (Non communicable). 1.3 Types of Infections: Opportunistic infections, Nosocomial infections, Primary, Reinfection, secondary, focal, Cross, Iatrogenic, In apparent, Latent, Inherited, congenital, Local, Generalized, Covert, overt, Simple, Mixed, Pyogenic.	08
Module -2:	Infection and Disease 2.1 Stages of infectious disease: Incubation period, Prodromal phase, invasive phase, decline phase, 2.2 Laboratory Diagnosis: Sample collection, transport, culturing of clinical samples 2.3 Causative agent, spread, pathogenesis, symptoms, microbiological diagnosis, prevention and control of Enteric fever, 2.4 General principles of prevention and control: Isolation, Quarantine, Immunization, Vector control	07
Module -3:	Host defense mechanism 3.1 Types of Immunity: Active and Passive	08

	3.2 First line of defense: Physical, Chemical and Biological barriers 3.3 Second line of defense: Antimicrobial substances present in blood and tissue fluids, Phagocytosis, Inflammation and fever. 3.4 Third line of defense (Specific defense mechanism)-Antibody mediated and cell mediated immunity activation of resting B lymphocytes to effect or cells, activation and mechanism of killing of Tc cells.	
Module -4:	Antigen and Antibodies 4.1 Antigens: Chemical nature, Immunogenicity and antigenicity, types factors affecting antigenicity. 4.2 Antibodies: Basic structure, properties and types 4.3 Primary and Secondary immune responses 4.4 Antigen - Antibody reactions - precipitation and agglutination	07

Reference Books:-

- 1) Champoux J. J., Neidhardt F. C., Drew W. L. and Plorde J. J.. Sherris Medical Microbiology: An Introduction to infectious diseases. 4th edition.
2. Ryan K. J and Ray C.G (editors)McGraw-Hill Companies.DOI:10.1036/0838585299. 2004
3. Dey N. C., Dey T. K. and Sinha D. (2013). Medical Bacteriology Including Medical Mycology and AIDS. 17thEdition. New Central Book Agency(P)Ltd (Publisher) India.
4. Frobisher et al., Fundamentals of Microbiology, W. B. Saunders company. 9th revised edition, 1977.
5. Madigan, Martinko, Dunlap, Clark Michael Madigan, Martinko John. Brock Biology of
6. Maneshwari D. K. S. Chand, A Textbook of Microbiology Dubey Co. Ltd. Ramnagar New Delhi 110055. 2013
- Microorganisms. 12th edition. Pearson International edition.
7. Pelczar and Reid. Microbiology, McGraw Hill publication., 5th edition. 1993.
8. Roitt E., Brostoff J. and Male D. (1993) Immunology. 6th Ed. Mos by and Co. London.
9. Ronald M. Principles of microbiology., Atlas, Mosby publications 2nd edition 1996.
10. Stainer R.Y. General Microbiology. Macmillan and CO., 5th edition 1999.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks):	End Semester Examination (30 Marks):
• CCE-I: 10 Marks: Assignment/ Class Tests • CCE-II: 10 Marks: Case study/ Seminar/ Field Work • CCE-III: 10 Marks: Multiple Choice Questions (The best of two marks will be considered for the final mark entry)	Q.1) Solve the following questions. [5X2=10] Q.2) Attempt any two questions. [2X10=20] Q.3) Attempt any four questions. [4X5=20] • Note: Conversion of 50 marks of ESE evaluation to 30 marks

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester- IV
	Type : Minor	Marks : 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BMiT 245 Applied Microbiology II		
Course Objectives: By the end of the course, students will be able to: 1. understand the importance of food and its preservation. 2. study the sewage microbiology and the various parameters used in waste water treatment. 3. know the design and operation of fermenter used for fermentation in industries. 4. learn the analytical techniques used for separation and purification of biomolecules		
Course Outcomes: By the end of the course, students will be able to: 1. recall the food preservation techniques and discuss food born infections. 2. illustrate the various parameters used in waste water treatment. 3. draw the design of industrial fermenter and discuss operation of fermenter. 4. explain different techniques for separation and purification of analytes		
Module	Title and Contents	Hrs
Module - 1:	Food Microbiology 1.1 Introduction, Classification of food based on stability. 1.2 General principles and methods of food preservations: Asepsis, Removal of Microorganisms, Dehydration, Use of Heat, Irradiation, anaerobiosis, Use of chemical Preservatives 1.3 Food borne infections	08
Module - 2:	Sewage Microbiology 2.1 Types, Chemical characteristics and Microflora of typical sewage 2.2 BOD and COD- Definitions, basic concepts 2.3 Treatment and disposal i) Primary treatment ii) Secondary treatment- trickling filter, activated sludge process, oxidation ponds iii) Final treatments-Anaerobic digestion, chemical treatment	07
Module - 3:	Sewage Microbiology 2.1 Types, Chemical characteristics and Microflora of typical sewage 2.2 BOD and COD- Definitions, basic concepts 2.3 Treatment and disposal i) Primary treatment ii) Secondary treatment- trickling filter, activated sludge process, oxidation ponds iii) Final treatments-Anaerobic digestion, chemical treatment	08

Module - 4:	Analytical Techniques - I 4.1 Chromatography techniques - Affinity chromatography and Ion Exchange Chromatography 4.2 Centrifugation - Principle, working and types of Centrifuges	07
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Reference Books:-

1. Aithal, S. C., and N. S. Kulkarni. Water Microbiology: An Indian Perspective. 1st ed. Mumbai: Himalaya Publishing House, 2015. ISBN: 978935202129.
2. Banwart, G. J. Basic Food Microbiology. 2nd ed. Chapman and Hall, International Thompson Publishing, 1989.
3. Casida, L. E. Industrial Microbiology. New Delhi: Wiley Eastern, 1984.
4. Frazier, W. C., D. C. Westhoff, and N. M. Vanitha. Food Microbiology. 5th ed. India: McGrawHill Education, 2013.
5. Frobisher, M. Fundamentals of Microbiology. 9th ed. Michigan: Saunders, Michigan University Press, 1974. ISBN: 9780721639222.
6. Ingraham, J. L., and C. A. Ingraham. Introduction to Microbiology. United Kingdom: Brooks/Cole, 2000. ISBN: 9780534552244.
7. McNeil, B., and L. M. Harvey, eds. Fermentation: A Practical Approach. Oxford: IRL Press.
8. MPCB, CPCB, BIS, and WHO. Guidelines for Drinking Water Quality. Relevant websites accessed for water quality standards.
9. Patel, A. H. Industrial Microbiology. New Delhi.
10. Salle, A. J. Fundamental Principles of Bacteriology. New York and London: McGraw-Hill Book Co., 1973.
11. Stanbury, P. F., and A. Whitaker. Principles of Fermentation Technology.
12. Tortora, G. J., B. R. Funke, and C. L. Case. Microbiology: An Introduction. 12th ed. Boston: Pearson, 2016. ISBN: 9780321929150

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation (20 Marks): • CCE-I: 10 Marks: Assignment/ Class Tests • CCE-II: 10 Marks: Case study/ Seminar/ Field Work • CCE-III: 10 Marks: Multiple Choice Questions (The best of two marks will be considered for the final mark entry) •	End Semester Examination (30 Marks): • Q.1) Solve the following questions. [5X2=10] • Attempt any two questions. [2X10=20] • Attempt any four questions. [4X5=20] • Note: Conversion of 50 marks of ESE evaluation to 30 marks
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	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester - IV
	Type : Minor	Marks: 50
	Credits : 2	From: A. Y. 2025-26
Name of the Course: BMiP 246 Practical Course		
Course Objectives: By the end of the course, students should be able to: 1. study principle of biochemical characterization of microorganisms. 2. acquire the skill for isolation of pathogens like <i>salmonella</i> and <i>proteus spp</i> from the clinical sample. 3. understand the principle of immunological reaction and their applications. 4. learn the primary screening methods for isolation of industrially important microorganisms.		
Course Outcomes: By the end of the course, students will be able to: 1. observe different bacterial organelles like flagella, endospore, nucleus under microscope by staining techniques. 2. determine the effect of various environmental factors on growth of microorganisms. 3. apply the different techniques for microbial analysis of air and water. 4. screen industrially important microorganisms by primary screening techniques.		
Module	Title and Contents	Hrs
1.	Preparation of media - Peptone nitrate broth, Gelatin agar, Hugh Leifson medium	60
2.	Nitrate reduction test	
3.	Urea hydrolysis test	
4.	Gelatin hydrolysis test	
5.	Oxidase Test.	
6.	Hugh Leifson Test	
7.	Isolation of causative agent of enteric fever: <i>Salmonella spp</i>	
8.	Isolation of causative agent of urinary tract infection: <i>Proteus spp</i>	
9.	Determination of blood groups- ABO and Rh blood groups by agglutination test	
10.	Study of Immunodiffusion by Ouchterlony precipitation test	
11.	Serological diagnosis of Enteric fever- Widal test (Qualitative	
12.	Rapid Plasma Reaction Test for Syphilis.	
13.	Enumeration of microorganisms from street food by standard plate count.	
14.	Isolation of bacteria from given fermented food samples.	
15.	Detection of adulteration in given food samples.	
16.	Primary Screening of antibiotic producing microorganisms by crowded plate technique	

17.	Primary Screening of industrially important enzyme producing microorganisms – Amylase	
18.	Demonstration of Alcohol fermentation	
19.	Separation of amino acids by paper chromatography.	
20.	Separation of blood cells by centrifugation technique	
Reference Books:- 1. Arora, B., and D. R. Arora. Practical Microbiology. New Delhi, India: CBS Publishers and Distributors, 2020. 2. Atlas, R. M. Handbook of Microbiological Media. Ukraine: Taylor and Francis, 2010 3. Baker, F. J. Bacteriological Techniques. London: Butterworth & Co Publishers Ltd, 1967. 4. Cruick, S. R., J. P. Dugaid, B. P. Marmion, and R. H. Swain. Medical Microbiology. 12th ed. Vols. 5. 1 and 2. Edinburgh: Churchill Livingstone Publishing, 1980. 6. Dubey, R. C., and D. K. Maheshwari. Practical Microbiology. New Delhi, India: S. Chand and Company Limited, 2012. 7. Goldman, E., and L. Green. Practical Handbook of Microbiology. Taylor & Francis, 2008.		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation: 20 M • Student Performance/ Attendance -10 M • Journal Record / Viva-Voce -10 M		End Semester Examination: 30 M • Q.1 Major- 14 M • Q.2 Minor 1- 08 M • Q.3 Minor 2- 08 M



Karmaveer Bhaurao Patil University, Satara

(A State Public University Est. u/s 3(6) of MPUA 2016)

Faculty of Science and Technology

Yashavantrao Chavan Institute of Science, Satara

Board of Studies in Microbiology

Programme: B.Sc.

Semester- IV

Type : VSC

Marks : 50

Credits : 2

From: A. Y. 2025-26

Name of the Course: BMiPVSC 2: Analytical Techniques and Instrumentation

Course Objectives: By the end of the course, students should be able to:

1. acquire basic skill like preparation of standard solutions, buffer etc. required for analysis of biomolecules in laboratory.
2. understand the principle of colorimetric estimation of biomolecules in various samples
3. know separation and purification of biomolecules of by chromatographic techniques.
4. study working principal of analytical instruments in laboratory like GC-MS, HPLC, scanning electron microscope etc.

Course Outcomes: By the end of the course, students will be able to:

1. analysis of biomolecules in laboratory.
2. estimate biomolecules quantitatively from given samples by colorimetric techniques.
3. separate biomolecules from given samples in pure form by chromatographic techniques.
4. demonstrate the working of analytical instruments in laboratory like gc, hplc, scanning electron microscope etc.

Module	Title and Contents	Hrs
	Practicals based on Analytical Techniques and Instrumentation	
1	Methods and practices in microbiology lab: Standard Operating Procedure (SOP), Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP).	60
2	Preparation of standard solutions of given molarity.	
3	Preparation of standard solutions of given normality.	
4	Preparation of buffer solutions: Phosphate buffer, Acetic acid buffer.	
5	Determination of pH of given samples using pH meter.	
6	Separation of serum from blood samples by centrifuge	
7	Verification of Beer and Lambert's law using 5% CuSO ₄ and 5% KMNO ₄	
8	Determination of absorption spectrum of given dye.	
9	Quantitative analysis of sugars by Benedict's method	
10	Quantitative estimation of amino acids using the ninhydrin reaction	
11	Quantitative estimation of protein by Folin-Lowry method	
12	Determination of saponification values of lipids/fatty acid samples.	
13	Determination of iodine number of lipids/fatty acid samples.	
14	Identification of sugars in fruit juices by thin layer chromatography.	

15.	Separation of molecules by ion exchange chromatography	
16.	Demonstration of Gas chromatography.	
17.	Demonstration of High-performance liquid chromatography (HPLC)	
18.	Demonstration of Microfiltration technique	
19.	Demonstration of UV spectrophotometer .	
20.	Demonstration of working of Scanning Electron Microscope	
Reference Books:		
1) Chatwal, G. R., and Sham K. Anand. Instrumental Methods of Chemical Analysis. 5th ed. Mumbai: Himalaya Publishing House, 2010.		
2) Jayraman, J. Laboratory Manual in Biochemistry. New Delhi: New Age International Publishers, 1998.		
3) Plummer, David T. An Introduction to Practical Biochemistry. London and New York: McGrawHill, 1987.		
4) Ramadass, P., and A. Wilson Aruni. Practical Biotechnology. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd., 2007.Instrumental Methods of Chemical Analysis- Chatwal AnandHimalaya		
5) Sadasivam, S., and A. Manickam. Biochemical Methods. 3rd ed. New Delhi: New Age International Publishers, 2008.		
6) Wilson, Keith, and John Walker. Principles and Techniques of Biochemistry and Molecular Biology. 7th ed. Cambridge: Cambridge University Press, 2010.		
Evaluation Pattern:		
Total Marks: 50		
Internal Continuous Evaluation: 20 M		End Semester Examination: 30 M
• Student Performance/ Attendance -10 M • Journal Record / Viva-Voce -10 M		• Q.1 Major- 14 M • Q.2 Minor 1- 08 M • Q.3 Minor 2- 08 M

	Karmaveer Bhaurao Patil University, Satara (A State Public University Est. u/s 3(6) of MPUA 2016) Faculty of Science and Technology	
	Yashavantrao Chavan Institute of Science, Satara	
	Board of Studies in Microbiology	
	Programme: B.Sc.	Semester - IV
	Type : SEC	Marks: 50
	Credits : 2	From: A. Y. 2025-26
	Name of the Course: BMiPSEC II Fundamentals of Bioinformatics	
Course Objectives: By the end of the course, students should be able to: 1. collect, classify and organize biological data using appropriate sampling techniques. 2. use microsoft excel and statistical software for data entry, organization, visualization and analysis. 3. apply descriptive statistical methods to analyze microbiological and biological data. 4. interpret statistical results for solving problems in microbiology, biotechnology and environmental sciences.		
Course Outcomes: By the end of the course, students will be able to: 1. design suitable sampling methods for microbiological investigations. 2. prepare frequency tables and graphical presentations of biological data. 3. calculate measures of central tendency and dispersion using manual and computer-based methods. 4. perform basic statistical analysis using microsoft excel and statistical software.		
Module	Name of the practical	Hrs
1.	Introduction to Bioinformatics and its applications.	60
2.	Familiarization with the NCBI website and its resources.	
3.	Searching scientific literature using PubMed.	
4.	Retrieval of nucleotide sequences from GenBank.	
5.	Retrieval of protein sequences from UniProt.	
6.	Study of EMBL-EBI database.	
7.	Study of DDBJ nucleotide database.	
8.	Exploring the Entrez search engine for biological information.	
9.	Downloading nucleotide sequences in FASTA format.	
10.	Downloading protein sequences in FASTA format.	
11.	Identification of genes and proteins using accession numbers.	
12.	Study of sequence file formats (FASTA, GenBank, and PDB).	
13.	Basic nucleotide sequence analysis using NCBI BLAST (BLASTn).	
14.	Basic protein sequence analysis using BLASTp.	
15.	Sequence similarity search using FASTA	
Reference Books: 1) Lesk, Arthur M. Introduction to Bioinformatics. 5th ed. Oxford: Oxford University Press, 2019. 2) Mount, David W. Bioinformatics: Sequence and Genome Analysis. 2nd ed. Cold Spring Harbor, NY: Cold Spring Harbor Laboratory Press, 2004. 3) Pevsner, Jonathan. Bioinformatics and Functional Genomics. 3rd ed. Hoboken, NJ: Wiley Blackwell, 2015.		

- 4) Rajaraman V., Fundamentals of Computers, Phi Learning, ISBN:8120321758, 2001.
- 5) Rastogi, S. C., Namita Mendiratta, and Parag Rastogi. Bioinformatics: Methods and Applications:
- 6) Genomics, Proteomics and Drug Discovery. 4th ed. New Delhi: PHI Learning, 2013.
- 7) Tanenbaum Andrew S, Computer Networks, 4th Edition, Prentice Hall PTR, ISBN:8120321758, 2003.

Evaluation Pattern:

Total Marks: 50

Internal Continuous Evaluation: 20 M

- Student Performance/ Attendance -10 M
- Journal Record / Viva-Voce -10 M

End Semester Examination: 30 M

- Q.1 Major- 14 M
- Q.2 Minor 1- 08 M
- Q.3 Minor 2- 08 M