

SantGadge Baba Amravati University, Amravati

Faculty: Science and Technology

Programme: B.Sc. (Microbiology)

POs:

Students of undergraduate general degree programme at the time of graduation would be able to–

PO1.Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, check out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Effective Communication: Speak, read, write and listen clearly in person and through electronic media inEnglish and in one Indian language, and make meaning of the world by connecting people, ideas, books, media andtechnology.

PO3.Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4.Effective Citizenship: Demonstrate empathetic social concern and equity centre national development, and the ability to act with an informed awareness of issues and participatein civil life through volunteering

PO5.Ethics: understand the moral dimensions of your decisions, and accept responsibility for them.

PO6.Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO7. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest contexts socio-technological changes.

PSOs:

Upon completion of the programme successfully, The students would be able to:

1. Gain insight of Microbiology starting from history and fundamental knowledge about the microorganisms.
2. Acquire the skill in the use and care of basic microbiological equipment and can perform basic laboratory procedures in microbiology.
3. Be well-informative about the integral role of microorganisms and different branches of Microbiology.
4. Be acquainted with the basic concept of prokaryotes, their taxonomy, their differentiation from eukaryotes.

Employability Potential of the Programme:

Microbiology is a branch of science that deals with study of microorganisms. The microbiological study has wide range of scope ranging from basic sciences to applied sciences. Microbiological study is mainly focused on causative agents of various diseases, microorganisms of agricultural, environmental and industrial use. The production of antimicrobial drugs to cure various diseases is covered in this discipline. Here is an overview of job opportunities where our students has explored and would be helpful for upcoming students as well.

Medical microbiology refers to the use of microbiology in the healthcare industry. Microbiology firms are at the heart of the healthcare industry, whether they're developing diagnostic kits, vaccines, biologics, pharmaceuticals, or medical gear. Microbiology fields such as molecular biology, cell biology, recombinant technology, and immune therapeutics benefited from the medical sector's evolution. For those interested in a career in Medical Microbiology, there are numerous career prospects in Research and Development, Pharmaceutical Companies, Hospitals, Diagnostic Centers, Manufacturing Sector of Microbiology, and Academic Sector. Many of our students have joined as Microbiologist at renowned pharmaceutical companies. Our students have also joined COVID-19 diagnostic laboratories across various districts, thus help in the society. Beside these students has also joined vaccine manufacturing institutions.

Previously, this field only focused with the discovery and development of small molecules (drugs), but the industry has evolved throughout time. This industry's horizon has widened. Biopharmaceutics has added a new dimension to the industry. The use of microbiology in drug research and discovery has always been a component of the process, but the addition of biology as therapeutic elements has resulted in a rise of biotech businesses in the pharmaceutical sector. To begin, consider cell-based treatments, monoclonal antibodies, vaccinations, and other medicines. In this regard our students has got jobs in various pharmaceutical industries.

Low crop yield, crop quality deterioration, weeds, loss of soil fertility, abiotic stress, and biotic stress are just a few of the issues that have plagued agriculture. Microorganisms are also helpful in enhancing the crop productivity. Our students are entrepreneur in this field. The biofertilizers are produced in bulk and are commercialized by few of our students. Incidentally biofertilizers are ecofriendly.

Food microbiology overcomes challenges in food production, processing, and preservation. The production of value-added food products are the greatest examples. Almost all food industries need pure water. The bacterial quality of water is tested by microbiologist. Food industry provides large scope for microbiologist. Our students have occupied jobs at different food industries. Microbiology always helps in introducing technology which aims to enhance the production, processing, packaging and preservation of food also.

Environment microbiology aims to restore the balance between nature, ecology and human interest. Bioremediation and biological intervention is only possible by the way of utilization of techniques of microbiology. All these issues are now being addressed by using biotech processes. Microbes like bacteria, fungi algae and plants are being used in the process of bioremediation.

Beside job opportunities in the sector of agriculture, pharmaceutical and food industries our students are working as research fellow at various National Institutes. Many students are working as Assistant Professor in colleges, Laboratory Technicians at Government and private pathological laboratories.

Laboratory Skills:

- Students are trained in
- Laboratory safety practices
- Accurate weighing and reagent preparation
- Skillful handling of basic and advanced instruments
- perform IMViC test for coliform
- perform Multiple tube dilution technique for faecal streptococci.
- Determination of Chlorine demand and residual chlorine.
- To perform Isolation of *Azotobacter* & *Rhizobium* from Soil.
- To perform Isolation of *Actinomyces* from soil
 - Logical thinking
 - Analysis and interpretation of results
 - Collection, organization and presentation of data

Transferable Skills:

During the course student will develop skills other than laboratory skills that are transferable across the number of career areas. These are:

- Analytical skill
- Report writing skill
- Presentation skill
- Time management
- Creative thinking
- Problem solving
- Planning
- Observational skill

Job Opportunities: After successful completion of B.Sc. in Microbiology, student may continue further studies like M.Sc. in Microbiology and then Ph.D. in Microbiology and make career in research field. Students have opportunities in private as well as public sectors.

Private Sector: Microbiologist can work in quality control, quality assurance and R & D divisions of companies like- Biotech companies, Pharmaceutical companies, Chemical

manufacturing companies, Food and Drink (includes brewing), Health and Beauty Care, Medical Instrument companies, Agricultural companies, Research Companies and Laboratories etc.

Public Sectors: Blood Service, Cancer research institutes, Environmental Pollution Control, Forensic Science, Hospitals, National Blood Services, Overseas Development, Public Health Entities, Public Health Laboratories, Agriculture and fisheries etc.

Government Sector : Syllabus has been design keeping in view that students can apply for various government post filled by Maharashtra Public Service Commission (MPSC), Union Public Service Commission (UPSC), Food Corporation of India, Forensic department, Health department and Food and Drug Administration. These departments recruit successful candidates for the post of Food safety officers in food and drug administration, Assistant Chemical Analyzers in forensic laboratories of Maharashtra and other states all over India, Laboratory Technicians in Clinical pathology laboratories Health department and Food Corporation of India, Sanitary inspectors for schools etc.

Job profiles: Microbiologist, Biomedical Scientist, Biotechnologist, Clinical Scientist, Food Scientist, Forensic Scientist, Laboratory Technician, Research Associates, Research Officers, and Research Scientist etc.

Thus syllabus has been prepared anticipating the requirements of B.Sc. Microbiology students under CBCS Program. The contents have been drawn to accommodate the widening horizons of the Microbiology discipline and reflect the changing needs of the students.

Hence, Board of Studies in Biochemistry (Including Microbiology and Food Science) in its meeting held on 29/05/2024 resolved to accept the syllabus for B. Sc. III Sem. V (Microbiology) based on Choice Based Credit System (CBCS) as per UGC guidelines. The detailed syllabus for each paper is appended with a list of suggested readings.

SantGadge Baba Amravati University Amravati
Scheme of teaching, learning & Examination leading to the Degree Bachelors of Science (Choice Based Credit System)
(Three Years Six Semesters Degree Programme- C.B.C.S)

Sr.No.	Subjects	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination and Evaluation Scheme						
			Teaching Period Per week				Credits				Maximum Marks			Minimum Passing			
			L	T	P	Total	Theory	Practical	Total		Theory + MCQ External	Skill Enhancement module Internal	Practical		Total Marks	Marks	Grade
1	MCB(5S) Environmental and Agricultural Microbiology (Theory)	MCB (5S) T	6			6	4.5		4.5	3 hours	80	20	Internal	External	100	40	p
2	MCB (5S) Practical	MCB (5S)Pr			6	6		2.25	2.25	3 Hours			25	25	50	25	p
3	Mini-Project/Hands on Training/ workshop/DIY related to Subject-Phase I		-	-	6	6	-	2.25	2.25	2	Internal Assessment by college/Institute/department				50	25	P
	Total		6		12	18	4.5	4.50	9	8 hours	80	20	25	25	200	90	P

(B.Sc. Part-III) (Semester-V) MICROBIOLOGY**Syllabus Prescribed for 2024-2025 UG Programme****Programme: UG in Microbiology****Semester-V**

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
MCB (5S) T	Environmental and Agricultural Microbiology	90

COs : Upon completion of this course successfully, students would be able to:

1. Discuss the microbial life with components of environment viz. air, water and soil
2. Explain diseases caused by microorganisms in air, their analysis and control
3. Explain living of extremophiles
4. Describe the methods of analysis of soil quality
5. Study Beneficial and harmful activities of microorganisms in agriculture
6. Explain Purification techniques of drinking water and wastewater
7. Discuss the assessment of water quality and its treatments
8. Describe the methods of MSWM

COURSE MODULE	UNIT	CONTENT
DSC	Unit-I Air Microbiology and Extremophiles	A) Air Microbiology a) Different types of microorganisms in air . b) Causes of Microbial pollution of air and Methods to Control it

		<p>c) Techniques for microbiological analysis of air:</p> <ol style="list-style-type: none"> i) Solid impingement devices ii) Liquid impingement devices. iii) Air borne diseases: Etiology, symptoms and prevention. Ex. Meningitis, Tuberculosis, Pneumonia, Mumps, Measels, Influenza, Rubella <p>B) Extremophiles</p> <ol style="list-style-type: none"> a) Extremophiles and its types, b) Adaptation in extremophiles c) Bioactive compounds of different extremophiles d) Significance and applications of extremophiles <p>(15 Periods)</p>
	<p>Unit-II Microbiology of Soil.</p>	<ol style="list-style-type: none"> a) Microorganisms in soil. b) Decomposition of plant and animal residues in soil. c) Definition, formation, function and microbiology of humus and compost. d) Cycles of elements in nature: <ol style="list-style-type: none"> i) Carbon cycle: CO₂ fixation, organic carbon degradation. ii) Nitrogen cycle: Proteolysis, amino acid degradation, Nitrification, Denitrification, Degradation of nucleic acids. iii) Sulphur cycle iv) Phosphorus cycle. <p>(15 Periods)</p>

	<p style="text-align: center;">Unit-III Water Microbiology</p>	<ul style="list-style-type: none"> a) Planktons: Definition, types, problems and control b) Eutrophication and its control. c) Water Borne Diseases : Etiology, symptoms and prevention Cholera, Hepatitis, Typhoid d) Self-purification of water: Various zones and factors possible for self-purification. e) Treatment of water: Aeration, Coagulation, Flocculation, Sedimentation and Filtration. f) Slow and Rapid sand filters: Construction, mechanism of filtration, differences. g) Methods of chlorination: Plain, super chlorination, ammonia-chlorine treatment, Break-point chlorination <p style="text-align: center;">(15 Periods)</p>
	<p style="text-align: center;">Unit-IV Waste Water Treatment</p>	<ul style="list-style-type: none"> a) Sewage and its composition b) Aim of sewage treatment,. c) Municipal sewage treatment plant. d) Preliminary treatment(sieving and Grit chamber) e) Primary treatment(sedimentation) f) Secondary treatment(Aerobic) <ul style="list-style-type: none"> a) Trickling filter b) Activated sludge process c) Oxidation pond g) Anaerobic sludge digestion h) Domestic sewage treatment by septic tank and Imhoff tank. i) Concept of COD, BOD.

		j) Outline of bio-gas production (15 Periods)
	Unit-V Agricultural Microbiology	<p>A. Beneficial Microbes in agriculture</p> <p>a. Nitrogen fixing microorganisms: Types of nitrogen fixing microorganisms, factors affecting and mechanism of symbiotic and non-symbiotic nitrogen fixation. Process of nodulation, nitrogenase complex.</p> <p>b. PSM, VAM, Endophytes, PGPR, Tricoderma BT, Actinomycetes</p> <p>B. Harmful microbes in Agriculture</p> <p>a. Diseases, symptoms and identifying characters of Fungal pathogens – <i>R.botaticola</i>, <i>Fusarium oxysporum</i></p> <p>Bacterial Pathogens – <i>Xanthomonas</i>, <i>Pseudomonas solanacearum</i></p> <p>Viral pathogens – Tomato spotted wilt virus (TSWV)</p> <p>b. Introduction of Fungi like organisms phytoplasmas and viroids as plant pathogen</p> <p>c. Methods for Control of plant pathogens.</p> <p>(15 Periods)</p>
SEM	SEM : Microbiological skills for water analysis and solid waste management	<p>A. Bacteriological analysis of water:</p> <p>a) Significance of bacteriological analysis of water</p> <p>b) Collection and handling of water sample from various sources.</p> <p>c) Assessment of water quality index</p> <p>d) Indicators of excretal pollution.</p> <p>e) Membrane filter technique for</p>

		<p>coliform and faecal Streptococci.</p> <p>f) Microbiological quality control in distribution system</p> <p>g) ICMR and WHO Bacteriological standards of drinking water.</p> <p>B. Solid Waste and Composting</p> <p>i. Methods of Municipal solid waste management</p> <p>ii. Methods for preparation of compost and its analysis</p> <p>(15 Periods)</p>
	<p>Cos</p> <ol style="list-style-type: none"> 1. Describe Etiology, symptoms and prevention of waterborne and airborne diseases. 2. To collect water samples, estimate pathogens, Indicators of excretal pollutants in water, analyze portability of water by adopting various Biochemical tests: IMViC, MPN, Elevated temperature test. 3. Different Methods and techniques for the treatment of waste and sewage water. 	
<p>**Activities for SEM</p> <ol style="list-style-type: none"> 1. Class test(10M) 2. Assignment(5M) 3. Educational Visit /GD/Seminars/Projects/Any innovative activity (5M) 		

Syllabus Prescribed for 2024-2025 UG Programme

Programme: UG in Microbiology

Semester-V

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
MCB-(5S)Pr	MCB-(5S)Practical	06 / per week /per batch

COs

Upon completion of the course, the student would be able to:

1. Describe Sources of Microorganisms in Air and water.
2. Estimate the number and types of Microorganisms in soil and water.
3. Estimate the number and types of Microorganisms in soil and water.
4. Analyze microbiological quality of Microorganisms in soil and water by adopting standard techniques.
5. Know the benefits of use of Biofertilizer and biopesticide over chemical formulation

A) To perform Bacteriological analysis of water and Waste Water.

1. To perform Standard plate Count of water
2. To perform Multiple tube dilution technique (MPN for Coliform)
3. To perform i) Presumptive test ii) Confirmatory test iii) Completed test for Coliform
4. To perform IMViC test for coliform
5. To perform Multiple tube dilution technique for faecal streptococci.
6. Determination of Chlorine demand and residual chlorine.

B) Enumeration of Soil micro-organisms.

7. To perform Isolation of *Azotobacter* & *Rhizobium* from Soil.
8. To perform Isolation of *Actinomyces* from soil

9. To study Dual cultural technique for antagonistic microorganisms

10. Isolation and identification of Microorganisms from air samples

11. Analysis of compost quality

The distribution of marks for the practical examination shall be as follows:

External Examination		Internal Examination	
Performance of any two experiments	20 marks	Attendance & students performance	10 Marks
Viva-voce	05 marks	Practical Record book	10 Marks
		MCQ/ Objective test	05 Marks
Total	25 Marks	Total	25 Marks

Course Material/Learning Resources

List of Reference Books for 5S Microbiology:

1. Introduction to Soil Microbiology : Alexander Martin
2. Soil Microbiology :Subbaroa N.S.
3. Introduction to environmental Microbiology: Mitchell, Ralph
4. Sewage & Waste treatment : Hammer
5. Water Pollution :Zajic J.E.
6. Water Pollution Microbiology : Mitchell R.
7. Air Pollution :Perlins H.L.
8. Aquatic Microbiology :Stainer& Shewan
9. Introduction to Waste Water Treatment processes: Ramalhr R.S.

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Scheme of teaching, learning & Examination leading to the Degree Bachelors of Science (Choice Based Credit System)

(Three Years Six Semesters Degree Programme- C.B.C.S)

Sr.No.	Subjects	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination and Evaluation Scheme						
			Teaching Period Per week				Credits				Maximum Marks				Minimum Passing		
			L	T	P	Total	Theory	Practical	Total		Theory + MCQ External	Skill Enhancement module Internal	Practical		Total Marks	Marks	Grade
1	MCB(6S) Industrial Microbiology and Microbial Biotechnology (Theory)	DSE- MCB-I (6S)T	6			6	4.5		4.5	3 hours	80	20	Internal	External	100	40	p
2	MCB (6S) Practical	DSE- MCB-I (6S)Pr			6	6		2.25	2.25	3 Hours			25	25	50	25	p
3	Mini-Project/Hands on Traning/ workshop/DIY related to Subject-Phase II		-	-	6	6	-	2.25	2.25	2	Internal Assessment by college/Institute/department				50	25	P
	Total		6		12	18	4.5	4.50	9	8 hours	80	20	25	25	200	90	P

(B.Sc. Part-III) (Semester –VI) MICROBIOLOGY**Syllabus Prescribed for 2024-2025 UG Programme****Programme : UG in Microbiology****Semester-VI**

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
DSE-MCB-I (6S)T	Industrial Microbiology and Microbial Biotechnology	90

COs

Upon completion of this course successfully, students would be able to:

1. Acquire knowledge on industrially important microbes and their application in industries.
2. Describe fermentation process and terminologies related to fermentation.
3. Conquer knowledge on application of microbes in bioenergy and environmental management.
4. Accomplish knowledge on production, contamination and preservation of milk and food products.
5. Obtain detail knowledge on commercially important industrial product.

COURSE MODULE	UNIT	CONTENT
DSE- MCB -I	Unit-I Fermentation in General.	a) Definition and scope of Industrial Microbiology and Microbial biotechnology. b) Basic Terminology- Fermentation, Production strains, Scale up process & Inoculum buildup. Raw materials c) Lay out of a fermentation industry- Different units and functions (Stock, Production and fermentation, QA, QC, R & D, Packaging) d) Design of a typical fermenter, control of pH, temperature, dissolved oxygen, aeration and foaming (antifoaming agent) e) Types of fermentation processes - solid state, liquid state, batch, fed-batch, continuous, aerobic and anaerobic, downstream process f) Fermentation media- Crude and synthetic media, Molasses, SWL, CSL, Whey. (15 Periods)
	Unit-II Industrial Productions-I	A. a) Isolation of Production strains. b) Screening of Production Strains: - Definition, Primary screening (crowded plate technique, auxonography, enrichment culture technique, use of indicator dyes), secondary screening. c) Scale up process: - concept and significance.

		<p>d) Method of Inoculums buildup: Spore and vegetative inoculums.</p> <p>B. Microorganisms, raw material, inoculums buildup, fermentation conditions, recovery, uses of the following products.</p> <p>a) Ethyl- alcohol From molasses</p> <p>b) Beer.</p> <p>c) Wine (Red table and White table).</p> <p>d) Acetone- Butanol from CSL.</p> <p>e) Penicillin</p> <p>(15 Periods)</p>
	<p>Unit-III</p> <p>Industrial</p> <p>Productions-II</p>	<p>A) Industrial Production</p> <p>a) Single cell protein: From bacteria.</p> <p>b) Amylase: Bacterial and fungal.</p> <p>c) Citric acid</p> <p>d) Vinegar- Fring's process</p> <p>e) Vit. B12</p> <p>B) Microbial Biotechnological Industrial</p> <p>Productions</p> <p>a) Recombinant insulin</p> <p>b) Vaccine – Hepatitis B, COVID 19</p> <p>c) Bioplastics</p> <p>d) Biosensor.</p> <p>(15 Periods)</p>

	<p align="center">Unit-IV</p> <p>Milk</p> <p>Microbiology</p>	<p>a) Definition, Composition and types of milk</p> <p>b) Sources of microorganisms in Milk.</p> <p>c) Pasteurization of milk: LHT, HTST, UHT.</p> <p>d) Preparation of fermented milk products- yoghurt and cheese.</p> <p>(15 Periods)</p>
	<p align="center">Unit-V</p> <p>Food</p> <p>Microbiology</p>	<p>a) Sources of contamination and spoilage of food.</p> <p>b) Preservation of foods: - Low and high temperature, dehydration, high osmotic pressure, chemical preservation, radiations and canning.</p> <p>c) Fermented foods :Idli, and sauerkraut.</p> <p>d) Food poisoning: Food infection and food intoxication.</p> <p>Indicators of food contamination as per WHO.</p> <p>(15 Periods)</p>
SEM	<p align="center">Skill for</p> <p align="center">Microbiological</p> <p align="center">Industries</p>	<p>a) Bio safety measurements and aseptic technique in microbial industry.</p> <p>b) Importance of sterility maintenance and checking.</p> <p>c) Methods for food and milk adulteration.</p> <p>d) Microbial quality control of food</p> <p>e) Market analysis of fermented products</p> <p>(15 Periods)</p>

	<p>COs:</p> <p>By the end of this module, the students will be able to:</p> <ol style="list-style-type: none"> 1. To know the bio safety measurements and aseptic technique in microbial industry. 2. To know methods for microbial quality control of food 3. To know methods for detection of adulteration in food and milk
	<p>**Activities</p> <ol style="list-style-type: none"> 1. Class test(10M) 2. Assignment(5M) 3. Educational Visit /GD /Seminars/ projects/Any innovative activity (5M).

Syllabus Prescribed for 2024-2025 UG Programme

Programme: UG in Microbiology

Semester-VI

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
DSE-MCB-I (6S) Pr	MCB (6S) Practical	6 periods /per week/per batch

COs:

By the end of this module, the students will be able to perform:

- Alcohol and citric acid estimation.
- Detection of Wine production
- Microbial quality testing of milk and food product

Practical: 6S Microbiology

List of Practical/Laboratory Experiments.

- 1) Alcohol production using yeast
- 2) Alcohol estimation
- 3) Citric acid fermentation
- 4) Wine production
- 5) Phosphatase Test for milk.
- 6) Methylene blue reduction test (MBRT) for milk.
- 7) Preparation of yoghurt
- 8) SPC of Food
- 9) Isolation of microorganisms form food: Vegetable, Fruits, Canned food

The distribution of marks for the practical examination shall be as follows:

External Examination		Internal Examination	
Performance of any two experiments	20 marks	Attendance & students performance	10 Marks
Viva-voce	05 marks	Practical Record book	10 Marks
		MCQ/ Objective test	05 Marks
Total	25 Marks	Total	25 Marks

Course Material/Learning Resources : List of Books Recommended:

1. Food Microbiology : Fazier W.C. & Westhoff D.C.
2. Fermented Foods (Vol.7) : Rose A.A.
3. Industrial Microbiology : Prescott S.C. & Dunn C.G.
4. Industrial Microbiology : Miller B.M. & W. Litsky
5. Industrial Microbiology : A.H. Patel
6. Microbial Technology : Pepler H.J. (Vol. I & II)
7. Industrial Microbiology : Casida L.E.
8. Principles of Fermentation : Stanbury, Peter F. & Technology Allan. Whitaker

9. Outlines of Dairy Bacteriology : Sukumar De
10. Modern Food Microbiology : Jay, Mames M.
11. Principles of Industrial : Rhodes & Fletcher. Microbiology
12. Industrial Fermentation : Under Kofler & Hick. Vol. I & II
13. Dairy Microbiology : Foster Etal
14. Industrial Microbiology : Rose

SantGadge Baba Amravati University Amravati
Scheme of teaching, learning & Examination leading to the Degree Bachelors of Science (Choice Based Credit System)
(Three Years Six Semesters Degree Programme- C.B.C.S)

Sr.No.	Subjects	Subject Code	Teaching & Learning Scheme							Duration of Exams Hrs.	Examination and Evaluation Scheme						
			Teaching Period Per week				Credits				Maximum Marks			Minimum Passing			
			L	T	P	Total	Theory	Practical	Total		Theory + MCQ External	Skill Enhancement module Internal	Practical		Total Marks	Marks	Grade
1	MCB(6S) Microbial Biotechnology (Theory)	DSE- MCB-II (6S)T	6			6	4.5		4.5	3 hours	80	20	Internal	External	100	40	p
2	MCB (6S) Practical	DSE- MCB-II (6S)Pr			6	6		2.25	2.25	3 Hours			25	25	50	25	p
3	Mini-Project/Hands on Traning/ workshop/DIY related to Subject-Phase II		-	-	6	6	-	2.25	2.25	2	Internal Assessment by college/Institute/department				50	25	P
	Total		6		12	18	4.5	4.50	9	8 hours	80	20	25	25	200	90	P

(B.Sc. Part- III) (Semester- VI) MICROBIOLOGY**Syllabus Prescribed for 2024-2025 UG Programme****Programme : UG in Microbiology****Semester-VI**

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
DSE-MCB-II (6S)T	Microbial Biotechnology	90

COs

Upon completion of this course successfully, students would be able to:

1. Acquire knowledge on industrially important microbes and their application in industries.
2. Describe fermentation process and terminologies related to fermentation.
3. Conquer knowledge on application of microbes in bioenergy and environmental management.
4. Accomplish knowledge on production, contamination and preservation of milk and food products.
5. Obtain detail knowledge on commercially important industrial product.

COURSE MODULE	UNIT	CONTENT
DSE-MCB -II	Unit-I Introduction of Biotechnology	A. Scope of microbial biotechnology B. Industrial applications of microbial biotechnology 1. Biosurfactants, Biopolymers

		<p>2. Biosensor</p> <p>3. Bioplastics</p> <p>(15 Periods)</p>
	<p>Unit-II</p> <p>Microbes for</p> <p>Renewable</p> <p>energy</p>	<p>Renewable energy production :</p> <p>1. Biogas</p> <p>2. Biodiesel</p> <p>3. H₂ gas</p> <p>4. biomass</p> <p>(15 Periods)</p>
	<p>Unit-III</p> <p>Microbial</p> <p>biotechnology for</p> <p>Environment and</p> <p>its sustainability</p>	<p>1. GEMS for environmental cleaning</p> <p>2. Bioremediation</p> <p>3. Biomining</p> <p>4. Garbage decomposition</p> <p>(15 Periods)</p>
	<p>Unit-IV</p> <p>Advanced</p> <p>applications of</p> <p>biotechnology</p>	<p>1. Gene therapy: Somatic and germ line gene therapy</p> <p>2. Recombinant vaccines : (He-B, COVID)</p> <p>3. Synthetic vaccines, Insulin, Interferon</p> <p>(15 Periods)</p>

	Unit-V Green Biotechnology	<ol style="list-style-type: none"> 1. Micro biotechnology for agriculture 2. Techniques for transgenic plant 3. Biopesticides 4. Bioherbicides 5. Genetically modified food 6. Plant tissue culture <p>(15 Periods)</p>
SEM	Skill for Microbial Biotechnology	<ol style="list-style-type: none"> 1. Isolation of industrially important microorganism from different sources using specific substrates 2. Design and Preparation of Media for Bioprocesses; Growth curve studies of bacteria/Yeasts in batch culture and calculation of maximum specific growth rate 3. To study the various methods of biomass measurement; 4. Collection, segregation, and biodegradation of garbage 5. Enlist the commercially available biopesticides, bioherbicides and genetically modified food products 6. Layout plan for biogas production 7. Enlist general biotechnological products available in the market <p>(15 Periods)</p>
	<p>COs:</p> <p>By the end of this module, the students will be able to:</p> <ol style="list-style-type: none"> 1. To know the bio safety measurements and aseptic technique in microbial industry. 2. To know methods for microbial quality control of food 3. To know methods for isolation and screening of Production strains. 	
	**Activities	<ol style="list-style-type: none"> 1. Class test(10M) 2. Assignment(5M) 3. Educational Visit/GD/Seminars/projects/Any Innovative activity(5M)

Syllabus Prescribed for 2024-2025 UG Programme

Programme: UG in Microbiology

Code of the Course /Subject	Title of the Course/Subject	Total Number of Periods
DSE-MCB-II (6S) Pr	MCB (6S) Practical	6 periods /per week/per batch

Semester-VI

COs:

By the end of this module, the students will be able to perform:

- Alcohol and citric acid estimation.
- Detection of Wine production
- Scientific method of Biogas production
- Effective Garbage degradation by microorganisms

Practical: 6S Microbiology

List of Practical/Laboratory Experiments.

1. Alcohol production using yeast
2. Alcohol estimation
3. Citric acid fermentation
4. Wine production
5. Isolation of antibiotic producing microorganism from soil.
6. Biogas production
7. Isolation of microbes for garbage degradation
8. Isolation of microorganisms for biosurfactants producers
9. Preparation of bioherbicides

The distribution of marks for the practical examination shall be as follows:

External Examination		Internal Examination	
Performance of any two experiments	20 marks	Attendance & students performance	10 Marks
Viva-voce	05 marks	Practical Record book	10 Marks
		MCQ/ Objective test	05 Marks
Total	25 Marks	Total	25 Marks

Course Material/Learning Resources

List of Books Recommended:

1. Food Microbiology : Fazier W.C. & Westhoff D.C.
2. Fermented Foods (Vol.7) : Rose A.A.
3. Industrial Microbiology : Prescott S.C. & Dunn C.G.
4. Industrial Microbiology : Miller B.M. & W. Litsky
5. Industrial Microbiology : A.H. Patel
6. Microbial Technology : Pepler H.J. (Vol. I & II)
7. Industrial Microbiology : Casida L.E.
8. Principles of Fermentation : Stanbury, Peter F. & Technology Allan. Whitaker
9. Outlines of Dairy Bacteriology : Sukumar De
10. Modern Food Microbiology : Jay, Mames M.
11. Principles of Industrial : Rhodes & Fletcher. Microbiology
12. Industrial Fermentation : Under Kofler & Hick. Vol. I & II
13. Dairy Microbiology : Foster Etal
14. Industrial Microbiology : Rose