



॥ सा विद्या या विमुक्तये ॥  
**स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड**  
"ज्ञानतीर्थ" परिसर, विष्णुपुरी, नांदेड - ४३१६०६ (महाराष्ट्र)  
**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED**  
"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)  
Established on 17th September 1994 - Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade

**ACADEMIC (I-BOARD OF STUDIES) SECTION**

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संलग्नित महाविद्यालयांतील विज्ञान व  
तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील  
द्वितीय वर्षाचे CBCS Pattern नुसारचे  
अभ्यासक्रम शैक्षणिक वर्ष २०२०-२१  
पासून लागू करण्याबाबत.

**परिपत्रक**

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, दिनांक २० जून २०२० रोजी संपन्न झालेल्या ४७व्या मा. विद्या परिषद बैठकीतील विषय क्र.११/४७-२०२०च्या ठरावानुसार प्रस्तुत विद्यापीठाच्या संलग्नित महाविद्यालयांतील विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील द्वितीय वर्षाचे खालील विषयांचे C.B.C.S. (Choice Based Credit System) Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०२०-२१ पासून लागू करण्यात येत आहेत.

1. B.Sc.-II Year-Biophysics
3. B.Sc.-II Year-Biotechnology
5. B.Sc.-II Year-Food Science
7. B.Sc.-II Year-Horticulture
9. B.Sc.-II Year-Analytical Chemistry
11. B.Sc.-II Year-Chemistry
13. B.Sc.-II Year-Industrial Chemistry
15. B.I.T. (Bachelor of Information Technology)-II Year
17. B.Sc.-II Year-Network Technology
19. B.Sc.-II Year-Computer Science (Optional)
21. B.Sc.-II Year-Software Engineering
23. B.Sc.-II Year-Electronics
25. B.Sc.-II Year-Fishery Science
27. B.Sc.-II Year-Mathematics
29. B.Sc.-II year Agricultural Microbiology
31. B.Sc.-II Year Statistics
2. B.Sc.-II Year-Bioinformatics
4. B.Sc.-II Year-Biotechnology (Vocational)
6. B.Sc.-II Year-Botany
8. B.Sc.-II Year-Agro Chemical Fertilizers
10. B.Sc.-II Year-Biochemistry
12. B.Sc.-II Year-Dyes & Drugs Chemistry
14. B.C.A. (Bachelor of Computer Application)-II Year
16. B.Sc.-II Year-Computer Science
18. B.Sc.-II Year-Computer Application (Optional)
20. B.Sc.-II Year-Information Technology (Optional)
22. B.Sc.-II Year-Dairy Science
24. B.Sc.-II Year-Environmental Science
26. B.Sc.-II Year-Geology
28. B.Sc.-II Year-Microbiology
30. B.Sc.-II Year-Physics
32. B.Sc.-II Year-Zoology

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या [www.srtmun.ac.in](http://www.srtmun.ac.in) या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

'ज्ञानतीर्थ' परिसर,

विष्णुपुरी, नांदेड - ४३१ ६०६.

जा.क्र.: शैक्षणिक-१/परिपत्रक/पदवी-सीबीसीएस अभ्यासक्रम/

२०२०-२१/३३३

दिनांक : १५.०७.२०२०.

प्रत माहिती व पुढील कार्यवाहीस्तव :

- १) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- २) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
- ३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
- ४) साहाय्यक कुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
- ५) संचालक, पात्रता विभाग, प्रस्तुत विद्यापीठ.
- ६) संचालक, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

स्वाक्षरित / -

**उपकुलसचिव**

शैक्षणिक (१-अभ्यासमंडळ) विभाग

**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Learning Outcome Based Course Structure**  
**(New scheme)**

**Faculty of Science and Technology**  
**Subject: Microbiology**

**B. Sc. Second Year (Semester – III & IV)**  
**Semester Pattern effective from June – 2020**

Semester	Course No.	Name of the Course	Instruction Hrs/ week	Total period	Continuous Assessment (CA)	End Semester Evaluation (ESE)	Total Marks	Credits
III	CCMB III (Section A)	Applied Microbiology (P-VI)	03	45	10	40	50	2
	CCMB III (Section B)	Immunology(P-VII)	03	45	10	40	50	2
	CCMBP II [CCMB III & IV (Section A)]	Practical's based on P-VI & P-VIII (P-X)	04	10 Practicals	10	40	50	2
	SECMB I	SEC I (1 Skill/ optional)	03	45	25	25	50	(02)*
	CCMB IV (Section A)	Food, Soil Microbiology and Microbial Ecology (P-VIII)	03	45	10	40	50	2
	CCMB IV (Section B)	Medical microbiology (PIX)	03	45	10	40	50	2
	CCMBP III [CCMB III & IV (Section B)]	Practical's based on P-VII & P-IX (P-XI)	04	10 Practicals	10	40	50	2
	SECMB II	SEC II (1 Skill / optional)	03	45	25	25	50	(02)*
				<b>Total credits semester III and IV</b>				<b>12(04)*</b>

Note – ESE of CCMBP II, CCMBP III & SECMB I, SECMB II should be evaluated at annual.



Outline and  
 B. Sc. Micro-  
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**Outline and Salient Feature:**

B. Sc. Microbiology syllabus is crafted to serve the need of choice based credit system course structure to orient and practically train students in the field of Microbiology. The course is specifically bringing core courses, skilled enhanced courses together dealing additional domain of knowledge in this field of study where in Core Course includes applied microbiology, immunology, Food, Soil Microbiology and Microbial Ecology and medical microbiology.

Skill enhanced courses includes public health, diagnostic microbiology, medical laboratory technology and microbial biofertilizers, which is well suited to understand application of microorganisms in relation to health, diagnosis, and as fertilizers.

**Utility:**

The syllabus of B. Sc. microbiology course will orient and train the students in view of general microbiology, medical microbiology and laboratory technology, microbial genetics and molecular biology, occurrence of metabolic events and its relation to environment and agriculture, Industrial and Pharmaceutical Microbiology to understand and apply this knowledge for carrier orientation.

SE Course will provide additional opportunity for a student to develop skills of interest in this field of study.

**Learning Objectives:**

The learning or training objectives of SEC has been mentioned below the skill of the course.

**Prerequisite:**

The course is offered for a student registered for undergraduate programme in the faculty of Science and technology who had primary training in the field of biology at higher secondary school level evident in terms of certificate by CBSC/ ICSC/HSC for entry level core courses in microbiology optional subject. Whereas for SEC and DSE courses, student preferably needs training in microbial sciences and also likes to gain additional advanced knowledge in this field of science.



**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Learning Outcome Based Course Structure**  
 (New scheme)

**Faculty of Science and Technology**  
**B. Sc. Second Year (Semester – III)**  
**Subject: Microbiology**

**Paper Name: Applied Microbiology (P-VI) CCMB III (Section A)**  
**Paper Number: VI**

**Periods: 45**

**Credits: 02 (Marks: 50)**

**Specific Program Outcome:**

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in wide-ranging contexts, which involve the use of knowledge and skills of Microbiology and acquire knowledge and understanding of the microbiology concepts as applicable to diverse areas such as medical, industrial, environment, genetics, agriculture, food and others. Their understanding, knowledge and skills in Microbiology needs to be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

**Specific Course Outcome:**

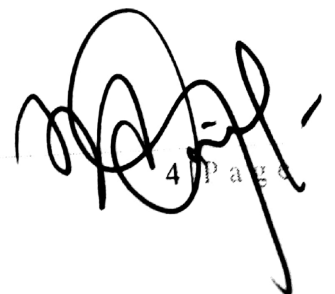
Applied microbiology trains students for gaining expertise in the microbial world and the way it interacts with humans. It looks at how we can harness and utilize the powers of the microbes in areas ranging from air, water and sewage microbiology to Milk Microbiology and extends to industrial applications. A wide range of microbial by-product production, quality assessment and health hazard monitoring is possible by students who get well versed in this course.

Unit Number and Name	Unit Content	Unit – Wise Learning Outcome	Number of Lectures
<b>Unit-I Air Microbiology</b>	1. Definition and composition of air 2. Sources of microorganisms in air 3. Significance of microorganisms in air (beneficial and harmful) 4. Droplet, droplet nuclei and aerosol 5. Enumeration of microorganisms in air 6. Control of microorganisms in air 7. Fate of aerosol, inactivation mechanisms – UV, HEPA filters, Desiccation, Incineration Precipitation, chemical disinfection, temperature	Gain Expertise in Microbial aspects of Air related to Human, Animal and Plant Health and their Environment	<b>10</b>
<b>Unit-II Water Microbiology</b>	1. Types of water 2. Sources of microorganisms in water 3. Index of water pollution 4. Different indicator microorganisms, coliform bacteria 5. Microbial examination of water, 6. Water borne diseases 7. Treatment and safety of potable water (drinking water)	Have developed a very good understanding and skills of analysis of water and contribute to control of environmental pollution	<b>12</b>

<b>Unit- III Sewage Microbiology</b>	<ol style="list-style-type: none"> <li>1. Definition of sewage</li> <li>2. composition and strength of sewage (BOD and COD)</li> <li>3. Microbiology of sewage</li> <li>4. Domestic sewage treatment</li> <li>5. Municipal sewage treatment (Primary, secondary, Tertiary sewage treatment) and Composting</li> </ol>	Become skilled in Microbial aspects Sewage and Effluent treatment and its proper disposal with respect to Human Health and Environment	<b>10</b>
<b>Unit-IV Milk Microbiology</b>	<ol style="list-style-type: none"> <li>1. Definition and composition of milk</li> <li>2. Sources of contamination of milk</li> <li>3. Desirable and undesirable changes in milk,</li> <li>4. Milk borne diseases</li> <li>5. Microbial examination of milk</li> <li>6. Pasteurization of milk</li> <li>7. Application of microorganisms in dairy industry – Dairy starter culture, Fermented dairy products – yoghurt, acidophilus milk, kumiss, kefir, Dahi and cheese, Probiotics – health benefits</li> </ol>	Able to understand the role of microorganisms in the production of fermented food, including their role in homemade fermented food. Also develop experimental skill for testing the milk for the presence of microorganism	<b>13</b>

**Reference Books: -**

1. Air microbiology an environment and Health Prospective by Aithal, Wakte & Manwar. Cinnamontal print and publishing Margao, Goa -403601.
2. Fundamental principles of bacteriology by A. J. Salle.
3. Fundamentals of Microbiology by Martin Frobisher.
4. General microbiology by Stanier, Ingraham, Wheelis, Pinter: Macmillan press Ltd. London.
5. General Microbiology Vol. II by Power C.H and H.F. Dagainawala. Himalaya Publishing House, Mumbai.
6. Microbiology by Pelczar and Crick.
7. Textbook of Microbiology by Dubey and Maheshwari.
8. Applied Microbiology by Dr. B. M. Sandikar.
9. Principle of Fermentation Technology. Whittaker, A. and Hall, S. J. 2<sup>nd</sup> Edition – Stanbury, P.F.
10. Biotechnology: Food Fermentation Microbiology, Biochemistry and Technology volume 2 – Joshi.
11. Brock Biology of Microorganisms Thirteenth Edition, Michael T., John M. Martinko, David A. Stahl, and David P. Clark.
12. Prescott, Harley, and Klein's Microbiology Seventh Edition, Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton Published by McGraw-Hill.
13. Applied Dairy Microbiology Elmer H. Marth James L. Steele
14. Yoghurt Science and Technology Second edition A. Y. Tamime and R. K. Robinson
15. Fermented Milks by Adnan Tamime.
16. Manual of Methods for Pure Culture Study, by A. B. Solunke, P. S. Wakte, V. D. Hamde, and R. S. Awasthi, Nirmal Publication Delhi (India).



**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Learning Outcome Based Course Structure**  
 (New scheme)

**Faculty of Science and Technology**  
**B. Sc. Second Year (Semester – III)**

**Subject: Microbiology**

**Paper Name: Immunology (P-VII) CCMB III (Section B)**

**Paper Number: VII**

**Credits: 02 (Marks: 50)**

**Periods: 45**

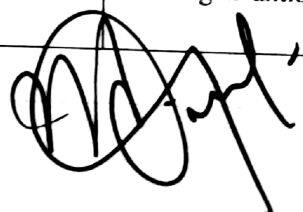
**Specific Program Outcome:**

Impart Knowledge of the diverse places where microbiology is involved. Understanding of diverse Microbiological processes. Basic skills such as culturing microbes, maintaining microbes, safety issues related to handling of microbes, Good Microbiological practices etc. Moderately advanced skills in working with microbes such as Pathogens.

**Specific Course Outcome:**

Understand the basic components of the immune system and how this system serves to protect the host against disease-causing microbes. Understand Concept related to cells and organs related to immune system, Immunity, Immune response and immune mechanism of both Immunity & Hypersensitivity.

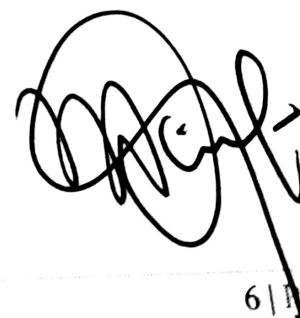
Unit Number and Name	Unit Content	Unit – Wise Learning Outcome	Number of Lectures
<b>Unit- I Immune system, Infection and Immunity</b>	<ol style="list-style-type: none"> <li>1. Structure and function of Leucocytes</li> <li>2. Normal Microflora of Skin, Oral Cavity, and Gastrointestinal Tract</li> <li>3. Infection: Definition, types of infections</li> <li>4. Sources of infection</li> <li>5. Modes of transmission</li> <li>6. Microbial pathogenicity</li> <li>7. Aggressive factors of pathogens</li> <li>8. Immunity: Definition and classification with suitable examples</li> </ol>	Understand the basic components of the immune system and how this system serve to protect the host against disease-causing microbes. Conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause infection leading to infectious disease in the human body. Understand the overall classification of Immunity	<b>13</b>
<b>Unit- II Antigens, Antibodies and Immune Response</b>	<ol style="list-style-type: none"> <li>1. Antigen: Definition</li> <li>2. General properties, antigen specificity</li> <li>3. Bacterial antigens with reference to <i>S. typhi</i></li> <li>4. Antibody: Definition, properties</li> <li>5. Structure of immunoglobulin, immunoglobulin classes</li> <li>6. Immune response: complement system, Definition, types and mechanism- Humoral and cellular, list of effector Molecules,</li> <li>7. Theories of antibody production</li> </ol>	Demonstrate an understanding of key concepts in immunology interns of antigen and antibodies. Understand the overall organization of the immune system its functioning and differentiate different type of Immune response to different pathogens.	<b>12</b>
<b>Unit -III Antigen Antibody Reactions</b>	<ol style="list-style-type: none"> <li>1. Mechanism and applications of the following reaction with suitable examples:</li> </ol>	Understand the salient features of antigen antibody reaction &	<b>10</b>



	Agglutination, Precipitation, Complement fixation, Virus neutralization, Toxin neutralization reaction 2. Principle and applications of recent techniques: Enzyme linked immunosorbent assay, Radioimmunoassay, Immunofluorescence test.	its uses in diagnostics and various other studies.	
<b>Unit-IV Hypersensitivity</b>	1. Definition. 2. Classification on the basis of time (Delayed and immediate) 3. Mechanism of Type I, II, III and IV hypersensitivity with one example of each. Type I hypersensitivity - Systemic Anaphylaxis Type II hypersensitivity - Blood Transfusion Reactions Type III hypersensitivity - Arthus Reaction Type IV hypersensitivity - Contact Dermatitis	Comprehend the destructive nature of Immunity and its mechanism in an human individual i.e. allergic reaction	<b>10</b>

#### Reference Books:

1. Basic Immunology by Joshi and Osarano. Agrobotanical publishers Ltd. Bikaner.
2. Elementary Microbiology Vol. I and II Dr. A. H Modi. Akta Prakashan. Nadiad.
3. Medical Microbiology. N. C. Dey and T. K. Dey. Allied agency, Calcutta.
4. Microbiology by Davis, Dulbecco, Eisen Harper and Row Maryland.
5. Molecular biology by David Frifelder, Narosa Publishing house, New Delhi.
6. Immunology by B. S. Nagoba and D. V. Vedpathak. BI publications, New Delhi.
7. Text book of Microbiology by R. Anantharayanan, C.K. Jayaram Panikar, Orient Longman, Mumbai.
8. Essential Immunology 10<sup>th</sup> edition Blackwell Science Roitt I.
9. Immunology 4<sup>th</sup> edition W. H. Freeman & company Kuby.
10. Brock Biology of Microorganisms Thirteenth Edition, Michael T., John M. Martinko, David A. Stahl, and David P. Clark.
11. Prescott, Harley, and Klein's Microbiology Seventh Edition, Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton Published by McGraw-Hill.
12. Fundamental Immunology 5th edition by William E., Md. Paul
13. Immunology Fifth Edition Richard A. Goldsby Thomas J. Kindt Barbara A. Osborne Janis Kuby



Swami Ramanand Teerth Marathwada University Nanded  
 Choice Based Credit System (CBCS) Learning Outcome Based Course Structure  
 (New scheme)  
 Faculty of Science and Technology  
 B. Sc. Second Year (Semester – IV)  
 Subject: Microbiology  
 Paper Name: Food, Soil Microbiology and Microbial Ecology (P-VIII) CCMB IV  
 (Section A)  
 Paper Number: VIII

Periods: 45

Credits: 02 (Marks: 50)

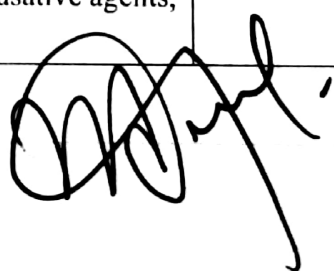
**Specific Program Outcome:**

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in wide-ranging contexts, which involve the use of knowledge and skills of Microbiology and acquire knowledge and understanding of the microbiology concepts as applicable to diverse areas such as medical, industrial, environment, genetics, agriculture, food and others. Their understanding, knowledge and skills in Microbiology needs to be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

**Specific Course Outcome:**

To apply the knowledge of microorganisms causing food spoilage, pathogens that may cause disease post cooked or storage, those used to produce fermented foods such as cheese, yogurt, bread, beer, and wine, meat and meat products, fruits vegetables and those with other useful roles such as producing probiotics. Understand of principles of soil science, microbiology, and the chemistry and physics of natural elemental cycles, which maintain the balance of our ecosystem. Describe significance of soil fertility, appreciate role of soil microorganisms which play essential roles in the nutrient cycles that are fundamental to life on the planet. Illustrate and explain how microbes are responsible for cycling nutrients through the environment, creating important symbiotic relationships, providing energy in the absence of sunlight, and digesting the food we eat.

Unit Number and Name	Unit Content	Unit – Wise Learning Outcome	Number of Lectures
<b>Unit-I Food Microbiology</b>	1. Definition and composition of food 2. Sources of contamination in food 3. Factors affecting kind and number of microorganisms in food 4. Significance of microorganisms in food, 5. Spoilage and its types (Different types of spoilages with suitable examples) 6. Preservation of food 7. Food poisoning (Botulinum, Staphylococcal intoxication and mycotoxin) Shigellosis – Causative agents, food involved	Understand and explain the action of microorganisms that inhibit, create, or contaminate food.	<b>12</b>





<b>Unit -II Soil Microbiology and Carbon cycle</b>	1. Definition and Types of soil 2. Composition of soil and Soil as culture medium 3. Signification of microorganisms in soil 4. Carbon cycle (with respect to cellulose and starch)	Identify and describe activities of Microorganisms in soil which affect soil structure and fertility.	<b>11</b>
<b>Unit -III Elemental Transformation in Soil</b>	1. Nitrogen cycle 2. Sulfur cycle 3. Phosphorus cycle	Describe and interpret the activities of Microorganisms in soil which affect decomposition of organic matter in soil to produce natural fertilizers.	<b>12</b>
<b>Unit -IV Microbial Interaction, Association and Ecology</b>	1. Symbiosis, antibiosis, mutualism, parasitism 2. Microbe -microbe interaction-Lichen 3. Plant-microbe interaction: Mycorrhiza, Rhizosphere 4. Animal - microbe interaction: Rumen, bioluminescence 5. Concept of population, community, Microbial succession, climax and adaptation (Phenotypic and genotypic adaptations) 6. Biofertilizers – Application and types	Illustrate and apply role of soil microorganisms in plant growth and plant exudates, root metabolism, and understand development of healthy soil structure.	<b>10</b>

#### Reference Books:

1. A Manual of Environmental Microbiology. Second Edition .2001 by Christion J. Hurst (Chief Editor), ASM Publications.
2. Environmental Biology. Edited by C. F. Foster and D. A. John Wase. Ellis Horwood Ltd. Publication.
3. Environmental Microbiology edited by Ralph Mitchell. A John Wiley and Sons. Inc.
4. General Microbiology Vol. I and II by Power C. H. & H. F. Dagainawala. Himalaya Publishing House, Mumbai.
5. Microbiology by Pelczar and Crick.
6. General Microbiology by Stanier. Ingraham, Wheelis, Painter: Macmillan Press Ltd. London.
7. Fundamental principles of bacteriology by A. J. Salle.
8. Food microbiology by Frazier.
9. Soil microbiology by Subba Rao.
10. Soil microbiology by Alexander.
11. Applied Microbiology by Dr. B. M. Sandikar.
12. Fundamentals of Microbiology by Martin Frobisher.
13. Textbook of Microbiology by Dubey Maheshwari.
14. Brock Biology of Microorganisms Thirteenth Edition, Michael T., John M. Martinko, David A. Stahl, and David P. Clark.
15. Prescott, Harley, and Klein's Microbiology Seventh Edition, Joanne M. Willey , Linda M. Sherwood and Christopher J. Woolverton Published by McGraw-Hill.
16. Manual of Methods for Pure Culture Study, by A. B. Solunke, P. S. Wakte, V. D. Hamde, and R. S. Awasthi, Nirmal Publication Delhi (India).



Credits: 02 (Marks: 50)

**Specific Program Outcome:**

Acquired a fairly good understanding of normal microflora of human body, common diseases caused by bacteria, viruses, fungi and other microbes.

**Specific Course Outcome:**

Impart Knowledge of the diverse places where microbiology is involved. Understanding of diverse Microbiological processes. Basic skills such as culturing microbes, maintaining microbes, safety issues related to handling of microbes, Good Microbiological practices etc. Moderately advanced skills in working with microbes such as Pathogens.

Unit Number and Name	Unit Content	Unit – Wise Learning Outcome	Number of Lectures
<b>Unit-I Bacterial Infection</b>	Etiology, Pathogenesis, Clinical features, Laboratory diagnosis, Epidemiology, Treatment and Prophylaxis of the following: 1. Cholera 2. Typhoid 3. Staphylococcus infection	Acquire a good understanding of bacterial diseases caused to intestine and skin wound infection. Develop a very good understanding of practical aspects of collection of different clinical samples, their transport, culture and examination by staining, molecular and immunological diagnostic methods, preventive measures by the use of antibiotics and vaccines	12
<b>Unit - II Bacterial Infection</b>	Etiology, Pathogenesis, Clinical features, Laboratory diagnosis, Epidemiology, Treatment and Prophylaxis of the following: 1. Diphtheria 2. Pulmonary Tuberculosis 3. Syphilis	Acquire a good understanding of bacterial diseases caused to throat, lungs and sexual organ Develop a very good understanding of practical aspects of collection of different clinical samples, their transport, culture and examination by staining, molecular and immunological diagnostic methods, preventive measures by the use of antibiotics and vaccines	13

<p align="center"><b>Unit - III</b> <b>Viral Infections</b></p>	<p>Etiology, Pathogenesis, Clinical features, Laboratory diagnosis, Epidemiology, Treatment and Prophylaxis of the following:</p> <ol style="list-style-type: none"> <li>1. AIDS</li> <li>2. Hepatitis A and B</li> </ol>	<p>Acquire a sound understanding of viral diseases Develop a very good understanding of practical aspects of collection of different clinical samples, their transport, culture and immunological diagnostic methods, preventive measures by the use of antibiotics and vaccines</p>	<p align="center"><b>10</b></p>
<p align="center"><b>Unit - VI</b> <b>Infection by Other Microorganisms</b></p>	<ol style="list-style-type: none"> <li>1. Morphology, life cycle, pathogenicity, Etiology, laboratory diagnosis, treatment and prophylaxis of Malaria.</li> <li>2. Etiology, pathogenesis, Clinical features, laboratory diagnosis and treatment of Candidiosis.</li> </ol>	<p>Comprehend the destructive nature of Immunity and its mechanism in an human individual i.e. allergic reaction</p>	<p align="center"><b>10</b></p>

**Reference Books:**

1. Medical Microbiology. N.C.Dey and T.K. Dey. Allied agency, Calcutta.
2. Microbiology by Davis, Dulbecco, Eisen Harper and Row Maryland.
3. Text book of Microbiology by R. Anantharayanan, C.K. Jayaram Panikar, Orient Longman, Mumbai.
4. Medical microbiology by Chakraborty.
5. Medical Microbiology: Prep Manual for Under Graduates by Nagoba, Elsevier.
6. Brock Biology of Microorganisms Thirteenth Edition, Michael T., John M. Martinko, David A. Stahl, and David P. Clark.
7. Prescott, Harley, and Klein's Microbiology Seventh Edition, Joanne M. Willey, Linda M. Sherwood and Christopher J. Woolverton Published by McGraw-Hill.
8. Medical Microbiology by F. H. Kayser



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Ref

**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Learning Outcome Based Course Structure**  
(New scheme)

**Faculty of Science and Technology**  
**B. Sc. Second Year (Semester – III & IV)**

**Subject: Microbiology**  
**Paper Name: Annual Practical's based CCMBP II [CCMB III & IV (Section A)]**  
**Paper Number: Practical's based on P-VI & P-VIII (P-X)** **Marks: 50**

**Credits: 02**

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(Annual practical Based on CCMBP II [CCMB III & IV (Section A)]) (Practical syllabus requires four periods per batch per week for 2 consecutive days B.Sc. Second year practical includes studies of growth of microorganisms and life activities of Microorganisms. These studies need two consecutive days for completion of practical.)

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**Specific Program Outcome:**

Impart Knowledge of the diverse places where microbiology is involved. Understanding of diverse Microbiological processes. Basic skills such as culturing microbes, maintaining microbes, safety issues related to handling of microbes, Good Microbiological practices etc. Moderately advanced skills in working with microbes such as Pathogens.

**Specific Course Outcome:**

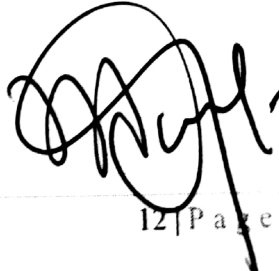
Acquire skills of handling microorganisms in the laboratory and study their characteristics. Has developed laboratory skills in isolating and detecting microbes from soil and water. Laboratory skills of testing microbial load in Food and milk. Has developed skills for growing microorganisms in the laboratory to produce different enzymes

1. Bacteriological examination of air by Solid Impingement Techniques.
2. Bacteriological examination of water: Quantitative analysis: MPN method
3. Bacteriological examination of water: Qualitative analysis: Presumptive, Confirmatory, Completed test,
4. Differentiation between fecal and non-fecal coliforms by IMViC test
5. Elevated temperature test (Ejeckman test).
6. Determination of R: S ratio.
7. Demonstration of Ammonification
8. Demonstration of Nitrification
9. Demonstration of Phosphate solubilization
10. Isolation and study of *Rhizobium species* from root nodules of leguminous plants.
11. Isolation and study of *Azotobacter sp.* from soil
12. Bacteriological analysis of milk: MBRT
13. Bacteriological examination of food by SPC method
14. Bacteriological examination of food by DMC method
15. Alkaline phosphatase test to check pasteurization of milk



**Reference Books:**

1. Laboratory Exercises in Microbiology, Fifth Edition Harley–Prescott
2. Microbiology – A laboratory Manual 10<sup>th</sup> edition by James Cappuccino and Natalie Sherman
3. Microbiological Applications Lab Manual, Eighth Edition by Benson
4. Laboratory Methods in Food Microbiology by Harrigan W F.
5. A Laboratory Manual in Food Microbiology by Garg N ,Garg K.L.



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Credits: 02

(Annual practical Based on CCMBP III [CCMB III & IV (Section B)] (Practical syllabus requires four periods per batch per week for 2 consecutive days B.Sc. Second year practical includes studies of growth of microorganisms and life activities of Microorganisms. These studies need two consecutive days for completion of practical.)

**Specific Program Outcome:**

Impart Knowledge of the diverse places where microbiology is involved. Understanding of diverse Microbiological processes. Basic skills such as culturing microbes, maintaining microbes, safety issues related to handling of microbes, Good Microbiological practices etc. Moderately advanced skills in working with microbes such as Pathogens.

**Specific Course Outcome:**

Acquire skills of handling microorganisms in the laboratory and study their characteristics. Has developed laboratory skills in detecting enzymes antigen and antibodies using diagnostic kits Laboratory skills of staining blood and enumerate RBCs and WBCs in whole blood. Has developed skills for growing Pathogenic microorganisms in the laboratory and identifying them on basis of various biochemical tests and perform antibiotic sensitivity tests.

1. Blood staining by Leishman's / Giemasa's method
2. Metachromatic granule staining (Albert's Method)
3. Acid fast staining
4. RBC counting
5. WBC counting
6. Blood grouping
7. Widal test: Qualitative and Quantitative by slide method
8. RPR test
9. Gel diffusion test (Demonstration)
10. Isolation and Study of Morphology, Cultural and Biochemical characteristics of the *Salmonella sp.*
11. Isolation and Study of Morphology, Cultural and Biochemical characteristics of the *Vibrio cholerae*
12. Isolation and Study of Morphology, Cultural and Biochemical characteristics of the *Staphylococci*
13. Study of bacterial flora of skin by swab methods
14. Antibiotic sensitivity tests for above pathogens by disc diffusion method
15. Coagulase test



**Reference Books:**

1. Laboratory Exercises in Microbiology, Fifth Edition Harley Prescott
2. Microbiology - A laboratory Manual 10th edition by James Cappuccino and Natalie Sherman
3. Microbiological Applications Lab Manual, Eighth Edition by Benson
4. Advanced Techniques in Diagnostic Microbiology by Yi-Wei Tang Charles W. Stratton
5. Basic laboratory procedures in clinical bacteriology by J. Vandepitte and J. Verhaegen, K. Engbaek P. Röhner, P. Piot, and C. C. Heuck
6. The Science of Laboratory Diagnosis by John Crocker and David Burnett
7. Diagnostic Bacteriology Protocols by Louise O'Connor

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**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Learning Outcome Based Course Structure**  
 (New scheme)

**Faculty of Science and Technology**  
**B. Sc. Second Year (Semester – IV)**

**Subject: Microbiology**  
**Paper Name: Public Health Microbiology SECMB - I (Section A)**

**Paper Number: SECMB - I**

**Marks: 50**

**Credits: 02**

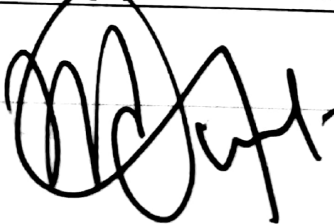
**Specific Program Outcome:**

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in wide-ranging contexts, which involve the use of knowledge and skills of Microbiology. Their understanding, knowledge and skills in Microbiology needs to be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

**Specific Course Outcome:**

Have developed a very good understanding of practical aspects diagnosis of common human waterborne infections, preventive measures for human waterborne infections by the use of antibiotics and vaccines, Gain skills food and milk quality testing.

Unit Number and Name	Unit Content	Unit – Wise Learning Outcome
<p style="text-align: center;"><b>Unit I</b>  <b>Scope of Public Health Microbiology</b></p>	Definition, areas covered in Public Health Microbiology, Overview of disease process	Have developed a very good understanding of practical aspects of testing, water and food testing skills using kits available in the market.
<p style="text-align: center;"><b>Unit II</b>  <b>Water Microbiology</b></p>	Water borne pathogens & water borne diseases Bacteria: <i>E.coli</i> , <i>Salmonella</i> , <i>Shigella</i> , <i>Vibrio cholerae</i> Viruses : Enteroviruses, Hepatitis virus Protozoa : <i>Entamoeba histolytica</i> , Giardia	
<p style="text-align: center;"><b>Unit III</b>  <b>Skill in water quality monitoring</b></p>	Sources of water, Potable water ,Importance of potable water, Indicator organisms of water pollution, standard tests for determination of potability of water, Quantitative: TC, FC, Membrane Filter count. Qualitative: Presumptive, Confirmed, Completed.	
<p style="text-align: center;"><b>Unit IV</b>  <b>Skill in food and milk quality monitoring</b></p>	Enrichment culture technique, Detection of specific microorganisms on selective media : XLD agar, Wilson and Blair agar, Mannitol Salt agar, MacConkey's agar Pathogenic microorganisms: Salmonella, Coliforms, <i>Staphylococcus aureus</i> ,	

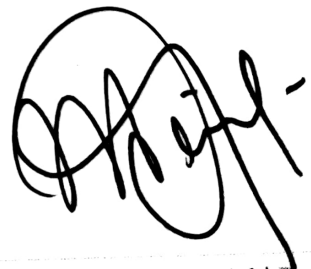




<b>PRACTICAL Practice</b>	<ol style="list-style-type: none"><li>1. Isolation of Coliforms, Identification of fecal Coliforms by IMViC tests</li><li>2. MPN: TC &amp; FC</li><li>3. Enrichment culture technique for <i>Salmonella</i>, <i>S. aureus</i>. Determination of Microbiological quality of Milk by MBRT, Resazurin Test.</li></ol>	This lab course aims to provide the students with analytical and on hands practical skills
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**References: -**

1. Da Silva N, Taniwaki M.H, Junqueira V.C. Microbiological Examination of food and Water- A Laboratory Manual
2. Harrigan W F. Laboratory Methods in Food Microbiology
3. Garg N ,Garg K.L. A Laboratory Manual in Food Microbiology
4. Jay J M and Loeswer M. J. Modern Food Microbiology



Refer

Swami Ramanand Teerth Marathwada University Nanded  
Choice Based Credit System (CBCS) Learning Outcome Based Course Structure  
(New scheme)

Faculty of Science and Technology  
B. Sc. Second Year (Semester – IV)  
Subject: Microbiology

Paper Name: Microbial Biofertilizers SECMB - I (Section B)  
Paper Number: SECMB - I

Marks: 50

Credits: 02

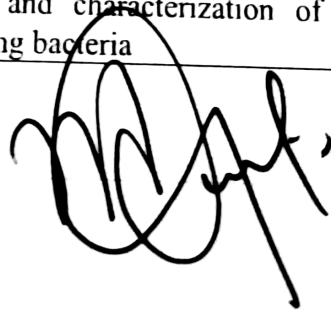
**Specific Program Outcome:**

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in wide-ranging contexts, which involve the use of knowledge and skills of Microbiology. Their understanding, knowledge and skills in Microbiology needs to be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

**Specific Course Outcome:**

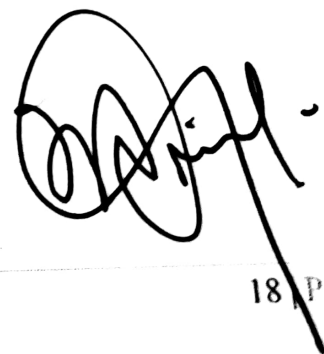
Have developed a very good understanding of practical aspects production of biofertilizers.

Unit Number and Name	Unit Content	Unit – Wise Learning Outcome
<b>Unit I Biofertilizers</b>	General account of the microbes used as biofertilizers for various crop plants and their advantages over chemical fertilizers.	Have developed a very good understanding of practical aspects of microbes as biofertilizer, types of biofertilizers, their role in environment
<b>Unit II Nitrogen fixing bacteria</b>	Symbiotic N <sub>2</sub> fixers: Rhizobium - Isolation, characteristics, types, inoculum production and field application, legume/pulses plants Non - Symbiotic N <sub>2</sub> fixers Free living Azotobacter - isolation, characteristics, mass inoculum production and Field application.	
<b>Unit III Mycorrhizal &amp; Algal Biofertilizer</b>	Importance of mycorrhizal inoculums, types of mycorrhizae and associated plants, Mass inoculums. Production of VAM, field applications of Ectomycorrhizae and VAM, Cyanobacteria,, Role in rice cultivation, , field application.	
<b>Unit IV Phosphate solubilizers</b>	Phosphate solubilizing microbes -, mass inoculum production, field Application	
<b>PRACTICAL Practice</b>	<ol style="list-style-type: none"> <li>1. Isolation of Azotobacter from soil and Rhizobium from leguminous nodule</li> <li>2. Azolla - Isolation, characterization, mass multiplication</li> <li>3. Isolation and characterization of phosphate solubilizing bacteria</li> </ol>	This lab course aims to provide the students skill to prepare various biofertilizer with ease and develop commercial view.



**References:**

1. Kannaiyan, S. (2003). Bioetchnology of Biofertilizers, CHIPS, Texas.
2. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
3. Reddy, S.M. (2002). Bioinoculants for sustainable agriculture and forestry, Scientific Publishers.
4. Subba Rao N.S (1995) Soil microorganisms and plant growth Oxford and IBH publishing co. Pvt. Ltd. NewDelhi.
5. Aggarwal SK (2005) Advanced Environmental Biotechnology, APH Publications
- Verma, A. (1999). Mycorrhiza. Springer Verlag, Berlin.
6. Wallanda, T. et al. (1997). Mycorrhizae. Backley's Publishers,

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Swami Ramanand Teerth Marathwada University Nanded  
Choice Based Credit System (CBCS) Learning Outcome Based Course Structure  
(New scheme)

Faculty of Science and Technology  
B. Sc. Second Year (Semester – IV)

Subject: Microbiology  
Paper Name: Diagnostic Microbiology SECMB - II (Section A)  
Paper Number: SECMB - II

Marks: 50

Credits: 02

**Specific Program Outcome:**

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in wide-ranging contexts, which involve the use of knowledge and skills of Microbiology. Their understanding, knowledge and skills in Microbiology needs to be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

**Specific Course Outcome:**

Have developed a very good understanding of practical aspects of collection of different clinical samples, their transport, culture and examination by staining, and molecular and immunological diagnostic methods for diagnosis of microbial diseases.

Unit Number and Name	Unit Content	Unit – Wise Learning Outcome
<b>Unit I</b> Importance of diagnosis of diseases	Common Bacterial, Viral, Fungal and Protozoan diseases.	Have developed a very good understanding of practical aspects of diagnostic testing, medical sample testing skills using kits available in the market
<b>Unit II</b> Collection and Examination of clinical samples	Collection of clinical samples and precautions required (oral cavity, throat, skin, Blood, Urine, and Feces). Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria.	
<b>Unit III</b> Diagnosis of pathogen using culture media	MacConkey's agar, Blood agar, Chocolate agar, Lowenstein-Jensen agar.	
<b>Unit IV</b> Serological methods for diagnosis	Agglutination, Precipitation, ELISA, Immuno fluorescence, Kits for rapid detection of Pathogens	
<b>PRACTICAL Practice</b>	<ol style="list-style-type: none"> <li>1. Clinical sample collection from throat &amp; Skin,</li> <li>2. Blood staining for Malarial parasite (MP),</li> <li>3. Preparation of Blood agar.</li> <li>4. Preparation of Chocolate agar</li> <li>5. Detection of Typhoid by WIDAL</li> <li>6. Detection of Syphilis by RPR</li> </ol>	This lab course aims to provide the students with analytical and on hands practical skills



**References:**

1. Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology, 26th edition, McGraw Hill Publication
3. Randhawa, V.S., Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby
5. Collee JG, Fraser, AG, Marnion, BP, Simmons A (2007) Mackie and McCartney Practical Medical Microbiology, 14th edition, Elsevier.

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**Swami Ramanand Teerth Marathwada University Nanded**  
**Choice Based Credit System (CBCS) Learning Outcome Based Course Structure**  
 (New scheme)

**Faculty of Science and Technology**  
**B. Sc. Second Year (Semester – IV)**  
**Subject: Microbiology**

**Paper Name: Medical Laboratory Techniques SECMB - II (Section B)**  
**Paper Number: SECMB - II**

**Marks: 50**

**Credits: 02**

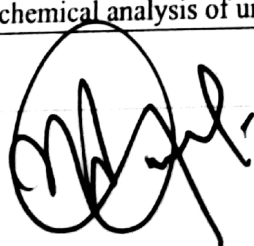
**Specific Program Outcome:**

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in wide-ranging contexts, which involve the use of knowledge and skills of Microbiology. Their understanding, knowledge and skills in Microbiology needs to be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

**Specific Course Outcome:**

Have developed a very good understanding of practical aspects of collection of different clinical samples, their transport, culture and examination by staining, and molecular and immunological diagnostic methods for diagnosis of microbial diseases.

Unit Number and Name	Unit Content	Unit – Wise Learning Outcome
<b>Unit I</b> <b>Importance of Haematology</b>	Components of Blood and Their functions. Study of Blood groups: ABO, Rh blood groups. Importance of Blood group, Blood collection and Anticoagulants in haematology	Have developed a very good understanding of practical aspects of diagnostic testing, medical sample testing skills using kits available in the market
<b>Unit II</b> <b>Routine Haematological techniques</b>	Haemoglobin estimation. Acid Hematin method (Sahils method) ESR, Cynometho hemoglobin Method, Wintrobs method, Capillary methods	
<b>Unit III</b> <b>Routine Diagnostic techniques</b>	Preparation of serum Plasma, Serum Immunoglobins and their significance	
<b>Unit IV</b> <b>Urine analysis</b>	Physical analysis: Importance of physical parameters colour , quantity, odour in diagnosis of disease Chemical Analysis: Urine Sugar/Albumin/Bile pigment/bile salt/occult blood/ketone bodies /keto urea and its importance in diagnosis of disease	
<b>PRACTICAL Practice</b>	<ol style="list-style-type: none"> <li>1. Blood grouping</li> <li>2. DLC</li> <li>3. TLC</li> <li>4. TEC</li> <li>5. Blood sugar</li> <li>6. Serum Cholesterol</li> <li>7. Physical and chemical analysis of urine</li> </ol>	This lab course aims to provide the students with analytical and on hands practical skills



**References:**

1. Ananthanarayan R and Paniker CKJ (2009) Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology, 26th edition. McGraw Hill Publication
3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby
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