



**R.P. Gogate College of Arts & Science
and R.V. Jogalekar College of
Commerce (Autonomous), Ratnagiri.**

**Bachelor of Science (B.Sc.) Programme
In Microbiology**

S.Y.B.Sc. [Sem-III & IV]

Course Structure

**Under Choice Based Credit System
(CBCS)**

**To be implemented from Academic
Year- 2024-2025**

Name of Programme	B.Sc. [Microbiology]
Level	UG
No of Semesters	06
Year of Implementation	2024-25
Programme Specific Outcomes (PSO)	<ol style="list-style-type: none"> 1] Learner shall know the various branches of Microbiology. 2] Learner shall know the role of microorganism in day-to-day life. 3] Learner shall able to Understand and identify the various Microorganisms. 4] Learner shall able to isolate and propagate various microorganisms. 5] Learner shall able to control microbial growth. 6] Learner shall know the fermentation of various fermented food products and industrial products by using microorganisms. 7] Learner should know the importance of microorganisms in infectious diseases.
Relevance of PSOs to the local, regional, national, and global developmental needs	<p>Microorganism's role in nature is indispensable. They involved in biodegradation, Fermentation, Antibiotic production, etc. Likewise some are involved in disease generation too. Therefore the understanding of microorganisms becomes essential to propagate or to control its number. As microorganism is responsible for food spoilage, food borne diseases so the maintenance of quality standard high is important from local level to global level. With respect to this learner should know the branches of microbiology. As microorganisms are ubiquitous so learner should know the role of microorganism in day to day life. There are millions of different microbes present on earth so identification of those microbes is globally important. In addition to that such identification skills have great importance in an infectious diseases control. Industrial fermentation processes requires pure culture of microbes so the knowledge of isolation of pure culture and its propagation is essential. Contamination by unwanted microbes is a worldwide problem. Learners must know the methods of microbial growth control. The various decontamination methods are not only locally important but also it is globally essential. In sterilized/controlled conditions only a good quality fermented food product can be prepared by specific microorganisms. Therefore learners should know skill and knowledge of such fermentation processes.</p> <p>Summarizing, graduates of B.Sc. Microbiology program will be informed citizens who can understand and apply basic microbiological technique at local to global level. It will be able to pursue wide range of careers including biological and life science research in higher educational institutions as well as careers in public health, clinical research, food, pharmaceutical and biotechnological industries.</p>

B.Sc. Programme
Under Choice Based Credit System (CBCS)
S.Y. B. Sc. Course Structure (Autonomous)

Major: Microbiology Minor: Chemistry

(To be implemented from Academic Year 2024-25)

Course Code	Semester III	Credits	Course Code	Semester IV	Credits
<i>Discipline Specific Courses (DSC)</i>				<i>Discipline Specific Courses (DSC)</i>	
<i>Major</i>				<i>Major</i>	
USMB301	Biomolecules and Microbial taxonomy	02	USMB401	Metabolism & Basic Analytical Techniques	02
USMB302	Environmental Microbiology	02	USMB402	Applied Microbiology	02
USMB303	Introduction to Clinical Microbiology	02	USMB403	Fermented Foods, Food Sanitation and Microbial Ecology	02
USMB304	Microbiology Practical	02	USMB404	Microbiology Practical	02
<i>Minor</i>				<i>Minor</i>	
USCH305	Physical, Inorganic, Organic Chemistry I	02	USCH405	Physical, Inorganic, Organic Chemistry II	02
USCH306	Chemistry Minor Practical III	02	USCH406	Chemistry Minor Practical IV	02
<i>Generic / Open Elective Course (OE)</i>				<i>Generic / Open Elective Course (OE)</i>	
	Any one course from Open Elective Basket	02		Any one course from Open Elective Basket	02
	Any one course from Open Elective Basket	02			
<i>Skill Enhancement Course (SEC)</i>				<i>Skill Enhancement Course (SEC)</i>	
	Any one course from Skill Enhancement Course Basket	02		Any one course from Skill Enhancement Course Basket	02

Ability Enhancement Course (AEC) Any I			Ability Enhancement Course (AEC) Any I		
	Marathi: Communication Skill-I	02		Marathi: Communication Skill-II	02
	Hindi: Communication Skill-I			Hindi: Communication Skill-II	
	Sanskrit: Communication Skill-I			Sanskrit: Communication Skill-II	
	Urdu: Communication Skill-I			Urdu: Communication Skill-II	
Co-Curricular Course (CC)			Co-Curricular Course (CC)		
	Any one course from the List given below of CC	02		Any one course from the List given below of CC	02
				FP or CEP	
				Field Project (FP) or Community Engagement and Service (CEP)	02
Total Credits		22	Total Credits		22

Table 1. Co-curricular Activities

Co-Curricular (Any One)		Co-Curricular (Any One)	
1	National Social Service (NSS)	1	National Social Service (NSS)
2	National Cadet Corps (NCC)	2	National Cadet Corps (NCC)
3	Sports	3	Sports
4	Cultural	4	Cultural
5	Yoga	5	Yoga
6	Life Long Learning	6	Life Long Learning
7	Shodhvedh / Avishkar	7	Shodhvedh
8	Publications	8	Publications
9.	Science Association	9.	Science Association
10.	Infosys courses	10.	Infosys courses

Table 2. Open Electives

<i>Open Elective (Any One)</i>		<i>Open Elective (Any One)</i>	
USOE301	Nutrition and diet management I	USOE401	Nutrition and diet management II
USOE302	Global Environmental Issues	USOE402	Neurobiology and behaviour
USOEBOT303	Plants in Human Welfare - Medicinal plants-III	USOEBOT403	Plants in Human Welfare - Medicinal plants-IV
USOEPH304	Physics in everyday Life I	USOEPH404	Physics in everyday Life II
USCSOE301	Multimedia and Digital Marketing	USOE405	Financial Mathematics
USCSOE302	Office Automation	USOE406	Research Analyst in Stock Market
		USCSOE401	Cyber Safety

Table 3. Skill enhancement courses for Science, IT, BT, CS Faculty

<i>Skill Enhancement Courses</i>		<i>Skill Enhancement Courses</i>	
USCH307	Skills in Water and soil analysis	USCH407	Skills in Organic Synthesis and Characterization
USZO307	Haematological techniques	USZO407	Beekeeping
USBOT307	Propagation of Horticultural Plants -III	USBOT407	Propagation of Horticultural Plants -IV
USPH307	Digital Electronics and Microprocessor 8085	USPH407	Advanced Microprocessor 8085 and Microcontroller 8051
USMB307	Microbiology skills -I	USMB407	Microbiology Skills - II
USBCH307	Clinical Biochemistry	USBCH407	Soil and water analysis
USCS307	Web Designing	USCS407	Net Technologies

Syllabus for S. Y. B. Sc. Microbiology [Since 2024-25] as per NEP

SEMESTER III			
Course Code	Title	Credits	Hours
USMB-301	Biomolecules and Microbial taxonomy	2 credits	30
Unit-I	Estimation of Biomolecules		10
Unit-II	Nucleic acid structure and chemistry		10
Unit-III	Microbial taxonomy		10
USMB-302	Environmental Microbiology	2 credits	30
Unit-I	Air Microbiology		10
Unit-II	Fresh Water and Sewage Microbiology		10
Unit-III	Soil and Geo Microbiology		10
USMB-303	Introduction to Clinical Microbiology	2 credits	30
Unit-I	Basic Microbiology		10
Unit-II	Common infectious diseases, Epidemiology and Public health awareness		10
Unit-III	Control of Microorganisms & Safety in Clinical Microbiology		10
USMB-304	PRACTICALS	2 credits	60
	Practical's based USMB-301, USMB-302 and USMB-303		

Syllabus for S. Y. B. Sc. Microbiology Semester III

Name of the Course	Biomolecules and Microbial taxonomy
Course Code	USMB301
Class	S.Y.B.Sc.
Semester	III
No of Credits	02
Nature	Theory
Type	Major subject
Highlight revision specific to employability/ entrepreneurship/ skill development	The course inculcate the knowledge and skills like estimation of proteins, amino acids, carbohydrates, lipids and nucleic acids which is applicable in microbiological and analytical industries. Understanding of nucleic acid structure and chemistry is very important in fields like drug discovery, genomics etc. Apart from this the knowledge of microbial taxonomy, genetic analysis, phylogenetic analysis and genome sequencing will be helpful for higher studies as well as for getting jobs in fields like molecular microbiology, biotechnology and genetics.

Nomenclature: Biomolecules and Microbial taxonomy

Course Outcomes:

At the end of the course students will be able

1. To understand and perform estimation of proteins, carbohydrates, lipids and nucleic acids.
2. To know nucleic acid structure and chemistry.
3. To explain microbial identification systems.

Curriculum:

USMB301 - Biomolecules and Microbial taxonomy			
Unit	Title	Learning Points	No of Lectures
1	Estimation Of Biomolecules	1a. Macromolecular composition of a microbial cell. 1b. Estimation of Proteins and amino acids Proteins by Biuret method (Direct and indirect) Amino acids by Ninhydrin method 1c. Estimation of Carbohydrates. Total carbohydrates by Anthrone method Reducing Sugars (maltose) by DNSA method 1d. Estimation of Nucleic acids General principles and extraction of nucleic acids DNA by DP method RNA by Orcinol method	10
2	Nucleic acid structure and chemistry	2a. Nucleic Acid Structure DNA stores genetic information DNA molecules have distinctive base composition DNA is a double helix DNA can occur in different 3D forms DNA sequences adopt unusual structures Many RNAs complex 3D structures 2b. Nucleic acid chemistry Denaturation of double helical DNA and RNA Nucleic acid from different species can form hybrids DNA methylation 2c. Structures of chromosomes of eukaryotic cell	10
3	Microbial Taxonomy	3a. Introduction to microbial taxonomy Systems of classification (Cavalier Smith 6 kingdom) Bergey's manual The three domain concept based on phylogeny Nomenclature 3b. Methods of analysis used in classification: Phenotypic analysis (Morphological characteristics, Physiological and metabolic characteristics, Biochemical characteristics, Ecological characteristics) 3c. Genetic analysis: DNA-DNA hybridization DNA Profiling G+C ratio 3d. Amino acid sequencing 3e. Phylogenetic analysis: Nucleic Acid sequencing Multilocus gene sequence analysis	10

Learning Resources recommended:

1. Methods in Microbiology, Vol.5B, Ed. Norris & Ribbon, Academic Press
2. A handbook book of Organic analysis: qualitative and quantitative 4th edition, Hans Thacher Clarke, CBS publishers & distributors, New Delhi.
3. Laboratory Manual in Biochemistry, J. Jayaraman, (2003) New Age International 11 Publishers
4. Lehninger: Principles of Biochemistry, 4th Ed., D. Nelson & M. Cox, W.H.Freeman & Co., (LPE)
5. Prescott's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, (2011) 8th edition, McGraw-Hill International edition
6. Prescott, Harley and Klein's Microbiology, Willey, Sherwood, Woolverton (2008) 7th edition, McGraw-Hill International edition
7. Brock Biology of Microorganisms, Madigan, Martinko, Dunlap and Clark (2009) 12th edition, Pearson Education
8. Peter J. Russell (2006), "Genetics-A molecular approach", 2nd ed. 2

Teaching Plan

Unit No.	Unit Title	Teaching Methods	No. of Lectures
I	Estimation Of Biomolecules	Chalk & Board, ICT	10
II	Nucleic acid structure and chemistry	Chalk & Board, ICT	10
III	Microbial Taxonomy	Chalk & Board, ICT	10

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance & Class performance	05
Total	20

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		30

Name of the Course	Environmental Microbiology
Course Code	USMB302
Class	S.Y.B.Sc.
Semester	III
No of Credits	02
Nature	Theory
Type	Major subject
Highlight revision specific to employability/ entrepreneurship/ skill development	<p>The course will be primarily oriented towards imparting skills and knowledge on environmental microbiology. Air, Water and Soil sampling, sample preparation, processing and analysis. The course aims at providing hands on training on various instrumental methods according to specified protocols.</p> <p>Students will improve skills in handling microorganisms and studying their morphological, physiological and biochemical characteristics. The expertise in analysis of air, water and soil samples will be beneficial to students to get placed in pollution control board, water testing agency and environmental monitoring industries. Skills like understanding of sewage treatment processes and soil bioremediation are useful for industries related to waste water treatment and bioremediation.</p>

Nomenclature: Environmental Microbiology

Course Outcomes:

At the end of the course students will be able

1. To understand the aeromicrobiology and its implications in human life.
2. To understand microbiology of water and explain modern waste water treatment.
3. To explain the role of soil microorganisms in bioremediation and biogeochemical cycles and its impact on environment.

Curriculum:

USMB302 - Environmental Microbiology			
Unit	Title	Learning Points	No of Lectures
1	Air Microbiology	<p>1a. Aeromicrobiology: Important airborne pathogens and toxins, Aerosols, nature of bioaerosols, aeromicrobiological pathway, microbial survival in the air, extramural aeromicrobiology, intramural aeromicrobiology</p> <p>1b. Sampling Devices for the Collection of Air Samples, Detection of microorganisms on fomites</p> <p>1c. Air Sanitation</p>	10
2	Fresh Water and Sewage Microbiology	<p>2a. Fresh water environments and micro-organisms found in Springs, rivers and streams, Lakes, marshes and bogs</p> <p>2b. Potable water: Definition, water purification, water quality standards and pathogens transmitted through water</p> <p>2c. Microbiological analysis of water: Indicator organisms and their detection in water Total Coliforms, Fecal Coliforms and <i>E. coli</i></p> <p>2d. Modern Waste Water treatment: Primary, Secondary and Tertiary Treatment.</p> <p>2e. The nature of wastewater and Monitoring of waste water treatment processes (BOD,COD)</p> <p>2f. Removal of Pathogens by Sewage treatment Processes</p>	10
3	Soil and Geo Microbiology	<p>3a. Terrestrial Environment Soil- Definition, Composition, function, Textural triangle, Types of soil microorganisms and their activities</p> <p>3b. Methods of studying soil microorganisms: Sampling, Cultural methods, Physiological methods, Radioisotope techniques</p> <p>3c. Biogeochemical Cycles: Carbon cycle, Nitrogen cycle, Sulphur cycle, Phosphorus Cycle, Iron cycle</p> <p>3d. Soil Bioremediation</p>	10

Learning Resources recommended:

1. Environmental Microbiology, 2nd Edition; Raina M. Maier, Ian L. Pepper, Charles P. Gerba, 2010 Academic Press
2. Fundamental Principles of Bacteriology, 7th Edition; A.J. Salle, Tata McGraw Hill Publishing Company
3. Air Quality Standards- NAAQS Manual, Volume I
4. Prescott's Microbiology, 8th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, 2011, McGraw Hill International Edition
5. Fundamentals of Microbiology, 9th Edition, Frobisher, Hinsdill, Crabtree, Goodheart, 1974, Saunders College Publishing
6. Introduction to Environmental Microbiology – Barbara Kolwzan, Waldemar Adamiak (E Book)
7. Soil Microbiology-4th Edition, N.S Subba Rao, 2000, Oxford and IBH Publishing Co. Pvt Ltd

Teaching Plan

Unit No.	Unit Title	Teaching Methods	No. of Lectures
I	Air Microbiology	Chalk & Board, ICT	10
II	Fresh Water and Sewage Microbiology	Chalk & Board, ICT	10
III	Soil and Geo Microbiology	Chalk & Board, ICT	10

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance & Class performance	05
Total	20

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		30

Name of the Course	Introduction to Clinical Microbiology
Course Code	USMB303
Class	S.Y.B.Sc.
Semester	III
No of Credits	02
Nature	Theory
Type	Major subject
Highlight revision specific to employability/ entrepreneurship/ skill development	<p>The course gives knowledge and skill required for becoming a competent medical clinical laboratory scientist through lectures and hands on work experience.</p> <p>The course will train the students in all sections of clinical laboratory to the point of being able to do the job independently in hospitals and pathology laboratories.</p> <p>Typical tasks of this course will include identifying fungal, parasitic, viral and bacterial infections. Testing the strength and virulence of microbes. Using a variety of biochemical and molecular methods to determine organisms that cause infection. Undertaking work aimed at helping to prevent the spread of infections within hospitals.</p> <p>Safety in clinical microbiology and control of microorganisms is important task in order to prevent the spread of infection. The knowledge about common infectious diseases, epidemiology and public health awareness along with safety in clinical microbiology enhance the employability in medical, paramedical and diagnostic industries.</p>

Nomenclature: Introduction to Clinical Microbiology

Course Outcomes:

At the end of the course students will be able

1. To know physiology of bacteria and their cultivation methods.
2. To explain different infectious diseases and their epidemiology.
3. To know and apply knowledge of sterilization and disinfection in clinical microbiology.

Curriculum:

USMB303 - Introduction to Clinical Microbiology			
Unit	Title	Learning Points	No of Lectures
1	Basic Microbiology	1a. Microbial World & you: Microbes in our lives Types of Microorganisms 1b. Morphology and Physiology of Bacteria: Microscopy Staining - monochrome, differential and cytological Shape of Bacteria Bacterial Anatomy- Structure &function Growth and Multiplication of Bacteria Bacterial Growth Curve 1c. Culture Methods Methods of Isolating Pure Cultures Anaerobic Culture Methods (Anaerobic blood agar, Cooked meat media, Thioglycollate medium) 1d. Culture Media and Bacterial Growth Types of Media and examples of media like Nutrient agar, Sabouraud's agar, MacConkeys agar Study of morphological & cultural characteristics.	10
2	Common infectious diseases, Epidemiology and public health awareness	2a. Skin Infections: Study of structure and functions of skin Study of skin infections caused by Pseudomonas, Acne & Measles 2b. Infections of Nervous system Study of structure and functions of nervous system Study of Rabies 2c. Infections of Respiratory systems Study of structure and function of respiratory system Study of pharyngitis, laryngitis, Sinusitis, Diphtheria 2d. Infections of Digestive systems Study of structure and function of digestive system Study of typhoid fever, Hepatitis A 2e. The Epidemiology of Infectious Diseases and Their Control Epidemiological terminology: Epidemiology, sporadic diseases, endemic diseases, hyper endemic diseases, epidemic diseases, Index Case, Pandemic Disease, Outbreak 2f. Transmission of Disease- Contact transmission, Vehicle Transmission and vectors 2g. Public Health Measures for Control of Disease: Control directed against reservoir, Transmission of	10

		the pathogens	
3	Control of Microorganisms & Safety in Clinical Microbiology	<p>3a. Sterilization and disinfection</p> <p>Methods of sterilization:</p> <p>Dry heat: Hot air sterilizers</p> <p>Moist heat: Steaming at 100°C, Autoclave.</p> <p>Gas Sterilization: Ethylene oxide sterilizer, Gasplasma</p> <p>Sterilizing filters</p> <p>Sterilization by radiation</p> <p>3b. Disinfectants:</p> <p>Disinfection of surfaces and spillages</p> <p>Disinfection of safety cabinets</p> <p>Discard jars</p> <p>Disinfection of rooms</p> <p>Disinfection of skin</p> <p>Testing of disinfectants</p> <p>3c. Safety in Clinical Microbiology</p> <p>Chemical safety</p> <p>Fire safety</p> <p>Electrical safety</p> <p>Handling of compressed gases</p> <p>Exposure control plan</p> <p>Employee education and orientation</p> <p>Disposal of hazardous waste</p> <p>Standard precautions</p>	10

Learning Resources recommended:

1. Microbiology, An Introduction by Tortora, Funke & Case 9th and 11th edition, Pearson education.
2. Bailey and Scott's Diagnostic Microbiology, 11th edition Publ: Mosby
3. Anantnarayan & Paniker's Textbook of Microbiology, 8th Ed.
4. Mackie and McCartney Practical medical microbiology 14th edition.
5. Brock biology of microorganism by Michael T Madigan. & John M Martinco.

Teaching Plan

Unit No.	Unit Title	Teaching Methods	No. of Lectures
I	Basic Microbiology	Chalk & Board, ICT	10
II	Common infectious diseases, Epidemiology and public health awareness	Chalk & Board, ICT	10
III	Control of Microorganisms & Safety in Clinical Microbiology	Chalk & Board, ICT	10

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance & Class performance	05
Total	20

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		30

Name of the Course	Microbiology Practical
Course Code	USMB304
Class	S. Y. B. Sc.
Semester	III
No of Credits	02
Nature	Practical
Type	Major subject
Highlight revision specific to employability/ entrepreneurship/ skill development	<p>The course inculcate the knowledge and skills like estimation of proteins, amino acids, carbohydrates, lipids and nucleic acids which is applicable in microbiological and analytical industries. Understanding of nucleic acid structure and chemistry is very important in fields like drug discovery, genomics etc.</p> <p>The course will be primarily oriented towards imparting skills and knowledge on environmental microbiology. Air, Water and Soil sampling, sample preparation, processing and analysis. The course aims at providing hands on training on various instrumental methods according to specified protocols.</p> <p>Students will improve skills in handling microorganisms and studying their morphological, physiological and biochemical characteristics. The expertise in analysis of air, water and soil samples will be beneficial to students to get placed in pollution control board, water testing agency and environmental monitoring industries.</p> <p>The course gives knowledge and skill required for becoming a competent medical clinical laboratory scientist through lectures and hands on work experience.</p> <p>The course will train the students in all sections of clinical laboratory to the point of being able to do the job independently in hospitals and pathology laboratories.</p> <p>Typical tasks of this course will include identifying fungal, parasitic, viral and bacterial infections. Using a variety of biochemical and molecular methods to determine organisms that cause infection. Undertaking work aimed at helping to prevent the spread of infections within hospitals.</p> <p>The knowledge about common infectious diseases, epidemiology and public health awareness along with safety in clinical microbiology enhance the employability in medical, paramedical and diagnostic industries.</p>

Nomenclature: Microbiology practical

Course Outcomes:

At the end of the course learner will be able

1. To estimate various biomolecules such as protein, lipid, carbohydrate, nucleic acids.
2. To perform routine analysis of water and waste water.
3. To understand and perform laboratory techniques related to clinical microbiology.

Curriculum:

USMB304 - Microbiology Practical			
Paper	Title	Learning Points	No of hours
1	Biomolecules and Microbial taxonomy	<ol style="list-style-type: none">1. Estimation of total sugar by Anthrone method2. Estimation of reducing sugar by DNSA method3. Estimation of protein Biuret method (indirect and direct)4. Isolation and detection of DNA from onion5. Estimation of DNA by DPA method6. Estimation of RNA by Orcinol method	20
2	Environmental Microbiology	<ol style="list-style-type: none">1. Standard Plate Count of water2. Waste water analysis:<ol style="list-style-type: none">a. Study of microbial flora in raw and treated sewageb. Determination of total solids in wastewaterc. Determination of BOD and COD of wastewater3. Total viable count of soil microflora4. Isolation of bacteria, Actinomycetes and fungi from soil5. Enrichment and isolation of, Cellulose degraders and Phosphate solubilisers from soil.	20
3	Introduction to Clinical Microbiology	<ol style="list-style-type: none">1. To study the growth of yeast on the Sabouraud agar2. To study the growth of lactose fermentor and nonlactose fermentors on the MacConkey's agar3. Isolation of <i>Pseudomonas</i>, <i>Escherichia coli</i> and <i>S. typhi</i>4. AST-Kirby method5. Effect of UV.	20

Teaching Plan

Unit No.	Unit Title	Teaching Methods	No. of Lectures
I, II and III	USMB304 - Microbiology Practical	Experiment	60

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Journal	15
Viva	15
Class performance	10
Total	40

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
3	20
4	10
Total	60

Note: As practical curriculum is for **2 credits** the internal marks obtained out of 40 will be converted to **out of 20**. Similarly, marks obtained in semester end practical exam marks out of 60 will be converted to **out of 30**.

Syllabus for S. Y. B. Sc. Microbiology [Since 2024-25] as per NEP

SEMESTER IV			
Course Code	Title	Credits	Lectures
USMB-401	Metabolism & Basic Analytical Techniques	2 credits	30
Unit-I	Introduction to Metabolism & Bioenergetics		10
Unit-II	Enzyme Kinetics		10
Unit-III	Analytical techniques		10
USMB-402	Applied Microbiology	2 credits	30
Unit-I	Host defense and public health (Epidemiology of infectious diseases)		10
Unit-II	Food Microbiology		10
Unit-III	Dairy Microbiology		10
USMB-403	Fermented Foods, Food Sanitation and Microbial Ecology	2 credits	30
Unit-I	Fermented foods		10
Unit-II	Food sanitation		10
Unit-III	Microbial evolution and ecology		10
USMB-404	PRACTICALS	2 credits	60
	Practical's based USMB-401, USMB-402 and USMB-403		

Syllabus for S. Y. B. Sc. Microbiology Semester IV

Name of the Course	Metabolism & Basic Analytical Techniques
Course Code	USMB401
Class	S. Y. B. Sc.
Semester	IV
No of Credits	02
Nature	Theory
Type	Major subject
Highlight revision specific to employability/ entrepreneurship/ skill development	This course introduces students to metabolism: the collection of chemical processes by which the cells drive energy from their surroundings and use this energy to make the building blocks of life. The major metabolic pathways involved in the synthesis and breakdown of important biological molecules are explored, along with the mechanisms of regulating these pathways in the body. The skills developed during the course are paper chromatography, thin layer chromatography, HPTLC, column chromatography, preparative centrifugation, analytical centrifugation and electrophoresis. These skills will enhance the employability of students in various industries- pharmaceutical, chemical and cosmetic industries.

Nomenclature: Metabolism & Basic Analytical Techniques

Course Outcomes:

At the end of the course students will be able

1. To understand metabolic pathways and thermodynamics of life.
2. To explain properties of enzymes and enzyme kinetics.
3. To learn instrumentation and analytical techniques, this will help them in their professional career.

Curriculum:

USMB401 - Metabolism & Basic Analytical Techniques			
Unit	Title	Learning Points	No of Lectures
1	Introduction To Metabolism & Bioenergetics	1a. Introduction to metabolism, Metabolic pathways 1b. Organic reaction mechanism 1c. Experimental approaches to study metabolism 1d. Thermodynamics of Phosphate compounds 1e. Oxidation-reduction reactions	10
2	Enzyme Kinetics	2a. Introduction of Enzymes: General properties of enzymes, How do enzymes accelerate reaction Rate Law for a simple catalyzed reaction, Michaelis-Menten equation and its derivation Lineweaver Burke plot. Classification of enzymes 2b. Overview of Coenzyme: Coenzymes: Different types and reactions catalyzed by coenzymes (in tabular form) 2c. Enzyme Kinetics: Saturation kinetics Effect of temperature and pH Effect of Inhibitors- Reversible and irreversible, competitive, Non competitive and uncompetitive inhibitors	10
3	Analytical techniques	3a. Chromatography Introduction to chromatography, types of chromatography Paper chromatography: Principle, circular, ascending and descending Paper Chromatography. Thin layer chromatography: principle, preparation of TLC plates, procedure for TLC, HPTLC-Separation of amino acids and sugars by TLC. Column chromatography: Introduction & principle Exclusion chromatography 3b. Centrifugation Introduction: basic principles of sedimentation Types, care and safety aspects of centrifuges, types of rotors, care and maintenance, safety & centrifugation 3c. Electrophoresis General principles, support media – agarose gels, polyacrylamide gels	10

Learning Resources recommended:

1. Principles of Biochemistry- G. Zubay, W.W. Parson, D.E.Vance. C.Brown Publishers
2. Fundamentals of Biochemistry. D. Voet and J. Voet Publisher Wiley plus Edition 5th.
3. Lehninger- Principles of Biochemistry- David Nelson, Michael Cox. 4th edition W.H. Freeman &Company[Low price edition- for sale in India, Pakistan, Sri Lanka, Bangladesh, Nepal & Bhutan]
4. Instrumental Methods of chemical analysis, V.K. Ahluwalia,Ane Books Pvt.Ltd; 2015.
5. Principles & techniques of Biochemistry &Mol biology 6th ed, Keith Wilson & John Walker, Cambridge University press, 2006
6. Laboratory manual in Biochemistry- J. Jayaraman

Teaching Plan

Unit No.	Unit Title	Teaching Methods	No. of Lectures
I	Introduction To Metabolism & Bioenergetics	Chalk & Board, ICT	10
II	Enzyme Kinetics	Chalk & Board, ICT	10
III	Analytical techniques	Chalk & Board, ICT	10

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance &Class performance	05
Total	20

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		30

Name of the Course	Applied Microbiology
Course Code	USMB402
Class	S. Y. B. Sc.
Semester	IV
No of Credits	02
Nature	Theory
Type	Major Subject
Highlight revision specific to employability/ entrepreneurship/ skill development	The course will train the students conducting microbiological analyses on samples collected from food processing facilities to determine potential causes of contamination. Students will be able to consult food manufacturers to determine the bacteria that may present in their food product and the microorganisms may affect the product's shelf life. During the course the student will understand and practices different types of tests of milk and practice to test microbiological quality of milk by MBRT and SFC test. The skills related to public health & epidemiology of infectious diseases will be useful in diagnostic & medical microbiology industries. Understanding of food microbiology, food spoilage, principles of food preservation microbial examinations of foods and dairy microbiology is required to work in food processing and dairy industries.

Nomenclature: Applied Microbiology

Course Outcomes:

At the end of the course students will be able

1. To understand immune system components and their role in control of infection.
2. To understand and apply basic knowledge of food microbiology, food preservation, food analysis and food safety.
3. To analyze quality of milk and milk product

Curriculum:

USMB402 - Applied Microbiology			
Unit	Title	Learning Points	No of Hours
1	Host defense and public health (Epidemiology of infectious diseases)	1a. Classification of immune system (innate immunity & acquired immunity) 1b. Physical barriers in nonspecific innate resistance revision. Chemical barriers (Complement: principle & significance (no pathway), Cytokines: interferon, antimicrobial peptides, bacteriocins 1c. Cells of Immune system: Haematopoiesis, lymphocytes, monocytes & macrophages, granulocytes, mast cells, dendritic cells & NK cells 1d. Phagocytosis & Inflammation 1e. Tools of epidemiology, recognition of an infectious disease in a population. 1f.. Nosocomial infections: Microorganism in hospital, compromised host.	10
2	Food Microbiology	2a. Introduction, Food as a substrate for microorganism a. pH, aw, O-R potential b. Nutrient Content 2b. Food Control Enforcement & Control Agency: International agencies, Federal agencies (FDA, USDA), FSSAI[website], Introduction to HACCP 2c. Important Microorganisms in Food Microbiology: Food-borne Illness associated Microorganisms: Classification of Food-borne diseases (Schematic). Bacteria responsible for food -borne intoxication and infections-overview/tabulation. Examples of nonbacterial food-borne pathogens Details of: a) Staphylococcus food intoxication (organism, enterotoxin, incidence, foods involved, prevention of outbreaks) 2d. Food Spoilage, General Principles of spoilage of: a. Fruits and vegetables b. Meat (including spoilage under aerobic & anaerobic conditions- exclude spoilage of different kinds of meats) c. Canned foods 2e. General Principles of Food Preservation: a. Preservation using High temperature : TDT, principle of canning b. Low temperature c. Drying d. Food preservatives (organic acids & their salts, Sugar & salt) e. Ionizing radiations 2f. Methods of microbial examination of foods: a. Homogenization of food samples	10

		b. Methods- SPC, surface examination-swab rinse & contact plate methods.	
3	Dairy Microbiology	3a. Raw and fluid milk products Pasteurization & Ultra-pasteurization 3b. Concentrated and dry milk, whey 3c. Microbiology of butter 3d. Fermented milk: Yogurt, cultured buttermilk and fermented milk in India 3e. Cheese: Cheddar, Cottage 3f. Microbiological Quality of Milk & Milk Products: SPC, coliform count, LPC, RPT (RRT, MBRT, DMC)	10

Learning Resources recommended:

1. Prescott, Harley Klein. McGraw international edition, 7th Ed
2. Anantnarayan & Paniker's ed 8th. University press
3. Food Microbiology by Frazier 5th ed
4. Modern Food Microbiology by James Jay 6th ed
5. Applied Dairy Microbiology by Martha & Steele
6. BIS standards, FSSAI
7. Outlines of Biochemistry. E.E. Conn & P.K. Stumpf, G. Bruening, R.N. 5th Edition, John Wiley and sons

Teaching Plan

Unit No.	Unit Title	Teaching Methods	No. of Lectures
I	Host defense and public health.	Chalk & Board, ICT	10
II	Food Microbiology	Chalk & Board, ICT	10
III	Dairy Microbiology	Chalk & Board, ICT	10

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance & Class performance	05
Total	20

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		30

Name of the Course	Fermented Foods, Food Sanitation and Microbial Ecology
Course Code	USMB403
Class	S. Y. B. Sc.
Semester	IV
No of Credits	02
Nature	Theory
Type	Major Subject
Highlight revision specific to employability/ entrepreneurship/ skill development	The course will guide the students to study the harmful organisms to understand how to prevent their growth in food. It may also be useful in work in technologies and innovations to enhance food safety for human consumption. The course typically aims to understand the use of microorganisms in fermented foods. These microbiologists may work in quality control & quality assurance industries or product development for food manufacturers, research institutes or the government bodies. The course encompasses skills required for jobs like sanitary inspector, food inspectors etc.

Nomenclature: Fermented Foods, Food Sanitation and Microbial Ecology

Course Outcomes:

At the end of the course students will be able

1. To explain food fermentation techniques and microbiology of fermented food
2. To know and apply food sanitation and hygiene measures.
3. To understand how life has evolved on earth.

Curriculum:

USMB403 - Fermented Foods, Food Sanitation and Microbial Ecology			
Unit	Title	Learning Points	No of Lectures
1	Fermented Foods	1a. Microorganisms used in food fermentations: yeasts, molds and lactic acid bacteria 1b. Microbiology of fermented food: cheese, butter, yogurt, soy products, tea, coffee and cocoa 1c. Fermented beverages: beer, wine 1d. Food ingredients of microbial origin: SCP, amino acids, vitamins, colors, nutraceuticals and flavors	10
2	Food Sanitation	2a. Food Sanitation & Hygiene: Water, potable water, Sources of contamination of water, treatment of water, pesticide residue 2b. Food, Food Handling, Food contamination, equipment, Control of insects & Rodents, Practical rules for good sanitation. 2c. Food borne diseases 2d. Toxins from plants, toxins from animals, Mycotoxins, Toxic Agricultural Residues, Poisoning by chemicals, Food poisoning by bacteria, Food infections 2.e Food adulteration	10
3	Microbial evolution and ecology	3a. Microbial evolution: formation and early history of earth, origin of cellular life, microbial diversification, endosymbiotic origin of eukaryotes 3b. Microbial ecosystems: Principles of Microbialecolgy, the microbial habitats, fresh water,soil and plant microbial ecosystems, marine microbial ecosystems	10

Learning Resources recommended:

1. Fundamental Food Microbiology by Bibek Ray, ArunBhunia (2007),4th edition CRC Press
2. Food Microbiology – An Introduction by Montville and Mathews,(2008), ASM Press
3. Industrial Microbiology by Waites and Morgan, Blackwell Science
4. Modern Industrial Microbiology and Biotechnology by NdukaOkafor, (2007), Science Publishers.

5. Food Science by Sumati R. Mudambi, Shalini Rao, M.V. Rajagopal, revised 2nd edition, (2006), New Age international publications.
6. Prescott's Microbiology by J.M. Willey, L.M. Sherwood, C.J. Woolverton, (2011) 8th edition, McGraw-Hill International edition
7. Prescott, Harley and Klein's Microbiology by Willey, Sherwood, Woolverton, (2008) 7th edition, McGraw-Hill International edition
8. Brock Biology of Microorganisms by Madigan, Martinko, Dunlap and Clark (2009) 12th edition, Pearson Education.

Teaching Plan

Unit No.	Unit Title	Teaching Methods	No. of Lectures
I	Fermented Foods	Chalk & Board, ICT	10
II	Food Sanitation	Chalk & Board, ICT	10
III	Microbial evolution and ecology	Chalk & Board, ICT	10

Evaluation Pattern

A. Internal Evaluation

Method	Marks
Class Test	10
Assignment	05
Attendance & Class performance	05
Total	20

B. Semester End Evaluation (Paper Pattern)

Question No	Unit	Marks
1	Unit 1	10
2	Unit 2	10
3	Unit 3	10
Total		30

Name of the Course	Microbiology Practical
Course Code	USMB404
Class	S. Y. B. Sc.
Semester	IV
No of Credits	02
Nature	Practical
Type	Major Subject
Highlight revision specific to employability/ entrepreneurship/ skill development	<p>This course introduces students to metabolism: the collection of chemical processes by which the cells drive energy from their surroundings and use this energy to make the building blocks of life. The major metabolic pathways involved in the synthesis and breakdown of important biological molecules are explored, along with the mechanisms of regulating these pathways in the body. The skills developed during the course are paper chromatography and electrophoresis.</p> <p>The course will train the students conducting microbiological analyses on samples collected from food processing facilities to determine potential causes of contamination. During the course the student will understand and practices different types of tests of milk and practice to test microbiological quality of milk by MBRT and SFC test. The skills related to public health & epidemiology of infectious diseases will be useful in diagnostic & medical microbiology industries.</p> <p>It may also be useful in work in technologies and innovations to enhance food safety for human consumption. The course typically aims to understand the use of microorganisms in fermented foods. These microbiologists may work in quality control & quality assurance industries or product development for food manufacturers, research institutes or the government bodies. The course encompasses skills required for jobs like sanitary inspector, food inspectors etc.</p>

Nomenclature: Microbiology Practical

Course Outcomes:

At the end of the course learner will be able

1. To perform practical of enzymology
2. To perform techniques related to food and dairy microbiology.
3. To prepare and analyze fermented food.

Curriculum:

Paper	Title	Learning Points	No of Hours
1	Metabolism & Basic Analytical Techniques	<ol style="list-style-type: none">1. Isolation of amylase, protease, lipase producers.2. Effect of pH on activity of invertase3. Effect on temperature on activity of invertase.4. Effect of substrate concentration on activity of invertase.5. Separation and identification of amino acids and sugars by ascending paper chromatography.6. Electrophoresis	20
2	Applied Microbiology	<ol style="list-style-type: none">1. Isolation of organism from fomites.2. Determination of TDT and TDP3. Determination of Salt and sugar tolerance4. Determination of MIC of a Chemical preservative.5. RPT of Milk– RRT, MBRT, DMC (Demo).6. Microbiological Quality Control of Milk as per BIS/FSSSAI (Group experiment)	20
3	Fermented Foods, Food Sanitation and Microbial Ecology	<ol style="list-style-type: none">1. Wine and Bread making2. Isolation of lactic acid bacteria from fermented food-e.g. Idli, curd.3. Isolation of <i>Staphylococcus aureus</i> from sweets and demonstrating its virulence.4. Food adulteration	20

Teaching Plan

Unit No.	Unit Title	Teaching Methods	No. of Lectures
I, II and III	USMB404 - Microbiology Practical	Experiment	60

Evaluation Pattern.

A. Internal Evaluation

Method	Marks
Journal	15
Viva	15
Class performance	10
Total	40

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
3	20
4	10
Total	60

Note: As practical curriculum is for **2 credits** the internal marks obtained out of 40 will be converted to **out of 20**. Similarly, marks obtained in semester end practical exam marks out of 60 will be converted to **out of 30**.



Chairperson,
(Dr. Nitin Potdar)
BoS, Microbiology



**R.P. Gogate College of Arts & Science
and R.V. Jogalekar College of
Commerce (Autonomous), Ratnagiri.**

**Skill Enhancement Course
[SEC]**

S.Y.B.Sc. [Sem-III & IV]

Course Structure

**Under Choice Based Credit System
(CBCS)**

**To be implemented from Academic
Year- 2024-2025**

Syllabus for **Skill Enhancement Course [SEC]** from the year 2024-25

Name of the Course	Microbiology skills - I
Course Code	USMB307
Class	S.Y.B.Sc.
Semester	III
No of Credits	2
Nature	Practical
Type	Skill enhancement course (SEC)
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	<p>Students will improve the skills in handling microorganisms and studying their morphological, physiological and biochemical characteristics.</p> <p>Using a variety of biochemical and molecular methods to determine organisms that cause infection. The students will acquire the important knowledge related to standard laboratory practices. The course will be primarily oriented towards imparting skills and knowledge on not only on basics but also covers the applied microbiology. The course aims at providing a hands on training on various instrumental methods according to specified protocols.</p>

Nomenclature: Microbiology skills - I

Course Outcomes:

- CO1- The learner will acquire the practical skills of laboratory based on the tests like blood grouping, Coombs test etc.
- CO2- The student will gain the knowledge in processing of blood samples with regard to check blood group.
- CO3- The learner will know the concept of fermentation test and its use in identification of microorganisms.
- CO4- The student shall improve the skills in staining as well as in aseptic handling of inoculum.

Curriculum:

Title	Learning Points	No of credits
Basic and skill Microbiology	<ol style="list-style-type: none">1. Method of preparation and sterilization of glassware and other material2. Disinfection and discarding techniques in the laboratory.3. Study of different parts of a compound Microscope.4. Monochrome staining of bacterial smear.5. Gram staining6. Isolation of gram positive and gram negative bacteria on selective media.7. Sugar fermentation test8. IMViC tests9. ELISA (Demonstration)10. Isolation of plasmid (Demonstration)11. Restriction digestion (Demonstration)12. Direct blood grouping13. Coombs test.14. Ubiquity of fungi in environment.15. Determination of MIC of a chemical disinfectant.	02

Learning Resources recommended:

Text books:

1. Jawetz, Melnick and Adelberg's Medical Microbiology, 26th Edition, Lange publication
2. Ananthanarayan and Panicker's, Textbook of Microbiology, 10th edition
3. Laboratory manual of Microbiology and biotechnology by K. R. Aneja, 2nd edition.

Reference books:

1. Brock Biology of Microorganisms, Madigan, Martinko, Dunlap and Clark (2009) 12th edition, Pearson Education
2. Peter J. Russell (2006), "Genetics-A molecular approach", 2nd ed. 2

Teaching Plan

Unit Title	Teaching Methods	No. of Lectures
USMB307 - Microbiology Skills - I	Experiment	60

Evaluation Pattern.

A. Internal Evaluation

Method	Marks
Journal	15
Viva	15
Class performance	10
Total	40

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
3	20
4	10
Total	60

Note: As practical curriculum is for **2 credits** the internal marks obtained out of 40 will be converted to **out of 20**. Similarly, marks obtained in semester end practical exam marks out of 60 will be converted to **out of 30**.

Syllabus for (S.Y.B.Sc.) Autonomous from the year 2024-25

Name of the Course	Microbiology skills - II
Course Code	USMB407
Class	S.Y.B.Sc.
Semester	IV
No of Credits	2
Nature	Practical
Type	Skill enhancement course (SEC)
Highlight revision specific to employability/ entrepreneurship/ skill development (if any) 100 words	Students will improve the skills in handling microorganisms and studying their morphological, physiological and biochemical characteristics. Using a variety of biochemical and molecular methods to determine organisms that cause infection. The students will acquire the important knowledge related to standard laboratory practices. The course will be primarily oriented towards imparting skills and knowledge on not only on basics but also covers the applied microbiology. The course aims at providing a hands on training on various instrumental methods according to specified protocols.

Nomenclature: Microbiology skills - II

Course Outcomes:

- CO1- The learner will acquire the practical skills of laboratory based on the tests like blood grouping, Coombs test etc.
- CO2- The student will gain the knowledge in processing of blood samples with regard to check blood group.
- CO3- The learner will know the concept of fermentation test and its use in identification of microorganisms.
- CO4- The student shall improve the skills in staining as well as in aseptic handling of inoculum.

Curriculum:

Title	Learning Points	No of credits
Basic and skill Microbiology	<ol style="list-style-type: none">1. Preparation of Microbiological Media.2. Preparation of solutions.3. Study of motility by Hanging drop technique.4. Study of Winogradsky's column (Demonstration).5. Study of biochemical tests – TSI agar test.6. Study of biochemical tests – Decarboxylase test.7. Evaluation of antimicrobial agents using E- Test.8. Study of Synergistic action.9. Effect of oxygen on microbial growth.10. Study of air microflora and determination of sedimentation rate.11. Detection of coliforms in water [MPN].12. Ubiquity of bacteria in environment.13. Enumeration of microorganisms in air and study of its load after fumigation14. Selective isolation of Staphylococcus & pseudomonas spp.15. Visit to a sewage treatment plant or water/purification plant.	02

Learning Resources recommended:**Text books:**

1. Ananthanarayan and Panicker's, Textbook of Microbiology, 10th edition
2. Laboratory manual of Microbiology and biotechnology by K. R. Aneja, 2nd edition.
3. Practical Microbiology by Dr. R.C. Dubey and Dr. D.K. Maheshwari

Reference books:

1. Brock Biology of Microorganisms, Madigan, Martinko, Dunlap and Clark (2009) 12th edition, Pearson Education
2. Essentials of Medical Microbiology by Apurba Sankar Satri and Sndhya Bhatt K.

Teaching Plan:

Unit Title	Teaching Methods	No. of Lectures
USMB407 - Microbiology Skills - II	Experiment	60

Evaluation Pattern.


A. Internal Evaluation

Method	Marks
Journal	15
Viva	15
Class performance	10
Total	40

B. Semester End Evaluation (Practical Exam)

Question No	Marks
1	20
2	10
3	20
4	10
Total	60

Note: As practical curriculum is for **2 credits** the internal marks obtained out of 40 will be converted to **out of 20**. Similarly, marks obtained in semester end practical exam marks out of 60 will be converted to **out of 30**.


Chairperson,
(Dr. Nitin Potdar)
BoS, Microbiology



**R.P. Gogate College of Arts & Science
and R.V. Jogalekar College of
Commerce (Autonomous), Ratnagiri.**

**Field Project / Community
Engagement Project
[FP/CEP]**

S.Y.B.Sc. [Sem- IV]

Course Structure

Under Choice Based Credit System (CBCS)

**To be implemented from Academic
Year- 2024-2025**

Field Project (FP)

Nomenclature of the Course	Field Project
Class	SYBSc
Semester	IV
Course Code	USMBF408 ([US (Subject)(F for Field project) 408])
No. of Credits	02
Nature	Project
Type	Elective Course

Course Outcomes:

After successful completion of this course the learner will be able to

- CO1: Enhance their ability to identify and address scientific problems or challenges using creative and analytical approaches.
- CO2: Acquire practical research skills, including literature review, experimental design, data collection, analysis and interpretation essential for pursuing further studies or careers in scientific research.
- CO3: Improve their scientific communication skills by writing comprehensive project reports, presenting their findings orally and effectively conveying complex scientific concepts to diverse audiences.
- CO4: Develop critical thinking skills by analyzing data, identifying patterns, and drawing evidence-based conclusions from their observations in the field.
- CO5: Enhance their employability by acquiring practical skills and experiences valued by employers in scientific fields, preparing them for future careers or further studies

Guidelines for Field Project

This course requires learners to participate in field based learning projects generally under the supervision of faculty.

Learner has to work 60 hours in a semester for Field Project.

20 hours for classroom activities

- Classroom activities include preparation for field activity, independent reading and study, analysis of data and preparation of report etc.

40 hours for Field work

- Field work includes implementation of the planned activities according to the programme schedule, collection of data
- Engagement activities may include events, workshops, meetings or door-to-door outreach.

A minimum of 4-6 weeks of summer work, either on college campus in activities related to conservation of environment / biodiversity or community-based work in the neighboring community (through NCC/NSS unit) or field level work with a recognized NGO or regional case studies programme at Villages may be undertaken as a part of Field projects.

In rare cases field visits may be included in the Field project. In such case, field visits need to be arranged meticulously so that there is a graded sequence and the submission is a compliance of all visits to make it a unified activity.

Evaluation Pattern

Continuous Internal Evaluation: Maximum Marks (20):

Method	Marks
Field Project Report	10
Viva-voce	10

Semester End Examination: Maximum Marks (30):

Method	Marks
Field work	15
Presentation	15

Community Engagement Project (CEP)

Nomenclature of the Course	Community Engagement and Service
Class	SYBSc
Semester	IV
Course Code	USMBC408
No. of Credits	02
Nature	Project
Type	Elective Course

Course Outcomes:

After successful completion of this course the learner will be able to

CO1: Contribute positively to the community by addressing local needs and challenges through science-based activities such as conservation of environment, promotion of good health and STEM education initiatives.

CO2: Develop a sense of social responsibility and civic engagement by actively participating in community-based projects and understanding the importance of giving back to society.

CO3: Gain interdisciplinary perspectives by applying scientific knowledge and skills to real-world issues, collaborating with individuals from diverse backgrounds, including community members, educators and professionals.

CO4: Reflect on their experiences, challenges and accomplishments which will contribute to their personal growth, self-awareness and resilience.

CO5: Enhance their employability and career readiness by gaining practical experience, networking opportunities and exposure to real-world applications of scientific knowledge.

CO6: Cultivate a lifelong commitment to community continuing to apply their scientific expertise and skills to address societal issues and contribute to positive change throughout their lives.

Guidelines for Community Engagement and Service (CEP)

This course requires learners to participate in field based learning /projects generally under the supervision of faculty. It will involve activities that expose learners to the socio-economic issues in the society.

Learner has to work 90 hours in a semester for Community Engagement and Service Project.

30 hours for classroom activities

- Classroom activities include preparation for community engagement and service, independent reading and study, analysis of data and preparation of report etc.

60 hours for Field work

- Field work includes implementation of the planned community engagement activities according to the programme schedule, collection of data
- Engagement activities may include events, workshops, meetings or door-to-door outreach.

Learners can participate in activities related to National Service Scheme (NCC), National Cadet Corps (NCC), Adult education / Literacy initiatives, Mentoring of school learners / Organization of Open Day/ Celebration of day on various national and international days like National Science Day, International day of women and Girls in Science etc

Evaluation Pattern

Continuous Internal Evaluation: Maximum Marks (20):

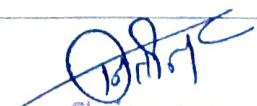
Method	Marks
CEP report	15
Active Participation	05

Semester End Examination: Maximum Marks (30):

Method	Marks
Field work Undertaking and completing community engagement and service	30

- Learners can participate in any one activity from the list given below.
- Learners should engage 90 / 60 Hours of work for CEP / FP respectively.

Sr. No.	Activities for Field Project and Community Engagement and Service
1	Host science talks or webinars open to the public on topics of scientific interest
2	Anti-Drug awareness campaign in an urban/ rural area
3	Engage community members in citizen science projects
4	Organize a science fair or exhibition
5	Aids awareness campaign in an urban/ rural area
6	Environment awareness campaign
7	Water Conservation Awareness program in an urban/ rural area
8	Design and execute a waste management initiative in an urban neighbourhood
9	Conduct surveys on access to clean water and sanitation facilities in both rural and urban settings
10	Conduct / participate in workshops or seminars to provide guidance and information about career opportunities in STEM fields
11	Organize science outreach workshops for local schools or community centres on various science topics
12	Create educational materials on environmental conservation and distribute them in schools and communities.
13	Conduct research projects on fruit processing and value added products.
14	Conduct research projects on fish industry and its impact on communities.
15	Conduct research projects on fruit industry and its impact on communities.
16	Organize events for building scientific temper
17	Implement initiatives to promote sustainable energy practices in rural environment.
18	Establish community-driven initiatives for disaster preparedness and response.
19	Organize community clean-up drives in both rural and urban areas.
20	Collaborate with local businesses to provide vocational training and job opportunities.
21	Conduct workshops on digital literacy and technology skills for community members.
22	Establish community-led initiatives for environmental conservation and biodiversity preservation.
23	Organize campaigns to promote responsible consumption and waste reduction.
24	Implement initiatives to address food insecurity and malnutrition in both settings.
25	Establish community-based initiatives for urban agriculture projects.
26	Organize capacity-building workshops for community-based environmental organizations.
27	Establish community-led initiatives for waste reduction and recycling.
28	Survey on quality and availability of water
29	Survey on quality of soil and soil fertility
30	Conduct research on the impact of pollution on marine ecosystem.
31	Conduct research projects on the environmental issues.
32	Conduct research on the impact of pollution on biodiversity.
33	Any other subjects of your choice and get it approved by the field project or CEP guide


 Chairperson,
 (Dr. Nitin Potdar)
 BoS, Microbiology