"Dissemination of Education for Knowledge, Science and Culture"

- Shikshanmaharshi Dr. Bapuji Salunkhe

Shri Swami Vivekanand Shikshan Sanstha's

VIVEKANAND COLLEGE, KOLHAPUR

(AUTONOMOUS)

DEPARTMENT OF MICROBIOLOGY

B.Sc. Part – I

Semester I & II

SYLLABUS

Under NEP 2020

To be implemented from Academic Year 2023-2024

B.Sc.–I (Sem -I and II) Microbiology

Course Structure

Old Course				New Course			
Sr.No	**Course Code**	**Title of Old Course**	**Credit**	**Course code**	**Title of New Course**	**Credit**	**% Change**
1	DSC 1010 A1	Introduction to microbiology and microbial diversity	2	DSC 03MIC11	Introduction to microbiology	2	20
2	DSC 1010 A2	Basic techniques in microbiology	2	DSC 03 MIC12	Bacteriology	2	20
3	DSC 1010 B1	Basic biochemistry and microbial nutrition	2	DSC 03 MIC21	Basic Biochemistry-I	2	25
4	DSC 1010 B2	Applied microbiology	2	DSC03 MIC 22	Microbial nutrition and techniques	2	20

Programme Specific Outcomes

Upon completion of B.Sc. Microbiology programme , student will be able to –

PSO1: Perform the basic techniques related to screening, isolation and cultivation of microorganism from various sources

PSO2: Understand microorganisms and their relationship with the environment

PSO3: Conduct the basic research with this microorganism and perform the diagnostic procedures required in food, milk and pharmaceutical industries**.**

PSO4: Follow the aseptic techniques and conduct the process of sterilization as well as perform the techniques to control the microorganism

PSO5: Produce and analyze the microbial product at laboratory level.

VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

Department of Microbiology

Teaching and Evaluation scheme

Three/Four- Years UG Program

Department/Subject Specific Core or Major (DSC)

First Year Semester- I&II

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-I										
1	DSC-I	DSC03MIC11	Introduction to microbiology	2	-	40	10	-	50	2
2	DSC-II	DSC03 MIC 12	Bacteriology	2	-	40	10	-	50	2
3	MIN-I	MIN03 MIC 11	Introduction to microbiology	2	-	40	10	-	50	2
4	MIN-II	MIN03 MIC 12	Bacteriology	2	-	40	10	-	50	2
5	OEC-I	OEC03 MIC 11	General Microbiology	2	-	40	10	-	50	2
6	OEC-II	OEC03 MIC 12	Techniques in Microbiology	2	-	40	10	-	50	2
7	AEC-i									
Semester-II										
1	DSC-III	DSC03 MIC 21	Basic Biochemistry-I	2	-	40	10	-	50	2
2	DSC-IV	DSC03 MIC 22	Microbial nutrition and techniques	2	-	40	10	-	50	2
3	MIN-III	MIN03 MIC 21	Basic Biochemistry-I	2	-	40	10	-	50	2
4	MIN-IV	MIN03 MIC 22	Microbial nutrition and techniques	2	-	40	10	-	50	2
5	OEC-III	OEL03 MIC 21	Microbial Nutrition and Control	2	-	40	10	-	50	2
6	OEC-IV	OEL03 MIC 22	Water and air microbiology	2	-	40	10	-	50	2
7	SEC-I	SEC03 MIC 29	Dairy Microbiology	-	4	-	-	50	50	2
Annual										
1	DSC-PR-I	DSC03 MIC 29	DSC Microbiology Lab-1	-	4	-	-	50	50	4
2	MIN-PR-I	MIN03 MIC 29	MIN Microbiology Lab-1	-	4	-	-	50	50	4
3	OEC-PR-I	OEC03 MIC 12	OEC Microbiology Lab-1	-	4	-	-	50	50	4
	Total			**24**	**16**	**480**	**120**	**200**	**800**	**38**

B.Sc. PART-I

SEMESTER- I

DSC03MIC11: INTRODUCTION TO MICROBIOLOGY

Course Outcomes: Upon successful completion of the course, students are expected to be able to-

CO1: Acquire knowledge of the diversity, distribution & significance of different types of microorganisms.

CO2: Understand the structure & functions of various cell organelles of bacteria.

CO3: Explain bacterial taxonomy & systems for classification of microorganisms.

CO4: Understand the basic microbial structure & study the comparative characteristics of prokaryotes & eukaryotes.

Unit I/ Credit I	**History of microbiology and types of microorganisms**	**No. of Hours per Unit/Credit**
	A. History and mile stones in microbiology: 1. Spontaneous generation *vs*. biogenesis. 2.Contributions of a) Antony von Leeuwenhoek b) Edward Jenner c) Louis Pasteur d) Robert Koch e) Joseph Lister f) Alexander Fleming g) Hargobindsingh Khorana. 3. Classification of microorganisms – a) Whittaker's five kingdom b) Carl Woese three kingdom classification systems. 4.Taxonomic ranks 5. Beneficial and harmful activities of microorganisms. **B. Bacterial systematics:** a) Common OR vernacular name b) Scientific name **C. Types of Microorganisms:** **1.General characteristics of different groups:** a) Acellular microorganisms-Viruses, Viroids, Prions b) Cellular microorganisms- with emphasis on distribution, occurrence and morphology. i)Bacteria, ii)Algae, iii)Fungi and iv)Protozoa; c) Structure of Prokaryotic and eukaryotic cell.	

	d) Difference between prokaryotic and eukaryotic microorganisms.	
Unit II / Credit II	**Bacterial Cell organization**	**15**
	1. Cell size, shape and arrangement, 2. Cytology of Bacteria: Structure and Function of- a) Cell-wall: b) Cell membrane ii) Cell Membrane: c)Capsule and slime layer. d) Flagella and Pili. e) Ribosomes, f) Mesosomes, g) Inclusion bodies, h)Nucleoid, chromosome and plasmids i) Endospore 3. Reserve food materials – a) Nitrogenous b) Non-nitrogenous	

Reference Books:

1.Microbiology by Pelczar, M.J.Jr., Chan E.C.S., Krieq, N.R. 5th edition,1986 (McGraw Hills Publication).

2.General Microbiology by Stanier R. Y. Vth edition, McMilan, London.

3. General Microbiology Vol I and II by Powar and Daginawala, Himalaya Publications.

4.Microbiology by Prescott, Herley and Klein, IInd edition.

DSC03MIC12: BACTERIOLOGY

Course Outcomes – Upon successful completion of the course, students are expected to be able to –

CO1: Get insight into working & importance of compound microscope.
CO2: Use different techniques for sterilization of microbiological culture media & glasswares.
CO3: Learn about principle, construction, working & applications of electron microscope.
CO4: Comprehend various staining methods for identification of unknown microorganism.

Unit I / Credit I	General Principles of Microscopy & Staining	No. of Hours per Unit/Credit
	A. General Principles of Microscopy: 1. Types of microscopes: a) light microscopes b) electron microscopes, 2.Light microscopy: a) Parts b) Image formation c) Magnification d)Numerical aperture e) Resolving power f) Working distance 2. Ray diagram, special features and applications of: a) Compound Microscope b) Phase Contrast Microscope c) Electron Microscope d) Fluorescence Microscope **B. Stains and Staining procedures** 1. Definition of dye and stain 2. Classification of stains – Acidic, Basic and Neutral 3. Principles, Procedure, Mechanism of staining - a) Monochrome staining b) Negative staining c) Differential staining: i) Gram's staining ii)Acid fast staining 4. Special staining methods a) Cell wall (Chance's method) b) Capsule (Manvel's method) c) Volutin granule (Albert's method)	**15**
Unit II/ Credit II	**Control of Microorganisms**	
	A. Control of Microorganisms 1. Definitions of – a) Sterilization	

	b) Disinfection c) Antiseptic d) Germicide e) Microbiostasis f) Antisepsis g) Sanitization 2. Mode of Action and application of- a) Physical agents: i) Temperature – Dry heat, Moist heat, ii) Desiccation, iii) Ultrasonication iv) Radiations – U.V. Ray, Gamma rays, v) Filtration– Asbestos and Membrane filter b) Chemical Agents: i)Phenol and Phenolic compounds ii)Alcohols (Ethyl alcohol) iii)Halogen compounds (chlorine and iodine) iv)Heavy metals (Cu and Hg) v)Fumigation by Gaseous Agents – vi)Ethylene oxide, vii)Beta-propiolactone viii)formaldehyde ix)Osmotic Pressure	

REFERENCE BOOKS:

1. A Biologics guide to principles, techniques of Practical Biochemistry by K. Wilson and K. H. Goulding, Edward Arnold Publication.
2. General Microbiology Vol I and II by Powar and Daginawala, Himalaya Publications
3. Microbiology by Prescott, Herley and Klein, II nd edition.
4. Bacteriological Techniques by F. K. Baker
5. Introduction to Microbial Techniques by Gunasekaran

B.Sc. PART-I

SEMESTER- II

DSC03MIC21: BASIC BIOCHEMISTRY		
Course Outcomes – Upon successful completion of the course, students are expected to be able to – **CO1**: Understand building blocks of proteins & formation of polypeptides. **CO2**: Explain structure of carbohydrates & it's types with key properties. **CO3**: Learn about basic concepts of enzyme biochemistry including its structure & functions. **CO4**: Understand how nucleic acids are organized & their types.		
Unit I/ Credit I	**PROTEINS**	**No. of Hours per Unit/Credit**
	A. Proteins: 1) Introduction to amino acids, peptide bond. 2) Types of amino acids based on R group – a) Nonpolar, aliphatic amino acids. b) Polar, Uncharged amino acids. c) Aromatic amino acids. d)Positively charged (basic) amino acids e) Negatively charged (acidic) amino acids. 3) Structural levels of proteins: primary, secondary, tertiary and quaternary. **B. Enzymes:** 1)Definition and types of enzymes 2) Concept of apoenzyme, coenzyme, cofactor and active site 3) Mechanism of Enzyme Action- Lock and key hypothesis, Induced fit hypothesis.	**15**
Unit II/ Credit II	**BIOMOLECULES**	**15**
	A. Carbohydrates: 1) Monosaccharides: Classification based on aldehyde and ketone groups; structure of Ribose, Deoxyribose, Glucose, and Fructose. 2) Disaccharides: Glycosidic bond, structure of lactose and sucrose. 3) Polysaccharides: Structure of starch, glycogen and cellulose. **B. Lipids:** 1) Simple lipids – Fats, oils and waxes.	

	2) Compound lipids – Phospholipid, Glycolipids 3) Derived lipids – Cholesterol **C. Nucleic Acids:** 1) DNA – Structure (Watson and Crick Model) and function. 2) RNA – Types (m-RNA, t-RNA, r-RNA), structure and functions.	

REFERENCE BOOKS:

1. Biochemical methods by Sadasivam & Manickam
2. Elementary Microbiology Vol. I by Dr. H. A. Modi, Akta Prakashan, Nadiad, Gujrat.
3. Principles of Biochemistry by Nelson and Cox (Lehninger) – Fifth edition.
4. Biochemistry by Lubert Stryer, Jeremy M. Berg John L. Tymoczko, Seventh edition.

DSC03MIC22: MICROBIAL NUTRITION AND TECHNIQUES		
Course Outcomes – Upon successful completion of the course, students are expected to be able to – **CO1:** Know general bacteriology & microbial techniques for isolation of pure culture of bacteria. **CO2:** Learn aseptic techniques & be able to perform routine culture handling task safely & effectively. **CO3:** Classify microorganisms based upon their nutritional requirements. **CO4:** Know about different culture collection centers & their importance.		
	Paper IV	**No. of Hours per Unit/Credit**
Unit I/ Credit I	**MICROBIAL NUTRITION**	**15**
	A. Microbial Nutrition **1. Nutritional requirements of microorganisms:** a) Water; b) Micronutrients; c) Macronutrients d) Carbon, e) Energy source f) Oxygen and Hydrogen g) Nitrogen, h) Sulfur and Phosphorous i) growth factors. 2. Concept of auxotroph, Prototroph and fastidious organisms based on Growth factors. 3. Nutritional types of microorganism based on carbon and energy sources. a. Autotrophs b. Heterotrophs c. Phototrophs d. Chemotrophs e. Photoautotrophs f. Chemoautotrophs g. Photoheterotrophs h. Chemoheterotrophs. **B. Culture media:** 1. Components of media, 2. Types of media based on- a) Physical state- i. Solid media, ii. liquid media, iii semisolid media b) Chemical nature -i. Natural media, ii. Synthetic media iii. Complex media c) Function - i. Selective media ii. Differential media iii. Enriched media iv. Enrichment media	

	C. Cultivation of microorganisms: 1. Use of culture media for cultivation. 2. Conditions required for growth of the microorganisms	
Unit II / Credit II	**A. Enrichment and Isolation of Microorganisms from natural environment.** 1.Pure culture techniques – a. Streak plate, b. Spread plate, c. Pour Plate. 2.Isolation and cultivation of anaerobic organisms by using media components and by exclusion of air. B**. Preservation of microbial cultures by –** 1.Subculturing, 2.overlaying cultures with mineral oils 3. storage at low temperature, 4. Lyophilization. **C. Systematic study of pure cultures:** 1. Morphological characteristics. 2.Cultural characteristics – Colony characteristics on solid media, growth in liquid media. 3.Biochemical Characteristics - i) Sugar fermentation ii) H2S gas production iii) Detection of enzyme activity – Amylase Caseinase Catalase 4. Serological characters **D Concept of Culture collection centers.**	**15**

REFERENCE BOOK:

1. A textbook of Microbiology by Ananthnarayan – Orient Longman, Bombay
2. General Microbiology by Stanier R. Y. Vth edition, McMilan, London.
3. General Microbiology Vol I and II by Powar and Daginawala, Himalaya Publications
4. Microbiology by Prescott, Herley and Klein, IInd edition.

B.Sc. I Microbiology
Practical Course

Paper I	DSC-PR-I: DSC03 MIC 29 INTRODUCTION TO MICROBIOLOGY AND BACTERIOLOGY	No. of Hours per Unit/Credit
	1. Preparations of- a) stains (0.5% basic fuchsin, 0.5% crystal violet), b) Reagents (phosphate buffer of pH 7, 1 N and 1M solutions of HCL and NaOH), c)physiological saline. 2. Biosafety- a) Table disinfection, b) hand wash, c)use of aprons d)proper disposal of used material, e) Aseptic techniques, f) Cleaning and sterilization of glasswares. 3. Study of Laboratory instruments used in the microbiology laboratory: a) Laminar air flow, b) autoclave, incubator c)hot air oven d) colorimeter, e) colony counter f) bacteriological filter assembly 4. Study of compound microscope. 5. Microscopic observation of bacteria: a) Monochrome staining, b) Negative staining, c)Gram's staining, d)motility by Hanging-drop method. e) Cell wall staining (Chance's method), f) Capsule staining (Manuval's method), g) Volutine granule staining (Albert' s method) h) Demonstration of Acid –Fast stainig . 6. Preparation of liquid and solid culture media-. a) agar plates, b) slants; c) Peptone water,	**30**

	d) nutrient broth, e) nutrient agar; f) Sabourauds agar g) Potato Dextrose agar, h) Glucose yeast extract agar; i) MacConkey's agar. 7. Preparation of solid and liquid medium and assuring its sterility by autoclave and hot air oven. 8. Sterilization of glassware using Hot Air Oven and assessment for sterility 9. Fungal Mounting- *Penicillium and Aspergillus*	
Paper II	**DSC-PR-I: DSC03 MIC 29: MICROBIAL TECHNIQUES**	**No. of Hours per Unit/Credit**
	1. Personal hygiene- Demonstration of presence of bacterias from hands, Teeth and skin (swabbing) by cultivation methods. 2. Isolation of pure cultures of bacteria by four quadrant streaking method, and studies of Colony characteristics, Gram staining and motility of – i) *Escherichia coli* ii) *Bacillus species* iii) *Staphylococcus aureus* 3. Biochemical tests: i) Detection of production of indole, excess acid, acetoin and utilization of citrate as a carbon source by IMViC test ii) Detection of glucose and lactose fermentation ability of bacteria iii) Detection of H_2S production ability of bacteria 4. Detection of enzyme production ability of bacteria - i) Amylase ii) Catalas iii) Caseinase 5. Preparation of serial dilutions of water and soil for isolation of bacteria. 6. Isolation of bacteria from water (spread plate technique) and soil (pour plate technique) by preparation of serial dilutions.	**30**

	7. Enumeration of bacteria from water and milk by SPC method.	

Reference Books:

1) Medical Microbiology by Cruickshank Vol. II.
2) Stains and Staining procedures by Desai and Desai.
3) Introduction to Practical Biochemistry by D. Plummer, J Wiley and Sons.
4) Bacteriological techniques by F. J. Baker.
5) Introduction to Microbial techniques by Gunasekaran.
6) Biochemical methods by Sadasivam and D. Manickam.
7) Laboratory methods in Biochemistry by J. Jayaraman.
8) Experimental Microbiology by Patel & Patel.

B.Sc. PART-I

SEMESTER- I

OEC03 MIC 11: GENERAL MICROBIOLOGY

Course Outcomes – Upon successful completion of course, students are expected to be able to-

CO1: Acquire knowledge of the diversity, distribution & significance of different types of microorganisms.

CO2: Understand the structure & functions of various cell organelles of bacteria.

CO3: Explain bacterial taxonomy & systems for classification of microorganisms.

CO4: Understand the basic microbial structure & study the comparative characteristics of prokaryotes & eukaryotes.

Unit I/ Credit I	History and mile stones in microbiology	No. of Hours per Unit/Credit
	A. History and mile stones in microbiology: 1. Spontaneous generation *vs.* biogenesis. 2.Contributions of a) Antony von Leeuwenhoek b) Edward Jenner c) Louis Pasteur d) Robert Koch e) Ivanowsky f) Joseph Lister g) Alexander Fleming h) Martinus W. Beijerinck i) Sergei N. Winogradsky j) Hargobindsingh Khorana. 3. Classification of microorganisms – a) Whittaker's five kingdom b) Carl Woese three kingdom classification systems. 4.Taxonomic ranks 5. Beneficial and harmful activities of microorganisms. **B. Scope of Microbiology:** 1.Introduction to applied branches of Microbiology: a) Air b) Water c) Sewage d) Soil e) Dairy f) Food g) Medical h) Industrial i) Biotechnology j) Geomicrobiology **C. Bacterial systematics:**	

	a) Common OR vernacular name b) Scientific name	
Unit II / Credit II	**A. Types of Microorganisms:** **1.General characteristics of different groups:** a) Acellular microorganisms-Viruses, Viroids, Prions b) Cellular microorganisms- with emphasis on distribution, occurrence and morphology. i)Bacteria, ii)Algae, iii)Fungi and iv)Protozoa; c) Structure of Prokaryotic and eukaryotic cell. d)Difference between prokaryotic and eukaryotic microorganisms. **B. Bacterial Cell organization** 1. Cell size, shape and arrangement, 2. Cytology of Bacteria: Structure and Function of- a) Cell-wall: b) Cell membrane iii)Cell Membrane: c)Capsule and slime layer. d) Flagella and Pili. e) Ribosomes, f) Mesosomes, g) Inclusion bodies, h) Nucleoid, chromosome and plasmids i) Endospore 3. Reserve food materials – a) Nitrogenous b) Non-nitrogenous	**15**

Reference books:

1.Microbiology by Pelczar, M. J. Jr., Chan E.C.S., Krieq, N.R. 5th edition,1986 (McGraw Hills Publication).

2.General Microbiology by Stanier R. Y. Vth edition, McMilan, London.

3. General Microbiology Vol I and II by Powar and Daginawala, Himalaya Publications.

4.Microbiology by Prescott, Herley and Klein, IInd edition

OEC03 MIC 12: TECHNIQUES IN MICROBILOGY

Course Outcomes: Upon successful completion of course, students are expected to be able to-

CO1: Get insight into working & importance of compound microscope.

CO2: Use different techniques for sterilization of microbiological culture media & glasswares.

CO3: Learn about principle, construction, working & applications of electron microscope.

CO4: Comprehend various staining methods for identification of unknown microorganism.

Unit I / Credit I	TECHNIQUES IN MICROBILOGY	No. of Hours per Unit/Credit
	A. General Principles of Microscopy: 1. Types of microscopes: a) light microscopes b) electron microscopes, 2.Light microscopy: a) Parts b) Image formation c) Magnification d) Numerical aperture e) Resolving power f) Working distance 2. Ray diagram, special features and applications of: a) Compound Microscope b) Phase Contrast Microscope c) Electron Microscope d) Fluorescence Microscope **B. Stains and Staining procedures** 1. Definition of dye and stain 2. Classification of stains – Acidic, Basic and Neutral 3. Principles, Procedure, Mechanism of staining procedures a) Monochrome staining b) Negative staining c) Differential staining : i) Gram's staining ii)Acid fast staining 4. Special staining methods a) Cell wall (Chance's method) b) Capsule (Manvel's method) c) Volutin granule (Albert's method)	**15**
Unit II/ Credit II	**Enrichment and Isolation of Microorganisms from natural environment.**	

	A. Enrichment and Isolation of Microorganisms from natural environment. 1.Pure culture techniques – a) Streak plate, b) Spread plate, c) Pour Plate. 2.Isolation and cultivation of anaerobic organisms by using media components and by exclusion of air. B**. Preservation of microbial cultures by –** 1.Subculturing, 2.overlaying cultures with mineral oils 3. storage at low temperature, 4. Lyophilization. **C. Systematic study of pure cultures:** 1. Morphological characteristics. 2. Cultural characteristics – Colony characteristics on solid media, growth in liquid media. 3.Biochemical Characteristics - a) Sugar fermentation b) H2S gas production c) Detection of enzyme activity – i) Amylase ii) Caseinase iii) Catalase 4. Serological characters **D. Concept of Culture collection centres.**	

REFERENCE BOOKS:

1. A textbook of Microbiology by Ananthnarayan – Orient Longman, Bombay
2. General Microbiology by Stanier R. Y. Vth edition, McMilan, London.
3. General Microbiology Vol I and II by Powar and Daginawala, Himalaya Publications
4. Microbiology by Prescott, Herley and Klein, II nd edition

B.Sc. PART-I

SEMESTER- II

OEC03 MIC 21: MICROBIAL NUTRITION AND CONTROL

Course Outcomes – Upon successful completion of course, students are expected to be able to-

CO1: Classify microorganisms based upon their nutritional requirements.
CO2: Design the suitable growth medium for cultivation of microorganisms.
CO3: Learn aseptic techniques & be able to perform routine culture handling task safely & effectively.
CO4: Use different techniques for sterilization of microbiological culture media & glasswares

	A. Microbial Nutrition	No. of Hours per Unit/Credit
Unit I/ Credit I	**1. Nutritional requirements of microorganisms:** a) Water; b) Micronutrients; c) Macronutrients d) Carbon, e) Energy source f) Oxygen and Hydrogen g) Nitrogen, h) Sulfur and Phosphorous i) growth factors. 2. Concept of auxotroph, Prototroph and fastidious organisms based on Growth factors. 3. Nutritional types of microorganism based on carbon and energy sources. a. Autotrophs b. Heterotrophs c. Phototrophs d. Chemotrophs e. Photoautotrophs f. Chemoautotrophs g. Photoheterotrophs h. Chemoheterotrophs. **B. Culture media:** 1. Components of media, 2. Types of media based on- a) Physical state- i. Solid media, ii. liquid media, iii. Semisolid media b) Chemical nature - i. Natural media, ii. Synthetic media iii. complex media c) Function - i. Selective media ii. Differential media iii. Enriched media	**15**

	iv. Enrichment media **C. Cultivation of microorganisms:** 1. Use of culture media for cultivation. 2. Conditions required for growth of the microorganisms	
Unit II/ Credit II	**Control of Microorganisms**	**15**
	1. Definitions of – a) Sterilization b) Disinfection c) Antiseptic d) Germicide e) Microbiostasis f) Antisepsis g) Sanitization 2. Mode of Action and application of- a) Physical agents: i) Temperature – Dry heat, Moist heat, ii) Desiccation, iii) Ultrasonication iv) Radiations – U.V. Ray, Gamma rays, v) Filtration– Asbestos and Membrane filter b) Chemical Agents: i)Phenol and Phenolic compounds ii)Alcohols (Ethyl alcohol) iii)Halogen compounds (chlorine and iodine) iv)Heavy metals (Cu and Hg) v)Fumigation by Gaseous Agents – vi)Ethylene oxide, vii)Beta-propiolactone viii)formaldehyde ix)Osmotic Pressure	

REFERENCE BOOKS:

1. A textbook of Microbiology by Ananthnarayan – Orient Longman, Bombay
2. General Microbiology by Stanier R. Y. Vth edition, McMilan, London.
3. General Microbiology Vol I and II by Powar and Daginawala, Himalaya Publications
4. Microbiology by Prescott, Herley and Klein, IInd edition.

OEC03 MIC 22: WATER AND AIR MICROBIOLOGY		
Course Outcomes – Upon successful completion of course, students are expected to be able to- **CO1: Analyze the bacteriological quality of water.** **CO2: Understand the various water purification processes.** **CO3: Explain the role of organism in spoilage of milk.** **CO4: Use the various test to check the quality of milk.**		
Unit I/ Credit I	**WATER MICROBIOLOGY**	**No. of Hours per Unit/Credit**
	A. Water Microbiology: 1. Sources of microorganisms in water. 2. Fecal pollution of water. 3. Indicators of fecal pollution 4. Routine Bacteriological analysis of water. a) SPC b) Tests for Coli forms i) Qualitative test **Detection of coliforms –** Presumptive test, Confirmed Test, Completed test. **Differentiation between coliforms –** IMViC test, Eijkman test. ii) Quantitative – MPN, Membrane filter technique 5. Municipal water purification process and its significance.	**15**
Unit II / Credit II	**MILK MICROBIOGY**	**15**
	B. Milk Microbiology 1. General composition of Milk. 2. Sources of contamination in milk 3. Spoilage of milk – a. Change in Colour and flavor, b. Curdling and ropiness . 4. Microbiological examination of Milk – a.SPC b. dye reduction tests: i) MBRT test, ii) Resazurin test 5. Pasteurization (definition, types of methods used) –	

	a. LTH (Low Temperature Holding) b. HTST (High Temperature Short Time) c. UHT (Ultra High Temperature) 6. Efficiency of Pasteurisation – Phosphatase test(Qualitative)	

REFERENCE BOOKS:

1. Food Microbiology by Frazier.
2. Food Microbiology by H. A. Modi. (Vol. I&II)
3. Industrial Microbiology by A. H. Patel.
4. Industrial Microbiology by Prescott & Dunn

B.Sc. I Microbiology
Practical Course

Paper I	OEC03 MIC 12: INTRODUCTION TO MICROBIOLOGY	No. of Hours per Unit/Credit
	1. Preparations of- a) Stains (0.5% basic fuchsin, 0.5% crystal violet), b) Reagents (phosphate buffer of pH 7, 1 N and 1M solutions of HCL and NaOH), c) physiological saline. 2. Biosafety- a) Table disinfection, b) hand wash, c) use of aprons d) proper disposal of used material, e) Aseptic techniques, f) Cleaning and sterilization of glasswares. 3. Study of Laboratory instruments used in the microbiology laboratory: a) Laminar air flow, b) autoclave, incubator c) hot air oven d) colorimeter, e) colony counter f) bacteriological filter assembly 4. Study of compound microscope. 5. Microscopic observation of bacteria: a) Monochrome staining, b) Negative staining, c)Gram's staining, d)motility by Hanging-drop method. e) Cell wall staining (Chance's method), f) capsule staining (Manuval's method), g) Volutine granule staining (Albert' s method) h) Demonstration of Acid –Fast stainig . 6. Preparation of liquid and solid culture media-. a) agar plates, b) slants; c)Peptone water, d) nutrient broth, e) nutrient agar;	**30**

	f) Sabourauds agar g) Potato Dextrose agar, h) Glucose yeast extract agar; i) MacConkey's agar. 7. Preparation of solid and liquid medium and assuring its sterility by autoclave and hot air oven. 8. Sterilization of glassware using Hot Air Oven and assessment for sterility	
Paper II	**OEC03 MIC 12: MICROBIAL TECHNIQUES**	**No. of Hours per Unit/Credit**
	1. Personal hygiene- Demonstration of presence of bacterias from hands, Teeth and skin (swabbing) by cultivation methods. 2. Isolation of pure cultures of bacteria by four quadrant streaking method, and studies of Colony characteristics, Gram staining and motility of – i) *Escherichia coli* ii) *Bacillus species* iii) *Staphylococcus aureus* 3. Biochemical tests: i)Detection of production of indole, excess acid, acetoin and utilization of citrate as a carbon source by IMViC test ii) Detection of glucose and lactose fermentation ability of bacteria iii) Detection of H_2S production ability of bacteria 4. Detection of enzyme production ability of bacteria - i) Amylase ii) Catalas iii) Caseinase 5. Preparation of serial dilutions of water and soil for isolation of bacteria. 6. Isolation of bacteria from water (spread plate technique) and soil (pour plate technique) by preparation of serial dilutions. 7. Enumeration of bacteria from water and milk by SPC method.	**30**

Reference Books:

1) Medical Microbiology by Cruickshank Vol. II.
2) Stains and Staining procedures by Desai and Desai.
3) Introduction to Practical Biochemistry by D. Plummer, J Wiley and Sons.
4) Bacteriological techniques by F. J. Baker.
5) Introduction to Microbial techniques by Gunasekaran.
6) Biochemical methods by Sadasivam and D. Manickam.
7) Laboratory methods in Biochemistry by J. Jayaraman.
8) Experimental Microbiology by Patel & Patel.

B.Sc. PART-I

SEMESTER- I

VSC03 MIC 29: DAIRY MCROBIOLOGY		
	Paper I	**No. of Hours per Unit/Credit**
	A. Microbial Analysis of Milk **Direct Test** **1.** Enumeration of bacteria from milk by SPC method. 2. Direct Microscopic Count of Milk. (DMC) **Indirect Test:** 1. Methylene Blue Reduction Time Test (MBRT) Test. 2. Resazurine test. **B. Quality Control test for milk** 1. Alkaline phosphatase test. 2. Coliform Count 3.Lactometer test 4. Organoleptic test 5. Temperatute test 6. Determination of pH 7. Clot on boiling test 8.Alcohol test 9. Acidity of milk 10. Sedimentation test	**30**

REFERENCE BOOKS:

1. Food Microbiology by Frazier.
2. Food Microbiology by H. A. Modi. (Vol. I&II)
3. Industrial Microbiology by A. H. Patel.
4. Industrial Microbiology by Prescott & Dunn

EVALUATION PATTERN

Scheme of Marking: Theory

Sem.	Course Code	Marks	Evaluation	Answer Books	Standard Of passing
I	MIC03 DSC 11	40	Semester wise	As per Instruction	35%
II	MIC03 DSC 12	40	Semester wise	As per Instruction	35%
III	MIC03 DSC 21	40	Semester wise	As per Instruction	35%
IV	MIC03 DSC 22	40	Semester wise	As per Instruction	35%

Scheme of Marking: Continuous Internal Evaluation (CIE)

Sem.	Course Code	Marks	Evaluation	Sections	Answer Books	Standard Of passing
I	MIC03 DSC 11	10	Semester wise	-	Asper Instruction	35% (4marks)
II	MIC03 DSC 12	10	Semester wise	-	Asper Instruction	35% (4marks)
III	MIC03 DSC 21	10	Semester wise	-	As Per Instruction	35% (4marks)
IV	MIC03 DSC 22	10	Semester wise	-	Asper Instruction	35% (4marks)

Scheme of Marking: Practical

Sem.	Course Code	Marks	Evaluation	Sections	Standard of Passing
I and II	MBP 101	25	Semesterwise	As per Instruction	35%
	MBP 102	25			

Nature of Question Paper

Instructions: 1) All the questions are **compulsory**.
2 Figures to the right indicate **full** marks.
3)Draw neat labeled diagrams **wherever** necessary.
4) Use of calculator is allowed.

Time: 2 hours **Total Marks: 40**

SECTION-I/ SECTION-II

Q.1. Select correct alternative. **(8)**

i)
a) b) c) d)
ii)
a) b) c) d)
iii)
a) b) c) d)
iv)
a) b) c) d)
v)
a) b) c) d)
vi)
a) b) c) d)
vii)
a) b) c) d)
viii)
a) b) c) d)

Q.2. Attempt any Two. **(16)**

i)
ii)
iii)

Q.3. Attempt any Four **(16)**

i)
ii)
iii)
iv)
v)

Instruction to paper setters: Equal weight age should be given to all units.

For Continuous Internal Examination: (20 marks)

Mandatory 1) Presently ---- **(5 marks)**

***Select any one for B. Sc. II ---- (15 marks)**

1) Unit test
2) Home assignment
3) Project
4) Seminar

*Yet it is not finalized