

Academic Council Meeting No. and Date: 8 / September 04, 2023

Agenda Number: 2

Resolution Number: 34, 35/ 2.9, 2.30



**Vidya Prasarak Mandal's
B. N. Bandodkar College of
Science (Autonomous), Thane**



Syllabus for
Programme code: BUMB
Programme : Bachelor of Science
Specific Programme : Microbiology

[F.Y.B.Sc. Microbiology]
Level - 4.5

CHOICE BASED GRADING SYSTEM

Revised under NEP and Autonomy
From academic year 2023-24

Preamble

Microbiology is an ever-evolving branch of biology that includes the study that utilizes Microbial systems, to develop or create different products for betterment of society. Under-graduate (UG) program in Microbiology offers opportunity for students to learn fundamental microbiology, biochemistry, immunology, genetics, molecular biology and their applications in various industries like food, agriculture, dairy, health care etc. With the goal of engaging the learners in learning basic concepts in microbiology and acquainting them with current developments in the field that can be correlated better with theoretical learning, the syllabus was re-framed under autonomy. Continuing the Choice Based Credit System (CBCS) implemented by the esteemed University of Mumbai from the academic year 2016-2017, the existing syllabus of F.Y.B.Sc. Microbiology is restructured according to the NEP reforms for its effective implementation from 2023-24 under the autonomous status of VPM's B. N. Bandodkar College of Science.

Dr. Kalpita Mulye
Chairperson, BOS Microbiology
VPM's B.N.Bandodkar College of Science (Autonomous), Thane

PROGRAMME OUTCOMES (POs) OF BACHELOR OF SCIENCE (B.Sc.)

The Undergraduate Programmes of Science are intended to cater quality education and attain holistic development of learners through the following programme outcomes:

PO1 - Disciplinary Knowledge

Lay a strong foundation of conceptual learning in science. Instil ability to apply science in professional, social and personal life.

PO2 - Inculcation of Research Aptitude

Ignite spirit of inquiry, critical thinking, analytical skills and problem-solving approach which will help learners to grasp concepts related to research methodology and execute budding research ideas.

PO3 - Digital Literacy

Enhance ability to access, select and use a variety of relevant information e-resources for curricular, co-curricular and extracurricular learning processes.

PO4 - Sensitization towards Environment

Build a cohesive bond with nature by respecting natural resources, encouraging eco-friendly practices and creating awareness about sustainable development.

PO5 - Individuality and Teamwork

Encourage learners to work independently or in collaboration for achieving effective results through practical experiments, project work and research activities.

PO6 - Social and Ethical Awareness

Foster ethical principles which will help in developing rational thinking and becoming socially aware citizens. Build an attitude of unbiased, truthful actions and avoid unethical behaviour in all aspects of life.

Eligibility: Passed 12th standard (HSC) of Maharashtra State Board / CBSE / ICSE board

Duration: 1 Year (Includes SEM I and SEM II)

Mode of Conduct: Offline / Laboratory Practicals / Offline lectures / Online lectures

Specific Programme: F.Y.B.Sc. (Microbiology)

Qualification Title: UG certificate

Discipline/Subject: **MICROBIOLOGY**

Program Specific Outcome

1	Recall and define fundamental concepts related to microorganisms, including their diversity, structure, physiology, genetics, and ecological interactions.	L1
2	Explain the principles underlying microbiological, biochemical, immunological, and molecular biology techniques used in laboratory investigations, with emphasis on biosafety and scientific practices.	L2
3	Apply microbial principles to industrial, clinical, agricultural, and environmental contexts, and demonstrate how microorganisms are utilized in various biotechnological processes.	L3
4	Analyze and interpret microbiological data related to health and disease, including basic diagnostic, immunological, and antimicrobial concepts in clinical microbiology.	L4
5	Evaluate microbiological problems using critical thinking, data interpretation, and experimental reasoning to propose evidence-based and scientifically sound solutions.	L5
6	Design and propose microbiology-based approaches to address societal and environmental challenges, emphasizing sustainability, public health, and community welfare.	L6

Specific Programme: F.Y.B.Sc. (Microbiology -Major/ Minor)		
Assessment: Weightage for assessments (in percentage) For Major and Minor		
Type of Course	Formative Assessment / IA	Summative Assessment
Theory	40 %	60 %

**Curriculum Structure for the Undergraduate degree
F.Y.B.Sc. (Microbiology)**

	Course Code	Course Title	No. of lectures	Credits
SEMESTER I				
Major	23BUMB1T01	Fundamental Microbiology I	30	2
	23BUMB1T02	Fundamental Microbiology II	30	2
	23BUMB1P01	Practicals based on 23BUMB1T01 and 23BUMB1T02	60	2
Generic	23BUMB1T05	Majestic Microbial World	30	2
Vocational Skill Enhancement	23BU1VSC02	Laboratory techniques in Microbiology	15	1
		Practicals based on 23BU1VSC02	30	1
Indian Knowledge system	23BUIK1T02	Principles of Yoga for Body and Mind Management	30	2
Total			225	12

	Course Code	Course Title	No. of lectures	Credits
SEMESTER II				
Major	23BUMB2T01	Exploring Microbiology I	30	2
	23BUMB2T02	Exploring Microbiology II	30	2
	23BUMB2P01	Practicals based on 23BUMB2T01 and 23BUMB2T02	60	2
Generic	23BUMB2T05	Common diseases and their management	30	2
Indian Knowledge System	23BUIK2T02	Ayurveda for Healthy Lifestyle	30	2
CC	23BU2CC606	Departmental Activities I	60	2
Total			240	12

Semester I

Course Code	Course Title			Credits	No. of	
23BUMB1T01	Fundamental Microbiology I			2	lectures-30	
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Explain the structure and functions of prokaryotic cell wall, cell membrane, cytoplasmic matrix, nuclear material and details about bacterial reproduction					L2
CO2	Recall the structure and functions of components external to prokaryotic cell wall, inclusion granules, endospore, extrachromosomal material and difference between prokaryotic and eukaryotic cell structure					L1
CO3	Classify microorganisms based on nutritional requirements					L2
CO4	Choose appropriate methods of cultivation and preservation of microorganisms					L3
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	0	1	0	0	0
CO2	3	0	1	0	0	0
CO3	3	0	1	1	0	0
CO4	3	0	1	1	0	0
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
Units	Description					No of lectures
Unit I: Prokaryotic cell structure	a. Overview (Size, shape, arrangement) · Ultra structure of prokaryotic cell: bacterial and archaeal - cell wall and cell membrane. b. Components external to cell wall - capsule, slime layer, s-layer, pili, fimbriae, flagella: structure, motility, chemotaxis. c. Cytoplasmic matrix - ribosome, magnetosomes, peroxisomes, mesosomes d. Inclusion granules: Composition and function. e. Nuclear Material – bacterial structure (its differences with the eukaryotic chromosome); f. Extra Chromosomal material. g. Bacterial Endospore - Examples of spore forming organisms, habitats, function, formation and germination. h. Reproduction in bacteria i. Difference between prokaryotic and eukaryotic cell structure					15
Unit II: Microbial nutrition	a. Nutritional requirements – Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur and growth factors (definition only) b. Nutritional types of microorganisms c. Types of Culture media with examples d. Isolation of microorganisms and pure culture techniques · Cultivation of anaerobic microorganisms e. Preservation of microorganisms f. Culture Collection Centers					15

Course Code 23BUMB1T02	Course Title Fundamental Microbiology II			Credits 2	No. of lectures-30	
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Explain principle and working of different types of microscopes					L2
CO2	Recall different staining procedures					L1
CO3	Describe physical methods of microbial control					L1
CO4	Explain mechanism, advantages, disadvantages and applications of chemical methods for microbial control					L2
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	0	1	0	0	0
CO2	3	0	1	0	0	0
CO3	3	0	1	1	0	0
CO4	3	0	1	1	0	0
Units	Description					No of lectures
Unit I: Microscopy & Staining	Microscopy: a. History of microscopy, Optical spectrum, Lenses and mirrors · Simple and compound light microscope b. Dark field Microscopy c. Phase contrast d. Foldscope e. SEM and TEM Staining procedures a. Dyes and stains: Types, Physicochemical basis Fixatives, Mordants, Decolorizers b. Simple and differential staining c. Special staining (Cell wall, Capsule, Lipid granules Spores, Metachromatic granules & Flagella)					15
Unit II: Control of microorganisms	Definition of frequently used terms & Rate of microbial death, Factors affecting the effectiveness of antimicrobial agents & Properties of an ideal disinfectant Physical methods of microbial control a. Dry & moist heat – mechanisms, instruments used and their operations b. Electromagnetic (Ionizing) radiations - mechanisms, advantages & disadvantages, importance of cold sterilization c. Bacteria proof filters d. Low temperature e. Osmotic pressure f. Desiccation Chemical methods of microbial control - mechanism & Advantages & disadvantages (if any) applications: a. Phenolics					15

	b. Alcohols c. Heavy metals and their compounds d. Halogens e. Quaternary ammonium compounds f. Evaluation of disinfectant –Tube dilution & Agar plate techniques, Phenol coefficient, Tissue toxicity index Introduction to Chemotherapeutic agents	
--	--	--

Course Code 23BUMB1P01	Course Title Practical based on 23BUMB1T01 and 23BUMB1T02	Credits 2	No. of lectures-60
---	--	----------------------------	---------------------------

Course Outcomes

On completion of this course, students will be able to:

CO1	Choose an appropriate selective and differential medium to isolate an organism	L6
CO2	Estimate the effect of antimicrobial compounds	L5
CO3	Distinguish microorganisms based on their microscopic morphologies	L4
CO4	Demonstrate aseptic technique	L2

Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	0	0	2	0
CO2	3	2	0	0	2	0
CO3	3	1	0	0	2	0
CO4	3	0	0	0	2	0

Practical 1	Practicals Based on Unit I of 23BUMB1T01	
1	Introduction to Microbiology laboratory set up and good laboratory practices	3
2	Special Staining a. Cell Wall b. Capsule c. Endospore	6
	Practicals Based on Unit II of 23BUMB1T02	
3	Preparation of Culture Media: Liquid medium (Nutrient Broth)	6
4	Preparation of slant, butts & plates (Aseptic transfer)	6
5	Inoculation techniques: Liquid media Solid Media (Slants, Butts and Plates)	6
6	Study of Motility (Hanging Drop method& stab culture)	3
7	Use of Differential & Selective Media: (MacConkey & Salt Mannitol Agar)	6
8	Demonstration of microbial culture preservation	3
Practical 2	Practicals Based on Unit I of 23BUMB1T01	

1	Effect of dyes, phenolic compounds and chemotherapeutic agents (Disk diffusion method)	6
2	Effect of UV light, osmotic pressure, heavy metals on microbial growth	6
	Practicals Based on Unit II of 23BUMB1T02	
3	Monochrome staining and negative staining	3
4	Gram staining	3
5	Observing random samples using foldscope	3

Course Code 23BUMB1T05	Course Title Majestic Microbial World			Credits 2	No. of lectures-30	
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Explain the nutritional requirements and cultivation methods of microorganisms, their unique properties and VBNCs				L1	
CO2	Describe the basic cellular structures, functions and natural habitats of microorganisms with their unique abilities				L2	
CO3	Explain different products of microbial origin				L2	
CO4	Illustrate the effects of harmful microbes and strategies to control the same				L1	
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	0	1	0	0
CO2	2	0	0	2	0	0
CO3	2	0	0	2	0	0
CO4	2	0	0	2	0	0
Units	Description					No. of Lectures
Unit I: Introduction to microorganisms	a. Introduction to microbes, basic cellular features and function Uniqueness of Microbes: invisible to infinity b. Natural habitats c. Nutritional requirements, cultivation d. Life of microbes in extreme environments e. Microbes with unique abilities f. Viable but non culturable (VBNC)					15
Unit II: The Good and the Bad	Good bacteria contributing in a. Food production: fermented foods b. Pharmaceutical industry: vaccines, hormones, antibiotics c. Nutraceutical industry: prebiotics, probiotics d. Agriculture: Biofertilizers, biopesticides Bad bacteria a. Pathogens b. Plant pathogens c. Food spoilage d. Biodeterioration Strategies to control them					15

Course Code 23BU1VSC02	Course Title Laboratory techniques in Microbiology			Credits 1	No. of lectures-15	
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Discuss Good Laboratory Practices and Good Manufacturing Practices, BSL, BSC					L2
CO2	Explain working, maintenance, significance of basic equipments in microbiology lab and documentation of repair reports					L2
CO3	Test Beer Lambert's law					L6
CO4	Make use of fundamental knowledge of lab equipments for problem solving					L4
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	1	0	0	0
CO2	2	0	1	1	0	0
CO3	2	0	0	0	0	0
CO4	2	1	0	0	0	0
Units	Description					No of lectures
Unit I	<ul style="list-style-type: none">Methods and practices in microbiology labGood clinical practices, Standard operating procedures, good laboratory practices, good manufacturing practices,Usage and maintenance of basic equipments in microbiology lab: principle, working and calibrationBiosafety norms, Working and significance of LAFDocumentation, laboratory maintenance and repair reports					15

Course Code 23BU1VSC02	Course Title Practical based on 23BU1VSC02	Credits 1	No. of lectures-30
Practical 1	Methods of preparation of glassware for Sterilization (pipettes, Petri Plates, Plastic wares, Flask, Micropipettes)	3	
Practical 2	Demonstration of Microbes in air, cough, on table surfaces, finger tips.	3	
Practical 3	Introduction to laboratory equipments: a. Microscope: construction, working, care b. Autoclave: principle, construction, working, care, validation c. Hot air oven: principle, construction, working, care. d. Colorimeter: principle, construction, working, care.	12	

Practical 4	Determination of λ_{max} and verification of Beer-Lambert's law.	6
Practical 5	Variation in Microbiological analysis: Breed's count	3
Practical 6	Reproducibility of experimental results w.r.t pH meter	3

Course Code 23BUIK1T02	Course Title Principles of Yoga for Body and Mind Management	Credits 2	No. of lectures-30
---	---	----------------------------	---------------------------

Course Outcomes

On completion of this course, students will be able to:

CO1	Apply basics of Gunas and Doshas to identify body type	L3
CO2	Explain the importance of meditation and stress management	L2
CO3	Summarize on Prana and its types	L2
CO4	Develop habits in accordance with the principles of yoga	L3

Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	0	0	0	1
CO2	1	0	0	0	0	1
CO3	1	0	0	0	0	1
CO4	1	0	0	0	0	1

Units	Description	No of lectures
Unit I: Know Your Body	a. Three Gunas & Mental Nature b. The Three Doshas c. The Seven Dhatus d. The Five Pranas	15
Unit II: Meditation & Stress Management	a. Concept of Stress b. Stimulation - Relaxation for Stress Management c. Dinacharya d. Balancing the female cycle e. Pranayama & Its forms f. Meditation & The Mind g. Resolving inner conflict & limiting beliefs 'The Enquiry', Accomplishing goals	15

Semester II

Course Code 23BUMB2T01	Course Title Exploring microbiology I			Credits 2	No. of lectures-30	
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Enlist the structural and functional features of various macromolecules such as carbohydrates, proteins,amino acid and lipids				L1	
CO2	Enlist the structural and functional features of nucleic acids and water in biological system				L1	
CO3	Compare different methods of bacterial enumeration				L2	
CO4	Analyze different factors that influence microbial growth				L4	
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	0	1	0	0	0
CO2	3	0	1	0	0	0
CO3	3	1	1	0	0	0
CO4	3	1	1	1	0	0
Units	Description					No. of Lectures
Unit I: Macromolecules	Water- Structure, properties in brief Carbohydrates: a. Definition, Classification, Biological role b. Monosaccharides, oligosaccharides (maltose, cellobiose, sucrose, lactose) c. Polysaccharide (starch, glycogen, peptidoglycan, cellulose) Amino acids & Proteins: a. General structure and features of amino acids (emphasis on amphoteric nature) Classification by R-group, b. Uncommon amino acids and their functions c. Peptides & proteins- Definition & general features and examples with biological role d. Primary, secondary, tertiary, quaternary structures - Brief outline Nucleic acids: a. Nitrogenous bases- Purines, Pyrimidines, Pentoses - Ribose, Deoxyribose b. Nomenclature of Nucleosides and nucleotides, N-β-glycosidic bond, polynucleotide chain to show bonding between nucleotides (Phosphodiester bonds) c. Basic structure of RNA and DNA Lipids and Fatty acids: Classification and properties of saturated and unsaturated fatty acids					15

<p style="text-align: center;">Unit II Microbial Growth</p>	<ul style="list-style-type: none"> a. Definition of growth, Mathematical Expression, Growth curve · Measurement of growth b. Direct microscopic count–Breed’s count, Petroff–Hausser counting chamber- Hemocytometer c. Viable count – Spread plate and Pour plate technique · Measurements of cell constituents d. Turbidity measurements–Nephelometer and spectrophotometer techniques e. Synchronous growth, Continuous growth (Chemostat and Turbidostat) f. Influence of environmental factors on growth g. Microbial growth in natural environment h. Counting viable non-culturable organisms-Quorum sensing techniques 	15
---	--	-----------

Course Code 23BUMB2T02	Course Title Exploring microbiology II				Credits 2	No. of lectures-30
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Explain features of different classes of viruses, archaea, actinomycetes, rickettsia, coxiella, Chlamydia, mycoplasma					L2
CO2	Compare protozoa, algae, Fungi yeast, slime molds myxomycetes					L4
CO3	Illustrate different microbial interactions using suitable examples					L2
CO4	Explain the applications that make use of microbial interactions					L5
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	0	1	1	0	0
CO2	3	0	1	1	0	0
CO3	3	0	1	1	0	0
CO4	3	0	1	1	0	0

Units	Description	No. of Lectures
Unit I: Microbial Diversity	<p>a. Viruses: Historical highlights, General properties of viruses, prions, viroids Structure of viruses (capsids, envelopes, genomes), Cultivation of viruses (overview), Bacteriophages (Lytic cycle. Lysogeny, Structure and Life cycle of T4 phage)</p> <p>b. Rickettsia, Coxiella, Chlamydia, Mycoplasma: general features, medical significance</p> <p>c. Actinomycetes: General features of Nocardia and Streptomyces Importance</p> <p>d. Archaea: Introduction- Major Archaeal physiological groups, Archaeal cell wall, lipids and membranes, Ecological importance</p> <p>e. Protozoa: Major Categories of Protozoa Based on motility, reproduction. Medically important Protozoa Life cycle of Entamoeba</p> <p>f. Algae: Characteristics of algae: morphology, Pigments, reproduction Cultivation of algae. Major groups of Algae –an overview. Algae. Differences between Algae and Cyanobacteria</p> <p>g. Fungi and Yeast: Characteristics: structure, Reproduction. Major fungal divisions- overview.</p> <p>h. Slime molds and Myxomycetes</p>	15
Unit II Microbial interactions	<p>a. Types of Microbial Interactions: Mutualism, Cooperation, Commensalism, Predation Parasitism, Amensalism, Competition</p> <p>b. Microbial associations with vascular plants: Phyllosphere, Rhizosphere & Rhizoplan; Plant pathogens</p> <p>c. Applications</p> <ul style="list-style-type: none"> • Biofertilizers: Mycorrhizae, Nitrogen fixation: Rhizobia, Stem nodulating Rhizobia Actinorhizae • Biopesticides: <i>Bacillus thuringiensis</i> based • PGPRs: Fungal & Bacterial endophytes <p>d. Two sides of a coin: <i>Agrobacterium tumefaciens</i></p>	15

Course Code 23BUMB2P01	Course Title Practical based on 23BUMB2T01 and 23BUMB2T02				Credits 2	No. of Lectures - 60 hrs
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Estimate the cell density using appropriate method					L5
CO2	Demonstrate the presence of macromolecules					L2
CO3	Plan an experiment for the isolation of microorganism					L6
CO4	Identify the specimen based on morphological characteristics					L3
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	0	0	2	0
CO2	3	1	0	0	2	0
CO3	3	1	0	0	2	0
CO4	3	1	0	0	2	0
Practical 1	Practicals Based on Unit I of 23BUMB2T01					
1	Qualitative estimation of Carbohydrates- Benedicts, Molisch’s test.					3
2	Qualitative estimation of Proteins, amino acids- Biuret, Ninhydrin					3
3	Qualitative estimation of Nucleic acid detection by DPA and Orcinol					3
	Practicals Based on Unit II of 23BUMB2T02					
4	Haemocytometer					3
5	Viable count: Spread plate and pour plate					12
6	Effect of pH and temperature on growth					3
7	Measurement of cell dimensions-Micrometry					3
8	Growth curve					6
Practical 2	Practicals Based on Unit I of 23BUMB2T01					
1	Spot assay for demonstration of bacteriophage					2
2	Fungal wet mount					2
3	Cultivation of fungi and yeast					6
4	Permanent slides of algae					3
	Practicals Based on Unit II of 23BUMB2T02					
5	Wet mount of lichen					2
6	Isolation of <i>Rhizobium</i>					3
7	Enrichment and isolation of <i>Azotobacter</i>					6

Course Code 23BUMB2T05	Course Title Common Diseases and their Management				Credits 2	No. of lectures-30
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Describe the course of infection and the factors influencing , microbial interaction					L2
CO2	Explain common infections on the basis of signs and symptoms					L1
CO3	Recall basic mode of actions associated with microbial control, properties of antimicrobial					L1
CO4	Describe types of antimicrobial agents, problem of drug resistance					L4
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	0	1	2	0	0
CO2	2	0	1	1	0	0
CO3	2	0	0	0	0	0
CO4	2	0	0	0	0	0
Units	Description					No of lectures
Unit I: Microbes as infectious agents	a. Human host and Microbes: interaction b. Course of infection c. Factors affecting infection d. Types of infections e. Common infections, signs and symptoms, prevention and cure: <ul style="list-style-type: none">Respiratory tract infection: upperGastrointestinal tract infectionUrinary tract infectionsSkin infections					15
Unit II: Introduction to antimicrobial agents	a. Antimicrobial agents b. Properties of Ideal Antimicrobial agents c. Basic definitions d. Drug effects e. Two examples of each : Antibacterial, Antiviral, Antifungal f. Problem of drug resistance and its prevention					15

Course Code 23BUIK2T02	Course Title Ayurveda for Healthy Lifestyle				Credits 2	No. of lectures-30
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Explain the importance of ayurvedic diets					L2
CO2	Choose the correct ingredient to make a balanced diet					L3
CO3	Recall the importance of ayurvedic herbs and the methods of their preparations					L1
CO4	Select appropriate ayurvedic herb for treating common ailments					L3
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	0	1	1	0	1
CO2	1	0	1	2	0	2
CO3	1	0	1	2	0	1
CO4	1	0	1	1	0	1
Units	Description					No of lectures
Unit I: Indian Diet & its Impact on Health	a. Ayurvedic detox programs b. Yogic & Ayurvedic Diets c. A balanced diet, the six tastes & Vipaka					15
Unit II: Ayurveda & Ancient Indian Drugs	a. Ayurvedic Herbs: Amla, Ginger, Ritha, Maka, Behada, Bell, Tondali, Brahmi, Anar, Coriander seeds, Durva, Erand, Papita, Gulvel, Haldi, Hirada, Hing, Jamun, Hibiscus, nutmeg, Cumin seeds, Banana, Karanja, Karela, Karpur, Khajur, Khaskhas, Kulith, Aloevera, Kesar, Lajalu, Lasun, Laung, Pepper, Methi, Saunf, Mula, Pan, coconut, Kadunimb, Onion, Fig, Sadafuli, Rai, Shatavari, Kadipatta, Shivga, Eliachi, Chandan, Chakraful, teel, Tulasi, Dalchini, Tamalpatra, Almond, Yashtimadhu, Ajwain, Ghee, Honey b. The Five Main Methods of Herbal Preparation					15

Course Code 23BU2CC606	Course Title Departmental Activities I			Credits 2	No. of lectures-60	
Course Outcomes						
On completion of this course, students will be able to:						
CO1	Apply basic academic and field-based skills to plan and execute a structured project or activity.					L3
CO2	Analyze information or data gathered during the activity to identify relevant patterns, issues, or insights.					L4
CO3	Interpret findings logically and connect them to the objectives of the project or activity.					L2
CO4	Communicate outcomes clearly through written reports, visual displays, or oral presentations.					L6
Grading will be as 3: High (>60%), 2: Moderate (40%-60%), 1: Low (<40%), 0: No mapping						
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	1	2	2
CO2	2	2	2	1	2	2
CO3	2	2	2	1	2	2
CO4	2	2	2	1	2	2
Description						
The learner can take departmental activity as one of the options as CC for 2 credits. In this course, the learner can participate in activities that are based on basic academics and help acquire field-based skills through planning and execution of activities of 60 Hrs. duration. The learner would be required to qualify the assessment where he /she would be required to communicate outcomes clearly, Interpret findings logically through written reports, visual displays, or oral presentations.						

References: Semester I

Books and References: 23BUMB1T01					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Prescott, Harley & Klein's Microbiology	Willey, Sherwood & Woolverton	McGraw-Hill	7 th	2008
2.	Microbiology	Michael J Pelczar Jr. E. C. S Chan Noel R. Krieg	Tata McGraw-Hill	5 th	1993
3	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4 th	2016

Books and References: 23BUMB1T02					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Prescott, Harley & Klein's Microbiology	Willey, Sherwood & Woolverton	McGraw-Hill	7 th	2008
2.	Microbiology	Michael J Pelczar Jr. E. C. S Chan Noel R. Krieg	Tata McGraw Hill	5 th	1993
3.	Fundamentals of Microbiology	Martin Frobisher Ronald Hinsdill Koby Crabtree Clyde GoodHeart	Thomson Learning	6 th	1957
4.	Fundamental Principles of Bacteriology	A J Salle	McGraw-Hill	2 nd	1943
5.	General Microbiology	Stanier, Ingraham, Wheelis & Painter	McMillan Press Ltd.	5 th	1987
6.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4 th	2016
7.	https://www.foldscope.com				

Books and References: 23BUMB1T05					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Prescott, Harley & Klein's Microbiology	Willey, Sherwood & Woolverton	McGraw-Hill	7 th	2008
2.	Microbiology	Michael J Pelczar Jr. E. C. S Chan	Tata McGraw Hill	5 th	1993

		Noel R. Krieg			
3.	Fundamentals of Microbiology	Martin Frobisher Ronald Hinsdill Koby Crabtree Clyde GoodHeart	Thomson Learning	6 th	1957
4.	General Microbiology	Stanier, Ingraham, Wheelis & Painter	McMillan Press Ltd.	5 th	1987
5.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4 th	2016

Books and References: 23BU1VSC02

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Code of Safety in Microbiological Laboratories	Bureau of Indian Standard	Published under the auspices of the Right to Information Act 2005	-	1987
2.	Prescott, Harley & Klein's Microbiology	Wiley, Sherwood & Woolverton	McGraw-Hill	7 th	2008
3.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4 th	2016

Books and References: 23BUIK1T02

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Yoga and Ayurveda: Self Healing and Self Realization	David Frawley	Motilal Banarsidass Publishing House	5 th	2022
2.	Everyday Ayurveda – a practical guide to healthy living	Danny Cavanagh & Carol Willis	Ayurveda UK	1 st	2004
3.	The Yoga of Herbs	Dr David Frawley & Dr Vasant Lad	Lotus Press	2 nd	1993
4.	New Perspectives in Stress Management	H. R. Nagendra & Dr.R. Nagarathna	Swami Vivekananda Yoga Prakashana	3 rd	1986

Semester II

Books and References: 23BUMB2T01					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Prescott, Harley & Klein's Microbiology	Willey, Sherwood & Woolverton	McGraw-Hill	7 th	2008
2.	Lehninger Principles of Biochemistry	D. Nelson & M. Cox	W H Freeman & Company	4 th	2005
3.	Biochemistry	Satyanarayana and Chakrapani	Books & Allied (P) Ltd	4 th	2017
4.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4 th	2016
5.	General Microbiology	Stanier, Ingraham, Wheelis & Painter	McMillan Press Ltd.	5 th	1987

Books and References: 23BUMB2T02					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Prescott, Harley & Klein's Microbiology	Willey, Sherwood & Woolverton	McGraw-Hill	7 th	2008
2.	Microbiology	Michael J Pelczar Jr. E. C. S Chan Noel R. Krieg	Tata McGraw Hill	5 th	1993
3.	General Microbiology	Stanier, Ingraham, Wheelis & Painter	McMillan Press Ltd.	5 th	1987
4.	Brock Biology of Microorganisms	Madigan, Martinko, Stahl & Clark	Benjamin Cummings	13 th	2012
5.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4 th	2016
6	Foundations in Microbiology	Kathleen Park Talaro & Arthur Talaro	McGraw Hill	4th	2002
7.	Microbiology: An Introduction	Tortora, Funke and Case	Adisson Wesley Longman Inc	10th	2010

Books and References : 23BUMB2T05					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Prescott, Harley & Klein's Microbiology	Willey, Sherwood & Woolverton	McGraw-Hill	7 th	2008
2.	Brock Biology of Microorganisms	Madigan, Martinko, Stahl & Clark	Benjamin Cummings	13 th	2012
3.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4 th	2016
4.	Foundations in Microbiology	Kathleen Park Talaro & Arthur Talaro	McGraw Hill	4 th	2002
5.	Microbiology: An Introduction	Tortora, Funke and Case	Adisson Wesley Longman Inc	10 th	2010
6.	Textbook of Microbiology	R. Ananthanarayan and J. Paniker's	Universities Press	10 th	2017

Books and References: 23BUIK2T02					
Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Yoga and Ayurveda: Self Healing and Self Realization	David Frawley	Motilal Banarsidass Publishing House	5 th	2022
2.	Everyday Ayurveda – a practical guide to healthy living	Danny Cavanagh & Carol Willis	Ayurveda UK	1 st	2004
3.	The Yoga of Herbs	Dr David Frawley & Dr Vasant Lad	Lotus Press	2 nd	1993

VPM's B.N. Bandodkar College of Science (Autonomous), Thane
Curriculum Structure for the Undergraduate Degree Programme F.Y.B.Sc Microbiology

	SEMESTER – I	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
Course Code	Major course title	EM	EN	SD	PE	GE	HV	ES
23BUMB1T01	Fundamental Microbiology I	-	-	-	-	-	-	-
23BUMB1T02	Fundamental Microbiology II	-	-	-	-	-	-	✓
23BUMB1P01	Practicals based on 23BUMB1T01 and 23BUMB1T02	-	-	✓	-	-	-	-
23BUMB1T05	Majestic Microbial World	-	-	-	-	-	-	✓
23BU1VSC02	Laboratory Techniques in Microbiology	-	-	✓	-	-	-	-
23BUIK1T02	Principles of Yoga for Body and Mind Management	-	-	✓	✓	✓	✓	-

	SEMESTER – II	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
Course Code	Major course title	EM	EN	SD	PE	GE	HV	ES
23BUMB2T01	Exploring Microbiology I	-	-	-	-	-	-	-
23BUMB2T02	Exploring Microbiology II	-	-	-	-	-	-	✓
23BUMB2P01	Practicals based on 23BUMB2T01 and 23BUMB2T02	-	-	✓	-	-	-	-
23BUMB2T05	Common diseases and their management	-	-	-	-	-	-	-
23BUIK2T02	Ayurveda for Healthy Lifestyle	-	-	✓	✓	✓	✓	-
23BU2CC606	Departmental Activities I	-	-	✓	✓	✓	✓	-