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 23BUMB1T01	Course Title Fundamental Microbiology I	Credits 2	No. of 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 functio· 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	• Methods and practices in microbiology lab • Good clinical practices, Standard operating procedures, good laboratory practices, good manufacturing practices, • Usage and maintenance of basic equipments in microbiology lab: principle, working and calibration • Biosafety norms, Working and significance of LAF • Documentation, 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 λmax 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**

Unit II **Microbial Growth**	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	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) b. **Rickettsia, Coxiella, Chlamydia, Mycoplasma:** general features, medical significance c. **Actinomycetes:** General features of Nocardia and Streptomyces Importance d. **Archaea:** Introduction- Major Archaeal physiological groups, Archaeal cell wall, lipids and membranes, Ecological importance e. **Protozoa:** Major Categories of Protozoa Based on motility, reproduction. Medically important Protozoa Life cycle of Entamoeba f. **Algae:** Characteristics of algae: morphology, Pigments, reproduction Cultivation of algae. Major groups of Algae –an overview. Algae. Differences between Algae and Cyanobacteria g. **Fungi and Yeast:** Characteristics: structure, Reproduction. Major fungal divisions- overview. h. **Slime molds and Myxomycetes**	**15**
Unit II Microbial interactions	a. **Types of Microbial Interactions**: Mutualism, Cooperation, Commensalism, Predation Parasitism, Amensalism, Competition b. **Microbial associations with vascular plants:** Phyllosphere, Rhizosphere & Rhizoplan; Plant pathogens c. **Applications** ● Biofertilizers: Mycorrhizae, Nitrogen fixation: Rhizobia, Stem nodulating Rhizobia Actinorhizae ● Biopesticides: *Bacillus thuringiensis* based ● PGPRs: Fungal & Bacterial endophytes d. **Two sides of a coin:** *Agrobacterium tumefaciens*	**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 *Rhizobium*	**3**
7	Enrichment and isolation of *Azotobacter*	**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: ● Respiratory tract infection: upper ● Gastrointestinal tract infection ● Urinary tract infections ● Skin 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	Participate actively in academic, laboratory-based, outreach, or skill-oriented departmental activities.	L2
CO2	Demonstrate teamwork, time management, and organizational skills while performing assigned activities.	L3
CO3	Relate the experience gained from departmental activities to fundamental concepts of biotechnology and allied sciences.	L2
CO4	Communicate and reflect on learning experiences through presentations, reports, or creative academic outputs.	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	7th	2008
2.	Microbiology	Michael J Pelczar Jr. E. C. S Chan Noel R. Krieg	Tata McGraw-Hill	5th	1993
3	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4th	2016

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

3.	Fundamentals of Microbiology	Martin Frobisher Ronald Hinsdill Koby Crabtree Clyde GoodHeart	Thomson Learning	6th	1957
4.	General Microbiology	Stanier, Ingraham, Wheelis& Painter	McMillan Press Ltd.	5th	1987
5.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4th	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	Willey, Sherwood & Woolverton	McGraw-Hill	7th	2008
3.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4th	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	5th	2022
2.	Everyday Ayurveda – a practical guide to healthy living	Danny Cavanagh & Carol Willis	Ayurveda UK	1st	2004
3.	The Yoga of Herbs	Dr David Frawley & Dr Vasant Lad	Lotus Press	2nd	1993
4.	New Perspectives in Stress Management	H. R. Nagendra & Dr.R. Nagarathna	Swami Vivekananda Yoga Prakashana	3rd	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	7th	2008
2.	Lehninger Principles of Biochemistry	D. Nelson & M. Cox	W H Freeman & Company	4th	2005
3.	Biochemistry	Satyanarayana and Chakrapani	Books & Allied (P) Ltd	4th	2017
4.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4th	2016
5.	General Microbiology	Stanier, Ingraham, Wheelis & Painter	McMillan Press Ltd.	5th	1987

Books and References: 23BUMB2T02

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Prescott, Harley & Klein's Microbiology	Willey, Sherwood & Woolverton	McGraw-Hill	7th	2008
2.	Microbiology	Michael J Pelczar Jr. E. C. S Chan Noel R. Krieg	Tata McGraw Hill	5th	1993
3.	General Microbiology	Stanier, Ingraham, Wheelis& Painter	McMillan Press Ltd.	5th	1987
4.	Brock Biology of Microorganisms	Madigan, Martinko, Stahl & Clark	Benjamin Cummings	13th	2012
5.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4th	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	7th	2008
2.	Brock Biology of Microorganisms	Madigan, Martinko, Stahl & Clark	Benjamin Cummings	13th	2012
3.	Microbiology: An Evolving Science	Slonczewski and Foster	Norton & Company, Inc.	4th	2016
4.	Foundations in Microbiology	Kathleen Park Talaro& Arthur Talaro	McGraw Hill	4th	2002
5.	Microbiology: An Introduction	Tortora, Funke and Case	Adisson Wesley Longman Inc	10th	2010
6.	Textbook of Microbiology	R. Ananthanarayan and J. Paniker's	Universities Press	10th	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	5th	2022
2.	Everyday Ayurveda – a practical guide to healthy living	Danny Cavanagh & Carol Willis	Ayurveda UK	1st	2004
3.	The Yoga of Herbs	Dr David Frawley & Dr Vasant Lad	Lotus Press	2nd	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	-	-	✓	✓	✓	✓	-