

Resolution No.: BOS/14.06.02023 /AC/26.06.2023

Bharatiya Vidya Bhavan's

**M. M. College of Arts, N.M. Institute of Science, H.R.J.
College of Commerce
(Bhavan's College) Autonomous**

(Affiliated to University of Mumbai)



NEP Syllabus for: F.Y. B.Sc. Microbiology

Program: B.Sc.

Program Code: BH. BSc

Course Code: (BH.USMB.Maj. 101)

with effect from academic year 2023-24

PREAMBLE

The world is undergoing rapid changes in the sphere of knowledge. With various scientific and technological advances, like increased automation, machine learning, and artificial intelligence, many unskilled jobs worldwide may be taken over by machines, while the need for a skilled workforce, particularly in the field of biological sciences will be in greater demand.

Microbiology is the study of microorganisms like bacteria, viruses, fungi, algae, cyanobacteria, protozoa that play an important role in health, agriculture, environment and industries. However, to provide more flexibility in the course curriculum and assigning credits based on the course contents and number of hours of teaching, Choice Based Credit System (CBCS) was introduced by the University of Mumbai on recommendations of the University Grants Commission (UGC) from the academic year 2016-2017.

The Choice Based Credit System (CBCS) curriculum for Microbiology at the undergraduate level has now been developed into a new system called Learning Outcome Curriculum Framework (LOCF) under the recommendations and guidance of University Grants Commission (UGC). LOCF aims to equip students with knowledge, skills, values, attitude, leadership and lifelong learning.

This National Education Policy 2020 is the first education policy of the 21st century and proposes the revision and refurbishing all aspects of the education structure, including its regulation and governance, to create a new system that is aligned with the aspirational goals of 21st century education.

The entire course of Bachelor of Science in Microbiology is revamped according to the guidelines prescribed under the NEP-2020 and the process of restructuring the F.Y.B.Sc syllabus according to the NEP-2020 was initiated for its implementation from academic year 2023-24. The first-year curriculum involves discipline specific core [DSC] subjects that cover the fundamental aspects of Microbiology and are all compulsory papers. Additionally, a Minor Subject course is designed to increase the expanse of the subject. Also, generic elective courses and skill-based courses would enable students to develop requisite skills in the areas of direct employability. The main aim behind designing this curriculum is to enable the students to select the courses of their choice depending on their interest.

PROGRAM OUTCOMES

A student opting this course will be able to: -

SR NO	PROGRAM OUTCOMES
PO 1	Understand the fundamental and applied concepts of Microbiology and its allied areas
PO 2	Demonstrate expertise in requisite laboratory skills and techniques that are required in various industries.
PO 3	Improve critical thinking & observation skills through diverse practicals involving varied aspects of microbes and their applications
PO 4	Inculcate the quality of team spirit by working cohesively in groups and demonstrate suitable scientific writing skills

PROGRAM SPECIFIC OUTCOMES

After successful completion of this course, every student will be able to: -

SR NO	PROGRAM SPECIFIC OUTCOMES	MAPPING OF PSO
PSO 1	Grasp and demonstrate requisite skill-set in handling microscope, staining techniques and other techniques required for microbial growth measurement	PAPER OF DSC & MINOR OF SEM I
PSO 2	Gain a thoughtful understanding and appreciate the significance of social work and community health care in India	vSEC OF SEM I & SEM II
PSO 3	Develop knowledge and expertise in understanding the principle and working of the basic analytical instruments	SEC OF SEM I
PSO 4	Explain the different requirements of microbes and develop understanding in their growth patterns on different culture media	PAPER I OF DSC OF SEM II
PSO 5	Grasp and explain basic concepts of genetics revolving around DNA and demonstrate proficiency in standard methods used for microbial control	PAPER OF MINOR OF SEM II
PSO 6	Classify different types of microbes and explain their use/applications in different areas like food, biotechnology, health and disease	MINOR OF SEM II
PSO 7	Develop a good understanding of basic practices used in mushroom cultivation and practically apply them for commercial purposes	SEC OF SEM II

SEMESTER-I

Subject - MICROBIOLOGY		Theory – 3 Credits & Practical – 1 Credits = 4 Credits	
Course Code BH.USMB.Maj.101		Course Title – MICROBIOLOGY & SYSTEMATICS	
Course Objectives This course is designed: - <ol style="list-style-type: none"> 1. To introduce the learner to the historical aspects and scope of microbiology 2. To introduce the learner to different types of microbes and their basic characteristics 3. To understand the impact of microbes on the society 4. To elucidate the working principle of different types of microscopy & staining techniques 5. To expose the learner to the basic instruments required in Microbiology laboratory 6. To understand the basic concepts of bacterial cell structure 7. To inculcate the concepts of bacterial growth and techniques for its measurement 			
Course Outcomes After completing this course, the learner will be able to: - <ol style="list-style-type: none"> 1. Explain characteristics of different types of microorganisms 2. Appreciate the diverse applications and role of microorganisms in day-to-day life 3. Demonstrate skill-set in handling basic light microscope 4. Grasp and demonstrate basic & special staining techniques 5. Demonstrate requisite hands-on expertise in basic techniques used for measurement of microbial growth 			
COURSE CREDITS – 4		CATEGORY - DSC	
PAPER CREDITS – 3		Paper Title – TECHNIQUES OF MICROBIOLOGY	No of Lec – 45 L
UNIT	SUB-UNIT	TOPICS	NO OF LEC
I		BACTERIAL CELL STRUCTURE	15
	2.1	Shape, size and arrangement of different bacterial cells	1L
	2.2	Structures external to bacterial cell wall a. Glycocalyx [capsule, slime layer & S-layer] b. Flagella [structure, types, synthesis] & Archaela c. Axial filaments a. Pili and Fimbriae	4L
	2.3	Bacterial Cell wall a. Structure of peptidoglycan b. Composition and characteristics of Gram positive and Gram-negative cell walls c. Atypical Cell wall a. Damage to cell wall [protoplast & spheroplast]	3L
	2.4	Structures internal to bacterial cell wall a. Structure and function of plasma membrane [fluid mosaic model] b. Concept of osmosis & effect of hypertonic solution, hypotonic solution & isotonic solution on bacterial cells c. Cytoplasm, Nucleoid and Ribosomes	5L

		a. Inclusions – Metachromatic granules, polysaccharide granules, lipid inclusions, sulphur granules, carboxysomes, Gas vacuoles & Magnetosomes	
	2.5	Endospores a. Formation of endospores b. Structural features and sporulation cycle c. Significance of endospores	2L
II			
BACTERIAL GROWTH & IT'S MEASUREMENT			
	2.1	Bacterial Growth a. Definition of bacterial growth, generation time b. Representation of growth using log ₁₀ value [significance] c. Microbial growth curve & its phases d. Synchronous and Diauxic growth	3L
	2.2	Methods of measurement of Microbial Growth a. Microscopic methods – DMC, Haemocytometer b. Cultural methods – Spread plate, pour plate method, MPN c. Indirect methods – turbidity, metabolic activity, dry weight	4L
	2.3	Factors affecting bacterial growth – Temperature, pH, Solute [salt and sugar], Heavy metals, UV light	3L
	2.4	Continuous culturing of bacteria a. Chemostat b. Turbidostat	2L
	2.5	Microbial growth in natural environments a. Biofilm formation b. Cell to cell communication	3L
III			
STAINS AND STAINING PROCEDURES			
	3.1	Stains and staining solutions • Dyes – definition, types, dichromatism, metachromatism • Types of dyes • Application of dyes as – biological stains, indicators, inhibitors, mutagens	7L
	3.2	• Principles and techniques of staining – intensifiers, mordants, fixatives, decolourisers Staining methods [Principle and method] • Simple staining: Monochrome and Negative staining • Differential staining: Gram's staining, Acid- fast staining • Special staining methods: Lipid granules, Endospore, Capsule, Cell wall, Metachromatic granule staining • Blood staining • Nuclear staining	8L
BH.USMB.Maj.P101:- Practicals based on Unit I and II [1 Credit]			
	1. Basic safety and Good Laboratory Practices in Microbiology Laboratory.		30L

	<ol style="list-style-type: none"> 2. Learning the basic techniques in Microbiology Laboratory – wrapping of petri plates and pipettes, plugging of tubes, biological waste disposal. 3. Preparation of McFarland Standards for determination of cell density 4. Direct Microscopic Count of bacterial cells by Breed’s Count 5. Enumeration of yeast cells by Hemacytometer [WBC and RBC squares] 6. Determination of viable count by surface spread method & pour plate method 7. Enumeration of coliforms in drinking water by MPN method 8. Study of bacterial motility by hanging drop method and TTC dye 9. Study of the effect of temperature, pH on bacteria 10. Study of oligodynamic action of heavy metals on microbes 11. Monochrome staining 12. Negative staining 13. Gram staining 14. Special staining: cell wall, lipid granules, metachromatic granules, demonstration of a capsule. 	
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REFERENCE BOOKS

1. Madigan Michael, Kelly Bender, Daniel Buckley, Matthew Sattley, David Stahl, Brock Biology of Microorganisms, 15th edition, 2019, Pearson Education
2. Prescott’s Microbiology, 8th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, 2009, McGraw Hill International Edition.
3. Prescott’s Microbiology, 10th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, 2017, McGraw Hill International Edition.
4. Tortora Gerard, Berdell Funke and Christine Case, Microbiology, an Introduction, 13th Edition, Pearson Education Inc, 2019.
5. R. Y. Stainier, J. Ingraham, M. Wheelis and P.R. Painter. General Microbiology. (2007) 5th Edition, Prentice Hall. New Jersey
6. Alfred Brown, Heidi Smith, Benson’s Microbiological Applications, 14th Edition, McGraw Hill Education, 2017
7. James Cappuccino and Chad Welsch, Microbiology, A Laboratory Manual, 12th Edition, Pearson Education. 2020.
8. J.D. Desai, Methods in Microbiology: Microscopy and Staining. (1980) Prashant Publication.
9. Sharma V.K. Techniques in Microscopy & Cell Biology. (1990) Tata McGraw Hill Publishing Company Ltd.

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PSO 6	Classify different types of microbes and explain their use/applications in different areas like food, biotechnology, health and disease	MINOR OF SEM
PSO 7	Develop a good understanding of basic practices used in mushroom cultivation and practically apply them for commercial purposes	vSEC OF SEM II

SEMESTER-I

Programme - CERTIFICATE		Year – FIRST	SEM –I [ONE]
Subject - MICROBIOLOGY		Theory – 3 Credits & Practical – 1 Credits = 4 Credits	
Course Code BH.USMB.Min.101		Course Title – FUNDAMENTALS OF MICROBIOLOGY	
<p>Course Objectives This course is designed: -</p> <ol style="list-style-type: none"> 8. To introduce the learner to the historical aspects and scope of microbiology 9. To introduce the learner to different types of microbes and their basic characteristics 10. To understand the impact of microbes on the society 11. To elucidate the working principle of different types of microscopy & staining techniques 12. To expose the learner to the basic instruments required in Microbiology laboratory 13. To understand the basic concepts of bacterial cell structure 14. To inculcate the concepts of bacterial growth and techniques for its measurement <p>Course Outcomes After completing this course, the learner will be able to: -</p> <ol style="list-style-type: none"> 6. Explain characteristics of different types of microorganisms 7. Appreciate the diverse applications and role of microorganisms in day-to-day life 8. Demonstrate skill-set in handling basic light microscope 9. Grasp and demonstrate basic & special staining techniques 10. Demonstrate requisite hands-on expertise in basic techniques used for measurement of microbial growth 			
COURSE CREDITS – 4		CATEGORY - MINOR	
PAPER – BH.USMB.Min. 101			
PAPER CREDITS – 3		Paper Title – FUNDAMENTALS OF MICROBIOLOGY	No of Lec – 45 L
UNIT	SUB- UNIT	TOPICS	No of Lec
I		HISTORY AND SCOPE OF MICROBIOLOGY	15L
	1.1	<p>Historical aspects of Microbiology</p> <ol style="list-style-type: none"> a. Discovery of Microscope & Microorganisms [Anton Van Leewenhoek and Robert Hooke] b. Aristotle’s notion of spontaneous generation c. Experiments of Redi, Spallanzani, Pasteur, & Tyndall to disprove theory of spontaneous generation d. Theory of biogenesis 	3L
	1.2	<p>Golden age of Microbiology - Contributions of Notable Scientists to Microbiology</p> <ol style="list-style-type: none"> a. Louis Pasteur [Fermentation & Pasteurization] b. Robert Koch [Koch’s Postulates, Germ theory of disease] c. Edward Jenner [Discovery of vaccination] d. Alexander Flemming [Discovery of Antibiotics] e. Martinus Beijerinck [Enrichment culture technique] 	3L

		f. Sergei Winogradsky [Soil Microbiology & N ₂ fixation]	
	1.3	Types of Microorganisms a. Carlos Linnaeus system of naming microorganisms b. Carl Woese's system of classification of microorganisms Study of differentiating characters of different microbes Bacteria, Archaea, Fungi, Protozoa, Algae, Viruses, Animal parasites [helminths]	4L
	1.4	Impact of Microbes on Human Society a. Beneficial role of Microbes – recycling vital elements, bioremediation, sewage treatment, insect pest control, production of biofuels, production of fermented foods & alcoholic beverages, probiotics, production of antibiotics & enzymes, human gut microflora & human health, biotechnology [rDNA technology & gene therapy] b. Harmful effects of Microbes – As agents of infectious diseases, food spoilage, biofilm formation, eutrophication	4L
	1.5	Different Branches of Microbiology [overview only] a. Bacteriology, Mycology, Parasitology b. Immunology, Virology c. Molecular genetics	1L
II		MICROSCOPY, STAINING & BASIC INSTRUMENTATION	15L
	2.1	Basic concepts of Microscopy a. Bending of light by prism b. Definition of magnification, resolution, refractive index c. Numerical aperture and oil immersion objective	2L
	2.2	Principle and Applications of different Microscopy b. Brightfield microscopy & Dark field microscopy c. Phase contrast microscopy & Fluorescence microscopy d. Electron Microscopy – SEM & TEM	4L
	2.3	Staining b. Preparation of smear c. Concept of smear fixation and types of fixations d. Types of dyes [acidic and basic dyes] and examples e. Simple staining – monochrome and negative staining f. Differential staining – Gram staining & Acid-fast staining g. Special Staining – Endospore, Capsule, Flagella staining, metachromatic granule staining	4L
	2.4	Principle and applications of basic instruments b. Autoclave c. Hot air oven d. Incubator e. Centrifuge f. Bacteria Proof Filtration g. Colorimeter [Beer and Lambert Law]	5L
III		EVOLUTION OF MICROORGANISMS AND MICROBIOLOGY	15L
		Biological entities studied by Microbiologists: Members of the Microbial world. ▪ Microbial Evolution-	8L

		<ul style="list-style-type: none"> ▪ Evidence for origin of life, RNA world, overview of history of Life on earth ▪ Evolution of the three domains of life ▪ Endosymbiotic origin of life ▪ Evolution of cellular Microbes ▪ Microbial species <ul style="list-style-type: none"> ○ Microbiology and its origin ● Microscopy and discovery of organisms ● Culture based methods ● Important events in development of Microbiology ○ Microbiology today & diverse applied fields of Microbiology to date. 	7L
		<p>BH.USMB.Min.P101:- Practicals based on Unit I,II and III [1 credit]</p> <ol style="list-style-type: none"> 1. Preparation of an assignment on the contribution of any one Scientist to Microbiology 2. Study of basic parts of a compound microscope and its handling 3. Studying the principle and applications of basic instruments viz autoclave, shaker, colorimeter, hot air oven, incubator, centrifuge 4. Sterilization of media and glassware by autoclave and checking the efficiency of an autoclave cycle by chemical indicator strips and biological indicators 5. Aseptic transfer technique – tube to tube & butt to plate 6. Verification of Beer and Lambert’s law using 5% CuSO₄ and 5% KMNO₄ 7. Study of principle and application of Phase contrast & Fluorescent microscopy 8. Preparation of a bacterial smear and its monochrome staining using crystal violet, malachite green, basic fuchsin 9. Negative staining of a bacterial smear by Nigrosin/India Ink dye 10. Gram staining of bacteria and identification of Gram nature and morphology 11. Special staining techniques – Capsule, endospore, and metachromatic granule 	30L
		<p>REFERENCE BOOKS</p> <ol style="list-style-type: none"> 1. Madigan Michael, Kelly Bender, Daniel Buckley, Matthew Sattley, David Stahl, Brock Biology of Microorganisms, 15th edition, 2019, Pearson Education 2. Prescott’s Microbiology, 8th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, 2009, McGraw Hill International Edition. 3. Prescott’s Microbiology, 10th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, 2017, McGraw Hill International Edition. 4. Tortora Gerard, Berdell Funke and Christine Case, Microbiology, an Introduction, 13th Edition, Pearson Education Inc, 2019. 5. R. Y. Stainier, J. Ingraham, M. Wheelis and P.R. Painter. General Microbiology. (2007) 5th Edition, Prentice Hall. New Jersey 6. Alfred Brown, Heidi Smith, Benson’s Microbiological Applications, 14th Edition, McGraw Hill Education, 2017 	

	7. James Cappuccino and Chad Welsch, Microbiology, A Laboratory Manual, 12 th Edition, Pearson Education. 2020.	
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NEP Syllabus for: F.Y.B.Sc Microbiology

Program: B.Sc.

Program Code: BH. BSc

Vocational /Skill enhancement course

Course Code: (BH.USMB.vSEC.101)

Semester – I

Basic Analytical Techniques

with effect from academic year 2023-24

**SEMESTER-I
DETAILED SYLLABUS**

Programme: Bachelor degree honour				Semester: I	
Teaching scheme				Evaluation Scheme (Theory)	
Lecture (Periods per week)	Practical (Periods per week per batch)	Tutorial (Periods per week per batch)	Credits (Theory + Practical)	Continuous Internal Assessment (CIA-I & II) (Marks - 40)	End Semester Examination (ESE) (Marks: 60)
03	02	Nil	3+1		

Any other information: Batch size for practical as prescribed by the University of Mumbai.

Pre-requisites & eligibility: As prescribed by the University of Mumbai.

Course	BASIC ANALYTICAL TECHNIQUES I	Course code:- BH.USMB.vSEC.101
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COURSE OBJECTIVES:

The course will focus on

- Details of Centrifugation, its types and applications
- Different types of microscopy with their working and principles
- Concepts of separation techniques and their applications

COURSE OUTCOMES:

At the end of the course students will

- be able to gain knowledge about process of centrifugation and detailed working
- be able to understand all concepts of microscopy with their applications
- To identify unknown samples by systematic analysis
 - To quantify samples, present in solutions by selecting appropriate methods
 - To isolate and identify samples present in a mixture, by various separation techniques

Detailed Syllabus: (per session plan)

Unit No.	Description	No of Lec – 45L
1	HYDRODYNAMIC TECHNIQUES	15L
	Principle, instrumentation, methods and application of adsorption and partition chromatography-Paper chromatography, Thin layer chromatography. Gel filtration chromatography, Affinity chromatography, Ion-exchange chromatography, HPLC.	3L
		3L
		4L
	Centrifugation- Principle, methods and applications of Ultra-centrifugation; differential and density gradient centrifugation.	3L
		2L

2	MICROSCOPY	15L
	2.1 Introduction (1L)	1L
	2.2 The light Microscopy- Basic components of light microscope- compound microscope, stereomicroscope	3L
	2.3 Contrast in the light microscope, optical sectioning	2L
	2.4 Laser scanning confocal microscope (LSCM)	3L
	2.5 The electron microscope-SEM, TEM	3L
	2.6 Fluorescence microscope.	3L
3	SPECTROPHOTOMETRIC TECHNIQUES	15L
	Principle, instrumentation, and applications of UV-Visible, Infra-red and Fluorescence spectroscopy. Matrix assisted LASER desorption/ionization- time of flight-mass spectroscopy (MALDI-TOF MS).Flow cytometry and applications.	1L 3L 5L
	Methods for studying the structure of macromolecules- X Ray crystallography, Nuclear magnetic resonance spectroscopy (NMR), Electron Spin Resonance (ESR).	1L 2L 3L

BH.USMB.vSEC.P101 :- Practical: Credits :- 01 No. of lectures :- 30

1. Spectrophotometric experiments:

Determination of UV-Visible spectrum of compounds

2. Quantitative Analysis-

Quantitative estimation of reducing sugars by Dinitrosalicylic acid method
Estimation of protein by biuret method.

3. Chromatographic techniques

Separation of amino acids by Paper chromatography
Separation of Plant pigments/lipids/sugars by Thin layer chromatography

4. Density Gradient centrifugation.

5. Study different parts of Microscope

Observation of Microorganism in stained & unstained preparation

Reference Books:

1. Wilson, K., & Walker, J. (Eds.). (2000). *Principles and techniques of practical biochemistry*. Cambridge University Press.
2. Willey, J. M., Sherwood, L., & Woolverton, C. J. (2011). *Prescott's microbiology* (Vol. 7). New York: McGraw-Hill.
3. Sharma, B. K. (1981). *Instrumental methods of chemical analysis*. Krishna Prakashan Media.
4. Jayaraman, J., & Jayaraman, J. (1981). *Laboratory manual in biochemistry* (pp. 75-76). Delhi, India.: Wiley Eastern.
5. Introductory Practical Biochemistry, S. K. Sawhney & Randhir Singh (eds) Narosa Publishing House, New Delhi, ISBN 81-7319-302-9, P195-303
6. Standard Methods of Biochemical Analysis, S.K. Thimmaiah (ed), Kalyani Publishers, Ludhiana ISBN 81-7663-067-5, p 12-18
7. Hawk's Physiological Chemistry, Bernard L.Oser(ed) TATA McGraw Hill Publishing Company LTD, New Delhi, p 60-127, 1317-1334

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Public Health & Social Service-I

with effect from academic year 2023-24

Programme - CERTIFICATE		Year – FIRST	SEM-I [ONE]
Subject - MICROBIOLOGY		Theory – 3 Credits & Practical’s – 1 Credit = 4 Credits	
Course Code BH.USMB.OE.101		Course Title – PUBLIC HEALTH & SOCIAL SERVICE - I	
<p>Course Objectives This course is designed: -</p> <ol style="list-style-type: none"> 1. To introduce the concept of social service to the learners 2. To make the learner aware about the significance of social work at practice 3. To introduce the concepts of public health and community health care in India 4. To make the learner aware about the importance of family health 5. To orient students towards outbreak investigation and introduce natural and man-made disasters and mitigation principles <p>Course Outcomes After completing this course, the learner will be able to: -</p> <ol style="list-style-type: none"> 1. Explain the social service and its process 2. Understand and comprehend significance of social work at practice 3. Elucidate the concepts of public health and community health care in India 			
COURSE CREDITS – 3		CATEGORY - OE	
PAPER – BH.USMB.OE.101		Paper Title –PUBLIC HEALTH & SOCIAL SERVICE-I	
PAPER CREDITS – 3			No of Lec. – 45L
UNIT	SUB- UNIT	TOPICS	No of Lec
I		BASICS OF SOCIAL WORK AND PRACTICE	15L
	1.1	<p>Social Work</p> <ol style="list-style-type: none"> a. Meaning and definition of social work b. History of social work c. Scope of social work d. Objectives of social work e. Functions of social work f. Methods of social work 	4L
	1.2	Social work process - Assessment, Relationship building, Contract for work, Implementation, Termination, Evaluation	2L
	1.3	<p>Social Work Practice</p> <ol style="list-style-type: none"> a. Different roles of a social worker b. Social work with individuals, families, groups, organizations, community. c. Social work values - NASW code of ethics – respect for individual dignity, confidentiality, advocacy, accountability, respect for religious beliefs, promoting social and economic justice 	4L
	1.4	Significance of social work at work place, schools, juvenile & criminal justice, family planning, people with physical and mental disabilities, medical social work	3L

	1.5	Social reformers in India and their contributions Dr Babasaheb Ambedkar, Savitribai Phule	2L
II		INTRODUCTION TO PUBLIC HEALTH – PART I	15L
	2.1	Basic concepts of public health a. Definition and general concepts in public health and community medicine b. Founders of modern public health and community medicine	2L
	2.2	Theories of Disease Causation 1. Germ theory and epidemiological triad 2. Beings model of Disease Causation 3. Theory of Web of Causation 4. Epidemiological Wheel Theory 5. Iceberg Phenomena in Human Diseases	4L
	2.3	Public health & Community Healthcare in India a. Organization of health care in India b. Health planning process in India c. National Rural Health Mission d. Reproductive and child health programme e. Revised National Tuberculosis Control Programme f. Polio Immunization Program g. National AIDS control program	6L
	2.4	Family Health a. Maternal and child health b. Care of infants c. School health services d. Adolescent health e. Preventive health care of elderly	3L
III		PUBLIC HEALTH IN OUTBREAKS	15L
	3.1	1. Disease outbreaks in India	5L
	3.2	2. Outbreak investigation	5L
	3.3	3. Epidemic control in India; integrated disease surveillance, legislation for the control of outbreak in India, international health regulations	5L
Practicals	I,II & III	Survey / Report	30L
Credit -1			
		REFERENCE BOOKS 1. Prasad, R.: Social Reforms: An Analysis of Indian Society, Y. K. Publishers, Agra, 1990. 2. Caroline Hodges Persell: Understanding Society: An Introduction to Sociology; 1984. Cambridge, Harper & Row Publishers. 3. Ahuja R.: Social Problems in India, Rawat Publication, Jaipur, 1992, 1999. 4. Liddie, J. & Joshi, R.: Daughters of Independence Gender, Caste and Class in India, Kali for Women, 1986. 5. Johnson, Louise C.: Social Work Practice: A Generalist Approach, 1995. 6. Wadia, A. R. (ed): History and Philosophy of Social Work in India, Bombay: Allied Publishers Pvt. Ltd., 1961. 7. Konopka, Gisel: Group Work in the Institution Association 1970	

<ol style="list-style-type: none">8. Trecker, H. B.: Social Work Administration, Principles and Practices, Association Press, New York, 1971.9. Chopra D: Social Work and Social Welfare, Sonali Publications, 201210. Zastraw C. Introduction to Social Work and Social Welfare, 12th Edition, 201511. Nayak D. History, Philosophy and Fields of Social Work, 201212. Agarwal S <i>et al</i>, Textbook of Public Health and Community medicine, AFMC Department of Community Medicine, Gayo Enterprises, 200913. Taori, K (2005) Disaster Management through Panchayati Raj, Concept Publishing Company, New Delhi.14. Roy, P.S. (2000): Space Technology for Disaster management: A Remote Sensing & GIS Perspective, Indian Institute of Remote Sensing (NRSA) Dehradun.15. Sharma, R.K. & Sharma, G. (2005) (ed) Natural Disaster, APH Publishing Corporation, New Delhi.	
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Bharatiya Vidya Bhavan's

**M. M. College of Arts, N.M. Institute of Science, H.R.J.
College of Commerce
(Bhavan's College) Autonomous**

(Affiliated to University of Mumbai)



NEP Syllabus for: F.Y.B.Sc Microbiology

Program: B.Sc.

Program Code: BH. BSc

Course Code: (BH.USMB.VEC.101)

MICROBIOLOGY FOR ECOLOGICAL SUSTAINABILITY -I

with effect from academic year 2023-24

Programme - CERTIFICATE		Year – FIRST	SEM-I [ONE]
Subject - MICROBIOLOGY		Theory – 3 Credits	
Course Code BH.USMB.VEC.101		Course Title – MICROBIOLOGY FOR ECOLOGICAL SUSTAINABILITY-1	
Course Objectives This course is designed: - <ol style="list-style-type: none"> 1. To introduce students to the concept of microbial diversity and its importance in India. 2. To explore the different ecosystems in India and the microbial communities inhabiting them. 3. To examine the ecological roles and functional diversity of microorganisms in Indian ecosystems. 			
Course Outcomes After completing this course, the learner will be able to: - <ol style="list-style-type: none"> 4. Explain the importance of microorganism 5. Understand microbial community 6. Elucidate the concepts of ecological role of microorganisms in India 			
COURSE CREDITS – 2		CATEGORY - VAC	
PAPER – BH.USMB.VEC.101		Paper Title – MICROBIOLOGY FOR ECOLOGICAL SUSTAINABILITY-1	
PAPER CREDITS – 2			No of Lec – 30L
UNIT	SUB- UNIT	TOPICS	No of Lec
I		Introduction to microbial diversity	15L
	1.1	CAVE MICROBIOME :- g. Microbial Diversity in Caves h. Viral Diversity i. Bacterial and Archaeal Diversity j. Fungal Diversity k. Bioprospection of Cave Microbes l. Moonmilk Microbiome as Source of Novel Compounds m. Importance of Cave Microbes in Production of Industrially Important Enzymes and Pigments n. Antimicrobial and Anticancer Activities of Cave Microbes	8L
	1.2	<u>Microbial Diversity of the Sundarbans, the World’s Largest Tidal Mangrove Forest –</u> a. Bacterial Diversity b. Cyanobacterial Diversity c. Fungal Diversity d. Archaeal Diversity	7L
II		ACTINOBACTERIA FROM INDIAN MANGROVE ECOSYSTEMS	15L
	2.1	c. Actinobacteria d. Marine Actinobacteria	15L

		e. Mangrove Ecosystems f. Indian Mangrove Ecosystems g. Diversity of Actinobacteria in Indian Mangrove Ecosystems h. Role of Actinobacteria in Mangrove Environment i. Bioprospecting Potential of Indian Mangrove Actinobacteria j. Antifouling Potentials of Indian Mangrove Actinobacteria	
		REFERENCE BOOKS 16. Microbial Diversity in Ecosystem Sustainability and Biotechnological Applications, Volume 2. Soil & Agroecosystems, Tulasi Satyanarayana, Subrata Kumar Das, Bhavdish Narain Johri, Springer Publications	

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NEP Syllabus for: F.Y.B.Sc Microbiology

Program: B.Sc.

Program Code: BH. BSc.

Course Code: (BH.USMB.IKS.101)

INDIAN KNOWLEDGE SYSTEM

with effect from academic year 2023-24

Programme - CERTIFICATE		Year – FIRST	SEM-I [ONE]
Subject - MICROBIOLOGY		Theory – 2 Credits	
Course Code BH.USMB.IKS.101		Course Title – INDIAN KNOWLEDGE SYSTEM	
Course Objectives This course is designed: - 1. To introduce the concept of Indian Knowledge system to the students 2. To understand the water management system in historical sites			
Course Outcomes After completing this course, the learner will be able to: - 1. Comprehend different water management systems in historical sites 2. Understand and explain the various terminologies and concepts related to Indian traditions			
COURSE CREDITS – 2		CATEGORY - IKS	
PAPER – 101		Paper Title – INTRODUCTION TO INDIAN KNOWLEDGE SYSTEM	
CREDITS – 2			No of Lec – 30L
UNIT	SUB- UNIT	TOPICS	No of Lec
I		Overview of IKS	15L
	1.1	Survey of IKS Domains: A broad overview of disciplines included in the IKS, and historical developments.	15L
	1.2	Sources of IKS knowledge, classification of IKS texts, a survey of available primary texts, translated primary texts, and secondary resource materials. Differences between a sutra, bhashya, karika, and vartika texts. Fourteen/eighteen vidyasthanas, tantrayukti	
	1.3	Vocabulary of IKS: Introduction to Panchamahabhutas, concept of a sutra, introduction to the concepts of non-translatables (Ex. dharma, punya, aatma, karma, yagna, shakti, varna, jaati, moksha, loka, daana, itihaasa, puraana etc.) and importance of using the proper terminology. Terms such as praja, janata, loktantra, prajatantra, ganatantra, swarjya, surajya, rashtra, desh,	
II		Microbiological Knowledge w.r.t. Water Management and Transportation	15L
	2.1	Harappan and Traditional Water Management System of Gujarat	15L
	2.2	Historical Sites- Sringeverpur, South Indian Water Management System, Western Ghats Cave- Kanheri, etc.	
	2.3	Communities Involved in Water Management	
REFERENCE BOOKS 1. An Introduction to Indian Knowledge Systems: Concepts and Applications, B Mahadevan, V R Bhat, and Nagendra Pavana R N; 2022 (Prentice Hall of India). 2. Indian Knowledge Systems: Vol I and II, Kapil Kapoor and A K Singh; 2005 (D.K. Print World Ltd).			

	<p>3. The Beautiful Tree: Indigenous India Education in the Eighteenth Century, Dharampal, Biblia Impex, New Delhi, 1983. Reprinted by Keerthi Publishing House Pvt Ltd., Coimbatore, 1995.</p> <p>4. Indian Science and Technology in the Eighteenth Century, Dharampal. Delhi: Impex India, 1971. The British Journal for the History of Science.</p> <p>5. The Wonder That Was India, Arthur Llewellyn Basham, 1954, Sidgwick & Jackson.</p> <p>6. The India they saw series (foreigner visitors on India in history from 5CE to 17th century), Ed. Meenakshi Jain and Sandhya Jain, Prabhat Prakashan</p>	
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Resolution No.: BOS/14.06.02023 /AC/26.06.2023

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NEP Syllabus for: F.Y. B.Sc. Microbiology

Program: B.Sc.

Program Code: BH. BSc

Course Code: (BH.USMB.Maj. 201)

with effect from academic year 2023-24

PREAMBLE

The world is undergoing rapid changes in the sphere of knowledge. With various scientific and technological advances, like increased automation, machine learning, and artificial intelligence, many unskilled jobs worldwide may be taken over by machines, while the need for a skilled workforce, particularly in the field of biological sciences will be in greater demand.

Microbiology is the study of microorganisms like bacteria, viruses, fungi, algae, cyanobacteria, protozoa that play an important role in health, agriculture, environment and industries. However, to provide more flexibility in the course curriculum and assigning credits based on the course contents and number of hours of teaching, Choice Based Credit System (CBCS) was introduced by the University of Mumbai on recommendations of the University Grants Commission (UGC) from the academic year 2016-2017.

The Choice Based Credit System (CBCS) curriculum for Microbiology at the undergraduate level has now been developed into a new system called Learning Outcome Curriculum Framework (LOCF) under the recommendations and guidance of University Grants Commission (UGC). LOCF aims to equip students with knowledge, skills, values, attitude, leadership and lifelong learning.

This National Education Policy 2020 is the first education policy of the 21st century and proposes the revision and refurbishing all aspects of the education structure, including its regulation and governance, to create a new system that is aligned with the aspirational goals of 21st century education.

The entire course of Bachelor of Science in Microbiology is revamped according to the guidelines prescribed under the NEP-2020 and the process of restructuring the F.Y.B.Sc syllabus according to the NEP-2020 was initiated for its implementation from academic year 2023-24. The first-year curriculum involves discipline specific core [DSC] subjects that cover the fundamental aspects of Microbiology and are all compulsory papers. Additionally, a Minor Subject course is designed to increase the expanse of the subject. Also, generic elective courses and skill-based courses would enable students to develop requisite skills in the areas of direct employability. The main aim behind designing this curriculum is to enable the students to select the courses of their choice depending on their interest.

PROGRAM OUTCOMES

A student opting this course will be able to: -

SR NO	PROGRAM OUTCOMES
PO 1	Understand the fundamental and applied concepts of Microbiology and its allied areas
PO 2	Demonstrate expertise in requisite laboratory skills and techniques that are required in various industries.
PO 3	Improve critical thinking & observation skills through diverse practicals involving varied aspects of microbes and their applications
PO 4	Inculcate the quality of team spirit by working cohesively in groups and demonstrate suitable scientific writing skills

PROGRAM SPECIFIC OUTCOMES

After successful completion of this course, every student will be able to: -

SR NO	PROGRAM SPECIFIC OUTCOMES	MAPPING OF PSO
PSO 1	Grasp and demonstrate requisite skill-set in handling microscope, staining techniques and other techniques required for microbial growth measurement	PAPER OF DSC & MINOR OF SEM I
PSO 2	Gain a thoughtful understanding and appreciate the significance of social work and community health care in India	vSEC OF SEM I & SEM II
PSO 3	Develop knowledge and expertise in understanding the principle and working of the basic analytical instruments	SEC OF SEM I
PSO 4	Explain the different requirements of microbes and develop understanding in their growth patterns on different culture media	PAPER I OF DSC OF SEM II
PSO 5	Grasp and explain basic concepts of genetics revolving around DNA and demonstrate proficiency in standard methods used for microbial control	PAPER OF MINOR OF SEM II
PSO 6	Classify different types of microbes and explain their use/applications in different areas like food, biotechnology, health and disease	MINOR OF SEM II
PSO 7	Develop a good understanding of basic practices used in mushroom cultivation and practically apply them for commercial purposes	SEC OF SEM II

SEMESTER –II

Programme - CERTIFICATE	Year – FIRST	SEM –II [TWO]
Subject - MICROBIOLOGY	Theory – 3 Credits & Practicals – 1 Credits = 4 Credits	
Course Code BH.USMB.Maj.201	Course Title – MICROBIAL NUTRITION & DIVERSITY	
<p>Course Objectives This course is designed to:-</p> <ol style="list-style-type: none"> 1. Introduce the requirements for microbial cultivation 2. Make the learner aware about the different types of culture media 3. Introduce the methods used to cultivate and study microbes 4. Understand different types of microbes and their peculiar characteristics 5. Understand the basic concepts of microbial genetics 6. Introduce different methods to control microbes in laboratory <p>Course Outcomes After completing this course, the learner will be able to: -</p> <ol style="list-style-type: none"> 1. Explain the requirements for microbial cultivation 2. Formulate the different types of culture media along with their growth patterns 3. Demonstrate strong practical expertise on the basic cultivation methods 4. Comprehend different types of microbes and explain their peculiar characteristics 5. Explain the basic concepts of genetics, DNA replication and bioinformatics 6. Demonstrate proficiency in the different methods used in controlling microbes in lab 		
COURSE CREDITS – 4		CATEGORY - DSC
PAPER CREDITS – 3		Paper Title – MICROBIAL NUTRITION & DIVERSITY
		No of Lec – 45L
UNIT	SUB- UNIT	TOPICS
		No of Lec
I		BASIC PRINCIPLES OF MICROBIAL NUTRITION AND CULTIVATION
	1.1	Basic physiological functions of elements • Macronutrients & micronutrients Major nutritional types of organisms
	1.2	Basic requirements of microbial nutrition a. Carbon, hydrogen, oxygen and electrons b. Nitrogen, phosphorous, sulphur and growth factors
	1.3	Introduction to Culture media a. Definition of culture medium, inoculum and culture b. Types of culture media – defined & complex medium c. Common ingredients of a culture medium Functional types of culture media a. General purpose medium – Tryptic Soy broth b. Selective & differential media – MacConkey agar, SMA, EMB agar c. Enriched medium – Blood Agar d. Enrichment medium – Selenite F broth
		15L
		1L
		2L
		5L

		e. Indicator medium – Wilson and Blair medium f. Anaerobic media – Robertson’s cooked meat medium	
	1.4	Methods of Cultivation of Microbes a. Isolation of pure cultures - Streak plate method, Stab culture, stroke culture, lawn culture b. Anaerobic culture methods – vacuum desiccation, candle & jar method, McIntosh & Filde’s Jar, Gaspak, thioglycolate medium Cultural characteristics of bacteria a. Colony characteristics on solid medium b. Cultural characters on slant and in liquid medium c. Morphological and staining reactions	5L
	1.5	Preservation techniques a. Storage at reduced temperature [agar slants, cryopreservation] b. Storage in dehydrated forms [dried culture, lyophilization]	2L
II		MICROBIAL DIVERSITY -I	15
	2.1	2.1.1 Viruses- Historical highlights, general properties of virus, virion structure- helical capsids, icosahedral capsids, capsids with complex symmetry, viral envelope and enzymes, viral genomes (RNA/DNA), types of viral infections, prions. 2.1.2 Protozoa- Introduction, nutrition, morphology, Free-living & symbiotic protozoans. Major classes of protozoa, Reproduction, classification (tabular form), ecological and medical importance of protozoa	7L 8L
III		Microbial Diversity - II	15L
	3.1	Actinomycetes: Characteristics of actinomycetes, major groups (in brief), applications.	5L
	3.2	Algae- Characteristics, Morphology, Pigments, Reproduction and cultivation of algae, Overview of Major groups of algae, Biological, Medical and economic importance of algae, classification (tabular form). Cyanobacteria	5L
	3.3	Fungi & Yeast- Distribution, Importance, Structure, Reproduction, Nutrition, Metabolism, Characteristics of fungal divisions (Tabular form), Lifecycle of <i>S. cerevisiae</i> , Lifecycle of Rhizopus	5L
		BH.USMB.Maj.P201 :- Practicals based on Unit I and II [1 Credit] 1. Preparation of a culture medium [broth, agar, slant, butt] 2. Study the effect of different media components on bacterial growth 3. Isolation of pure culture & mixed culture on general purpose medium 4. Isolation of bacteria on selective and differential media – MacConkey agar and Salt Mannitol Agar 5. Isolation of yeast on Sabouraud’s agar and Potato Dextrose Agar 6. Wet mount of hay infusion and pond water for observing bacteria, algae and protozoa 7. Isolation of actinomycetes from soil 8. Permanent slides of Cyanobacteria 9. Slide culture of moulds	30L

	<p>10. Study of <i>Aspergillus</i>, <i>Penicillium</i>, <i>Mucor</i>, <i>Rhizopus</i> by lactophenol cotton blue wet mount</p> <p>11. Demonstration of a bacteriophage.</p>	
	<p>REFERENCE BOOKS</p> <ol style="list-style-type: none"> 1. Madigan Michael, Kelly Bender, Daniel Buckley, Matthew Sattley, David Stahl, Brock Biology of Microorganisms, 15th edition, 2019, Pearson Education 2. Jacquelyn G. Black, Microbiology Principles and Explorations, 9th edition, 2015, Wiley & Sons Inc 3. Prescott's Microbiology, 8th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, 2009, McGraw Hill International Edition. 4. Prescott's Microbiology, 10th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, 2017, McGraw Hill International Edition. 5. R. Y. Stainier, J. Ingraham, M. Wheelis and P.R. Painter. General Microbiology. (2007) 5th Edition, Prentice Hall. New Jersey 6. Alfred Brown, Heidi Smith, Benson's Microbiological Applications, 14th Edition, McGraw Hill Education, 2017 7. James Cappuccino and Chad Welsch, Microbiology, A Laboratory Manual, 12th Edition, Pearson Education. 2020. 8. Microbiology, Michael J. Pelczar, Jr., E.C.S. Chan, Noel R. Krieg. 	

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NEP Syllabus for: F.Y.B.Sc Microbiology

Program: B.Sc.

Program Code: BH. BSc

Course Code: (BH.USMB.Min.201)

with effect from academic year 2023-24

PREAMBLE

The world is undergoing rapid changes in the sphere of knowledge. With various scientific and technological advances, like increased automation, machine learning, and artificial intelligence, many unskilled jobs worldwide may be taken over by machines, while the need for a skilled workforce, particularly in the field of biological sciences will be in greater demand.

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SR NO	PROGRAM OUTCOMES
PO 1	Understand the fundamental and applied concepts of Microbiology and its allied areas
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PO 3	Improve critical thinking & observation skills through diverse practicals involving varied aspects of microbes and their applications
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PROGRAM SPECIFIC OUTCOMES

After successful completion of this course, every student will be able to: -

SR NO	PROGRAM SPECIFIC OUTCOMES	MAPPING OF PSO
PSO 1	Grasp and demonstrate requisite skill-set in handling microscope, staining techniques and other techniques required for microbial growth measurement	PAPER I & II OF DSC & MINOR OF SEM I
PSO 2	Gain a thoughtful understanding and appreciate the significance of social work and community health care in India	VSC OF SEM I & SEM II
PSO 3	Develop knowledge and expertise in understanding the principle and working of the basic analytical instruments	vSEC OF SEM I
PSO 4	Explain the different requirements of microbes and develop understanding in their growth patterns on different culture media	PAPER I OF DSC & MINOR OF SEM II
PSO 5	Grasp and explain basic concepts of genetics revolving around DNA and demonstrate proficiency in standard methods used for microbial control	PAPER II OF DSC & MINOR OF SEM II
PSO 6	Classify different types of microbes and explain their use/applications in different areas like food, biotechnology, health and disease	MINOR OF SEM
PSO 7	Develop a good understanding of basic practices used in mushroom cultivation and practically apply them for commercial purposes	vSEC OF SEM II

SEMESTER –II

PAPER – BH.USMB.Min.201		Theory – 3 Credits & Practical – 1 Credits = 4 Credits	
PAPER CREDITS – 3		Paper Title – MICROBIAL CONTROL & INTRODUCTION TO GENETICS	No of Lec – 45 L
UNIT	SUB-UNIT	TOPICS	NO OF LEC
I		CONTROL OF MICROORGANISMS	15L
	2.1	Definition of frequently used terms and patterns of microbial death	1L
	2.2	Factors affecting effectiveness of antimicrobial agents Mode of action of chemical agents	2L
	2.3	Physical methods of microbial control a. Heat b. Low temperature – refrigeration, freezing c. Drying, freeze-drying d. Filtration e. High pressure –ultra sonic waves f. Osmotic pressure g. Radiations	5L
	2.4	Chemical methods of microbial control a. Soaps and detergents b. Acids & alkalis c. Heavy metals d. Halogens e. Alcohols f. Phenols g. Oxidizing agents h. Alkylating agents i. Dyes j. Sterilizing gases k. Other agents	5L
	2.5	Evaluation of effectiveness of chemical agents a. Phenol coefficient test b. Filter paper method c. Use dilution test	2L
II		INTRODUCTION TO MICROBIAL GENETICS & BIOINFORMATICS	15
	2.1	Basic concepts of genetics a. Definition of genetics, genome, chromosome, gene b. Sub-disciplines of genetics c. Flow of genetic information [Central Dogma of Life]	1L
	2.2	DNA as a genetic material a. Griffith’s transformation experiment b. Avery’s experiment c. Structure and composition of DNA [Watson and Crick’s Model] d. Organization of DNA in viral, procaryotic & eukaryotic chromosomes	3L

	2.3	Structure of Chromatin a. Role of histones and nonhistones, nucleosome, solenoid model b. Structure of Euchromatin and Heterochromatin	2L
	2.4	DNA replication a. Replication machinery b. Enzymes required for replication c. Events at replication fork d. Termination of replication	4L
	2.4	RNA a. RNA as genetic material in viruses b. Structure of RNA c. Types of RNA & significance – mRNA, rRNA, tRNA	3L
	2.5	Introduction to bioinformatics a. Definition of bioinformatics, genomics, proteomics, metabolomics b. Basics of other bioinformatics databases NCBI/PDB/DDBJ c. Components of NCBI nucleotide database d. Retrieval of sequence from NCBI nucleotide database	2L
III		MICROBIAL GROWTH AND PRESERVATION	15L
	3.1	<ul style="list-style-type: none"> ▪ Definition of growth, Binary fission ▪ Fts proteins and cell division ▪ MreB and cell morphology ▪ Population growth, Mathematics of Growth ▪ Growth cycle- phases of bacterial growth 	7L
	3.2	Measurement of growth: <ul style="list-style-type: none"> ▪ Measurement of cell numbers- counting chambers, viable count, spectrophotometric measurement ▪ Measurement of cell mass. ▪ Synchronous culture technique ▪ Preservation of microorganisms 	8L
	BH.USMB.Min P 201Practicals based on Unit I,II and III [1 Credit]		
	<ol style="list-style-type: none"> 1. Study of Bacteria proof filtration (Demonstration) 2. Effect of UV radiation on bacteria 3. Evaluation of alcohol and study of its effectiveness as an antiseptic 4. Effect of osmotic pressure and desiccation of bacteria 5. Effect of phenolics and other disinfectants used at home on microbes by paper disc method 6. Qualitative detection of RNA by colorimetric method 7. Determination of MIC and MBC of a disinfectant by tube method 8. Isolation of genomic DNA from <i>E. coli</i>/Onion and its detection by DPA method 9. Assignment on bioinformatics [NCBI] 10. Growth curve of <i>E.coli</i> 11. Total viable count – Pour Plate and Spread Plate method 12. DMC- Haemocytometer, Breed’s Count, McFarland standards for cell number determination. 		30L
	REFERENCE BOOKS		

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|--|
| <ol style="list-style-type: none">1. Madigan Michael, Kelly Bender, Daniel Buckley, Matthew Sattley, David Stahl, Brock Biology of Microorganisms, 15th edition, 2019, Pearson Education2. Jacquelyn G. Black, Microbiology Principles and Explorations, 9th edition, 2015, Wiley & Sons Inc3. Prescott's Microbiology, 8th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, 2009, McGraw Hill International Edition.4. Prescott's Microbiology, 10th Edition; Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, 2017, McGraw Hill International Edition.5. Peter Russel, iGenetics – A Molecular Approach, 3rd edition, 2010, Pearson Education Inc6. Mukhopadhyay C, R. Choudhary, M, Iquebal, Basic and Applied Bioinformatics, 2018, Wiley & Sons Inc7. Introduction to bioinformatics, Attwood T.K., Parry- Smith D.J., Phukan Samiron, Pearson Education 2007 |
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NEP Syllabus for: F.Y. B.Sc. Microbiology

**Program: B.Sc.
Program Code: BH. BSc.**

Vocational /Skill enhancement course

Course Code: (BH.USMB.vSEC.201)

Semester-II

with effect from academic year 2023-24

Programme – CERTIFICATE		Year – FIRST	Semester – II [TWO]
Subject - MICROBIOLOGY		Theory – 3 Credits; Practical – 1 Credit = 4 Credits	
Course Code BH.USMB.vSEC 201		Course Title – MUSHROOM CULTIVATION	
<p>Course Objectives This course is designed: -</p> <ol style="list-style-type: none"> To introduce the types of mushrooms to the learner along with its life cycle To understand the different techniques of mushroom cultivation To understand the post-harvest control and benefits of mushroom <p>Course Outcomes After completing this course, the learner will be able to: -</p> <ol style="list-style-type: none"> Demonstrate skills to identify edible and poisonous mushrooms and establish a mushroom cultivation enterprise. Develop a good understanding of nutritional aspects and commercial use of mushrooms for human consumption. Develop a very good understanding of practical cultivation of mushrooms, management of diseases affecting mushrooms, mushroom harvesting and various avenues for using it into an entrepreneurship 			
COURSE CREDITS – 4		CATEGORY – vSEC	
PAPER – I			
PAPER CREDITS – 3		Paper Title – MUSHROOM CULTIVATION & TRADING	No of Lec – 45L
UNIT	SUB-UNIT	TOPICS	
I		INTRODUCTION TO MUSHROOMS & ECOLOGY	15L
	1.1	<p>Introduction</p> <ol style="list-style-type: none"> Morphology, Classification and identification of edible & non-edible/poisonous mushroom History and scope of mushroom cultivation Nutritional and Medicinal value of mushroom Therapeutic aspects- antitumor effect, antiviral value, antibacterial effect, antifungal effect 	8L
	1.2	<p>Life Cycle of mushrooms</p> <ol style="list-style-type: none"> Button mushroom (<i>Agaricus bisporus</i>) Milky mushroom (<i>Calocybe indica</i>) Oyster mushroom (<i>Pleurotus sajor caju</i>) Paddy straw mushroom (<i>Volvariella volvcea</i>) 	7L
II		CULTIVATION OF MUSHROOMS	15L
	2.1	<p>Principles and Requisites</p> <ol style="list-style-type: none"> Sterilization and disinfections of substrates Pasteurization of different substrates Isolation, growth media Spawns' production and their maintenance. 	7L
	2.2	<p>Techniques of Cultivation</p> <ol style="list-style-type: none"> Structure and construction of mushroom house Layout of Traditional and Greenhouse method 	8L

		c. Multiplication of spawn d. Composting, bed and polythene bag preparation e. Spawning - casing – cropping	
III		POST HARVEST TECHNOLOGY	15L
	3.1	a. Cultivation management <ul style="list-style-type: none"> • Insect pests, fungal competitors and other important diseases b. Pest management - chemical control c. Harvest and Post harvest technology <ul style="list-style-type: none"> • Freezing • Dry freezing • Drying • Canning • Entrepreneurship 	15L
		PRACTICALS BASED ON UNIT I, II, III [1 CREDIT] 1. Preparation and maintenance of pure culture of mushrooms 2. Preparation of mother spawn, commercial spawn and its storage 3. Preparation of compost and composting methods 4. Spawning, Casing, Cropping and post-harvest handling 5. Cultivation of any one type of mushroom	30 L
		REFERENCE BOOKS 1. V.N. Pathak, Nagendra Yadav and Maneesha Gaur, Mushroom Production and Processing Technology/ Vedams Ebooks Pvt Ltd., New Delhi (2000) 2. Eiri Staff Hand Book of Mushroom Cultivation, Processing and Packaging Paperback – Import, 2007 3. Pandey R.K, S. K Ghosh, 1996. A Handbook on Mushroom Cultivation. Emkey Publications. 4. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur. 5. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi. 6. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. PVT.LTD, New Delhi	

Resolution No.: BOS/14.06.02023 /AC/26.06.2023

Bharatiya Vidya Bhavan's

**M. M. College of Arts, N.M. Institute of Science, H.R.J.
College of Commerce
(Bhavan's College) Autonomous**

(Affiliated to University of Mumbai)



NEP Syllabus for: F.Y.B.Sc Microbiology

Program: B.Sc.

Program Code: BH. BSc

Course Code: (BH.USMB.OE.201)

Public Health & Social Service- II

with effect from academic year 2023-24

SEMESTER –II

Programme - CERTIFICATE		Year – FIRST	SEM-II [TWO]
Subject - MICROBIOLOGY		Theory – 3 Credits & Practicals – 1 Credit = 4 Credits	
Course Code BH.USMB.OE.201		Course Title – PUBLIC HEALTH & SOCIAL SERVICE - II	
Course Objectives This course is designed: - 6. To introduce the concept of society and social stratification 7. To understand the theories of personalities 8. To understand the concept of social work and charity 9. To make aware about the social movements of India 10. To orient students with health issues of tribal population of India			
Course Outcomes After completing this course, the learner will be able to: - 6. Explain the concept of society and social stratification 7. Comprehend the various theories of personalities 8. Understand and explain the concept of social work and charity			
COURSE CREDITS – 4		CATEGORY - OE	
PAPER – BH.USMB.OE.201			
PAPER CREDITS – 3		Paper Title – FUNDAMENTALS OF PUBLIC HEALTH & SOCIAL WORK - II	No of Lec – 45L
UNIT	SUB- UNIT	TOPICS	No of Lec
I		INDIAN SOCIETY AND SOCIAL WORK	15L
	1.1	Analysis of Indian Society a. Family as the basic unit b. Joint and nuclear family, roles and functions of family, Changing trends in the family as a system. c. Institution of Marriage d. Urban and rural and tribal society and their characteristics e. Concept of unity in Diversity	4L
	1.2	Social stratification Marxist, Functionalist and Weberian approach.	3L
	1.3	Theories of Personality Abraham Maslow, Sigmund Freud and Eric Erickson	3L
	1.4	Social work with Charity Types of charitable organizations – voluntary, non-profit, NGOs, Environmental NGOs, charitable trust, charitable foundation, private foundation, religious corporation	3L
	1.5	Social movements in India – Dalit movement, Women’s movement, social reform movement	2L
II		PRINCIPLES OF PUBLIC HEALTH & VACCINATION	15L

	2.1	<p>Vaccination</p> <ol style="list-style-type: none"> Concept of herd immunity Types of vaccines National immunization programme Storage of vaccines and concept of cold chain UIP vaccines - BCG vaccine, Polio vaccine, DPT vaccine, TIG, and measles vaccine Non UIP vaccines – mumps vaccine, Rubella vaccine, MMR vaccine Development of new vaccines – Rotavirus vaccine, HPV vaccine International vaccine requirement – Yellow fever vaccine, 	6L
	2.2	<p>Principles and Practice of healthy life style</p> <ol style="list-style-type: none"> Food pyramid and principles of healthy diet High and low-calorie foods Recommendations on fats, sugar and salt, junk foods and hot foods Obesity – determinants of obesity, grades of obesity, quantifying obesity 	5L
	2.3	Mental health and stress management	4L
III		TRIBAL HEALTH	15L
	3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9	<p>Overview of territorial distribution and classification of tribes in India</p> <ol style="list-style-type: none"> Contemporary tribal health issues: tribal health indicators, trends and patterns Tribal health programmes, strategies, initiatives and schemes Nutrition and Food Security in tribal regions Poverty and Health in Tribal regions Tribal development, displacement, rehabilitation and its impact on health Water Hygiene Sanitation and Health in tribal communities Indigenous and emerging practices and its impact on health Ethno-medicine, forest resources and tribal health 	
Practicals	I,II & III	Survey /Report	30L
Credit - 1			
		<p>REFERENCE BOOKS</p> <ol style="list-style-type: none"> Prasad, R.: Social Reforms: An Analysis of Indian Society, Y. K. Publishers, Agra, 1990. Caroline Hodges Persell: Understanding Society: An Introduction to Sociology; 1984. Cambridge, Harper & Row Publishers. Ahuja R.: Social Problems in India, Rawat Publication, Jaipur, 1992, 1999. Liddie, J. & Joshi, R.: Daughters of Independence Gender, Caste and Class in India, Kali for Women, 1986. Johnson, Louise C.: Social Work Practice: A Generalist Approach, 1995. Wadia, A. R. (ed): History and Philosophy of Social Work in India, Bombay: Allied Publishers Pvt. Ltd., 1961. Konopka, Gisel: Group Work in the Institution Association 1970 Trecker, H. B.: Social Work Administration, Principles and Practices, Association Press, New York, 1971. 	

<p>15. Chopra D: Social Work and Social Welfare, Sonali Publications, 2012</p> <p>16. Zastraw C. Introduction to Social Work and Social Welfare, 12th Edition, 2015</p> <p>17. Nayak D. History, Philosophy and Fields of Social Work, 2012</p> <p>18. Agarwal S <i>et al</i>, Textbook of Public Health and Community medicine, AFMC Department of Community Medicine, Gayo Enterprises, 2009</p> <p>19. Census of India</p> <p>20. National Family Health Survey (NFHS) – 1, 2, 3, 4, 5 3) Lancet: Maternal and Child Health series – 2018</p> <p>21. Lancet: Indigenous Health series: 2010</p> <p>22. Tribal health report: First Comprehensive Report on Tribal Health in India: Report of the expert committee on tribal health</p> <p>23. R. K. Mutatkar (2018). Tribal Health and Malnutrition. Concept Publishing Company Private Ltd, New Delhi, India</p> <p>24. Salil Basu (2000). Dimensions of Tribal Health in India. Health and Population Perspectives and Issues 23(2): 61-70, 2000</p> <p>25. National Health Mission Programmes on Tribal Health Issues (Tribal RNTCP action plans, AIDS control programmes, NVBDCP, RCH-II)</p>	
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NEP Syllabus for: F.Y.B.Sc Microbiology

Program: B.Sc.

Program Code: BH. BSc

Course Code: (BH.USMB.VEC.201)

MICROBIOLOGY FOR ECOLOGICAL SUSTAINABILITY -II

with effect from academic year 2023-24

Programme - CERTIFICATE		Year – FIRST	SEM–II [TWO]
Subject - MICROBIOLOGY		Theory – 2 Credits	
Course Code BH.USMB. VEC.201		Course Title – MICROBIOLOGY FOR ECOLOGICAL SUSTAINABILITY-1	
Course Objectives This course is designed: - 9. To introduce students to the concept of microbial diversity and its importance in India. 10. To explore the different ecosystems in India and the microbial communities inhabiting them. 11. Understand Mushroom & Microbial pathogens specific to India			
Course Outcomes After completing this course, the learner will be able to: - 1. Explain the importance of microorganism in soil 2. Understand microbial community for beneficial uses 3. Elucidate the concepts of pathogenesis of microorganisms in India			
COURSE CREDITS – 2		CATEGORY - VAC	
PAPER – BH.USMB.VEC.201		Paper Title –	
PAPER CREDITS – 2		MICROBIOLOGY FOR ECOLOGICAL SUSTAINABILITY-1	No of Lec – 30L
UNIT	SUB-UNIT	TOPICS	No of Lec
I		SOIL MICROBIOTA AND SUSTAINABLE JHUM AGROECOSYSTEM	15L
	1.1	f. A Light on the Shifting Cultivation Practices in Northeast India g. Microbial Diversity Pertaining to Shifting Cultivation h. Microbes and Their Role in Plant Growth Promotion i. Impacts and Benefits of PGPR j. Role of PGPRs in Shifting Cultivated Fields k. Soil Fungi in the Context of Jhum Cultivation l. Mycorrhizal Fungi in Jhum Cultivation m. Plant Growth-Promoting Rhizobacteria (PGPR) in Jhum Agriculture n. Plant Growth-Promoting Fungi (PGPF) in Jhum Agriculture	13L
	1.2	Saffron Microbiome	2L
II		WILD EDIBLE MUSHROOMS OF NORTH WEST HIMALAYA	15L
	2.1	1. Diversity of Common Wild Edible Mushrooms 2. Non-lamellate Edible Mushrooms 3. Lamellate and Gasteromycetoid Edible Mushrooms	7L
	2.2	Microbial pathogens in India:- e. Tuberculosis (Mycobacterium tuberculosis)	8L

		f. Dengue fever (Dengue virus) g. Malaria (Plasmodium spp.) h. Emerging: Nipah virus	
		REFERENCE BOOKS 26. Microbial Diversity in Ecosystem Sustainability and Biotechnological Applications, Volume 2. Soil & Agroecosystems, Tulasi Satyanarayana, Subrata Kumar Das, Bhavdish Narain Johri, Springer Publications. 27. Ananthanarayan and Panicker's, Textbook of Microbiology, 10th edition	
