B.Sc Academic Year 2025-2028

Bharatiya Vidya Bhavan

Bhavan's Vivekananda College of Science, Humanities and Commerce, Sainikpuri, Secunderabad

Autonomous College (Affiliated to Osmania University)

(Reaccredited with "A" Grade by NAAC)

Department of Microbiology

Template for B Sc Microbiology under CBCS

(With effect from academic year 2025-28)

Semester 1

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	Environmental Studies	AECC-1	2		2	2		2
	English	CC-1A	4		4	4		4
	Second Language	CC-2A	4		4	4		4
MB131 / MB 131P	**Optional 1 General Microbiology**	**DSC-1A**	**4**	**2**	**6**	**4**	**1**	**5**
	Optional 2	DSC-2A	4	2	6	4	1	5
	Optional 3	DSC-3A	4	2	6	4	1	5
					28			**25**

Semester 2

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	Computer Skills	AECC-2	2		2	2		2
	English	CC-1B	4		4	4		4
	Second Language	CC-2B	4		4	4		4
MB231/ MB231 P	**Optional 1 Microbial Diversity**	**DSC-1B**	**4**	**2**	**6**	**4**	**1**	**5**
	Optional 2	DSC-2B	4	2	6	4	1	5
	Optional 3	DSC-3B	4	2	6	4	1	5
					28			**25**

Semester 3

Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1C	3		3	3		3
	Second Language	CC-2C	3		3	3		3
331 / MB331 P	**Optional 1 Food and Environmental Microbiology**	**DSC-1C**	**4**	**2**	**6**	**4**	**1**	**5**
	Optional 2	DSC-2C	4	2	6	4	1	5
	Optional 3	DSC-3C	4	2	6	4	1	5
	Skill Enhancement Course-1 Communication Skills	SEC-1	2		2	2		2
SE331A/ SE331B	**Skill Enhancement Course-2 Mushroom Cultivation/Microbial products-Biofertilizers and Biopesticides**	**SEC-2**	**2**		**2**	**2**		**2**
					28			**25**

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Semester 4								
Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1D	3		3	3		3
	Second Language	CC-2D	3		3	3		3
MB431 / MB431 P	**Optional 1 - Immunology & Medical Microbiology**	**DSC-1D**	**4**	**2**	**6**	**4**	**1**	**5**
	Optional 2	DSC-2D	4	2	6	4	1	5
	Optional 3	DSC-3D	4	2	6	4	1	5
	Skill Enhancement Course-3 Universal Human Values	SEC-3	2		2	2		2
SE431A / SE431B	**Skill Enhancement Course-4 Clinical Microbiology/Interactions with Entrepreneurs in Microbial Technology and start-ups**	**SEC-4**	**2**		**2**	**2**		**2**
					28			**25**
Semester 5								
Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1E	3		3	3		3
	Second Language	CC-2E	3		3	3		3
MB 531 / MB531P MB531A / MB531 A P	**Optional 1- A/B A. Molecular Biology & Microbial Genetics (or) B. Microbial Omics**	DSE-1E	**4**	**2**	**6**	**4**	**1**	**5**
	Optional 2	DSE-2E	4	2	6	4	1	5
	Optional 3	DSE-3E	4	2	6	4	1	5
GE531	**Generic Elective -Microbiology and Human Health**	GE-1	**4**		**4**	**4**		**4**
					28			**25**
Semester 6								
Course Code	Course title	Course Type	Hours/week			Credits		
			Theory	Practical	Total	Theory	Practical	Total
	English	CC-1F	3		3	3		3
	Second Language	CC-2F	3		3	3		3
MB631 / MB631 P MB631A / MB631A P	**Optional 1- A/B A. Industrial Microbiology (or) B. Pharmaceutical Microbiology**	DSE-1F	**4**	**2**	**6**	**4**	**1**	**5**
	Optional 2	DSE-2F	4	2	6	4	1	5
	Optional 3	DSE-3F	4	2	6	4	1	5
MB631_O/MB631_P	**Optional paper/Project Applied Microbiology and Artificial Intelligence**		4	-	4	4	-	4
					28			**25**
	Total Credits = 150							

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc MICROBIOLOGY
B. Sc. I YEAR SYLLABUS (2025 onwards)
SUBJECT -MICROBIOLOGY
I SEMESTER (4 HPW-4Credits)
MB131 Paper I GENERAL MICROBIOLOGY

Overall course objective:
To familiarize the students with the concepts of microscopy staining, general characters of microorganisms and microbial growth & nutrition.

Unit Wise Course Objectives:

COb1. Gives insight to the world of microorganisms in the aspect of historical developments and familiarize with the concepts of microscopy, staining, motility and Vedic microbiology.
COb2. Discuss the characteristics of various bacteria and illustrate structure of viruses
COb3. Discuss the nutritional requirements and familiarize with the concepts of bacterial metabolism
COb4. Basics on sterilization, isolation and preservation of microorganisms along with the growth of bacteria.

UNIT-1: INTRODUCTION TO MICROBIOLOGY **15hrs**

Meaning, definition and scope. History of microbiology: Contribution of Louis Pasteur and Robert Koch. Importance and application of Microbiology. 3hr
Concept of Vedic Microbiology:
Father of Vedic Microbiology-'Sage scientist kannva' 2hr
Principles of Microscopy-Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM). 5hr
Principles and types of stains-simple stain, differential stain, negative stain. Structural stain-spore, capsule, flagella. 4hr
Bacterial motility - Hanging drop method. 1hr

UNIT-2: STRUCTURE OF BACTERIA, VIRUSES & PURE CULTURE CONCEPT **15Hrs**

Prokaryotes—Ultra structure of eubacteria-Invariant components - Cell Wall, Cell Membrane, Ribosomes, Nucleoid. Variant components - Capsule, Flagella, Fimbriae, Endospore and Inclusion bodies. 5hr
Structure of TMV and HIV 4hr
Structure and multiplication of lambda bacteriophage
Isolation of Pure culture techniques- Enrichment culturing, Dilution plating, streak plate, spread plate, Pour plate and Micromanipulator 3hr
Preservation of Microbial cultures – Sub culturing, overlaying cultures with minerals oils, lyophilization, sand cultures, and storage at low temperature. 3hr

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UNIT-3: MICROBIAL NUTRITION AND METABOLISM — 15hrs

Microbial Nutrition – Nutritional requirement, Uptake of nutrients by cell.	2hr
Nutritional groups of microorganisms – Autotrophs, Heterotrophs, Mixotrophs.	1hr
Components and types of bacterial growth media	2hr
Enzymes – Properties, Nomenclature, Classification,	2hr
Models of enzyme substrate interactions	
Respiration – Glycolysis, HMP Pathway, ED Pathway, TCA Cycle and Anaplerotic reaction, Electron Transport chain, Oxidative and substrate level phosphorylation.	8hr

UNIT-4: STERILIZATION TECHNIQUES AND MICROBIAL GROWTH — 15hrs

Sterilization and disinfection techniques	3hr
Physical methods- Autoclave, Hot-air oven, Pressure cooker, Tyndallisation, Laminar air flow, Filter sterilization	
Radiation methods-UV rays, Gamma rays, Ultra sonic methods, Microwaves	2hr
Chemical methods- Use of alcohols, aldehydes, fumigants, phenols, halogens, hypochlorites	3hr
Microbial growth- Different phases of growth in batch culture	2hr
Factors influencing microbial growth	2hr
Synchronous, Continuous, Biphasic Growth	1hr
Methods for measuring microbial growth – Direct Microscopic, Viable count, Turbidometry, Biomass measurement	2hr

References:

1. Vedic Microbiology(2020),Dubey, R.C. , Motilal Banarsidass international publication
2. Michael J. Pelczar, Jr. E.C.S.Chan, Noel R. Krieg Microbiology Tata McGraw- Hill Publisher.
3. Prescott, M.J., Harly, J.P. and Klein Microbiology 5th Edition, WCB McGrawHill, New York.
4. Madigan, M.T., Martinkl, J.M and Parker,j. Broch Biology of Microorganism, 9th Edition, MacMillan Press, England.
5. Dube, R.C. and Maheshwari, D.K. General Microbiology S Chand, New Delhi.
6. Ananthanarayan and Panicker, Medical Microbiology.

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I SEMESTER PRACTICALS (2 HPW-1Credit)
MB131 P Paper I General Microbiology

2HPW-Credits-1

1. Handling and calibration of light microscope.
2. Simple and differential staining (Gram staining), Spore staining.
3. Microscopic observation of Cyanobacteria (*Nostoc, Spirulina*), algae and fungi (*Saccharomyces, Rhizopus, Aspergillus, Penicillium, Fusarium*).
4. Isolation of T2 bacteriophage from sewage sample.
5. Preparation of media for culturing autotrophic and heterotrophic microorganisms – algal medium, nutrient agar medium,Potato dextrose agar and McConkey agar
6. Sterilization techniques: Autoclave, Hot air oven and filtration.
7. Enumeration of bacterial numbers by serial dilution and plating (viable count)
8. Isolation of pure cultures by streak, spread and pour plate techniques
9. Preservation of microbial cultures- Slant, Stab, Sand cultures, mineral oil overlay and glycerol stocks
10. Turbidometric measurement of bacterial growth and plotting growth curve.

References:

1. Experiments in Microbiology by K.R. Aneja.
2. GopalReddy.M., Reddy. M.N., SaiGopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.
3. Dubey, R.C. and Maheshwari, D.K. Practical Microbiology, S. Chand and Co New Delhi.
4. Alcamo, I.E. Laboratory Fundamentals of Microbiology. Jones and Bartlett Publishers, USA.

Course Outcomes:

At the end of the course student will be able to

MB131.CO1. Acquaint with historical account and apply microscopy and staining techniques and basic concept of Vedic microbiology.

MB131.CO2. Able to classify microorganisms based on salient characteristics and summarize characteristics of various bacteria and compare different types of viruses.

MB131.CO3. Understand the nutritional requirements of different types of bacteria and importance of various metabolic pathways in food and energy production.

MB131.CO4. Able to identify, isolate, and preserve the microorganisms.

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SCHEME FOR CHOICE BASED CREDIT SYSTEM IN B.Sc. MICROBIOLOGY
B. Sc. I YEAR SYLLABUS (2025 Onwards)
SUBJECT -MICROBIOLOGY
II SEMESTER (4 HPW-4Credits)
MB231 PaperII MICROBIAL DIVERSITY

Overall Course Objective: To explain the relevance of the microbial biodiversity concepts and ecosystems.

Unit wise Course Objectives:

COb1. Discuss about diversification of microorganisms along with Vedic classification of Krimis
COb2. Explain about the physiological diversity of bacteria
COb3. Basic insights into few unique characteristics of protozoa, fungi and algae.
COb4. Discuss various microbial ecosystems and their interactions

UNIT 1: CONCEPT OF BIODIVERSITY — 15hrs

Basic concept of Biodiversity and Conservation.	3hr
Elements of Biodiversity- Ecosystem Diversity, Genetic Diversity, Species Abundance & Diversity.	
Economic Value of Biodiversity & Legal, Ethical and Conservation issues related to uses of biodiversity.	3hr
Vedic classification of Krimis	1hr
Classification of living organisms; Haeckel, Whittaker and Carl Woese systems.	3hr
Differentiation of prokaryotes and eukaryotes.	2hr
Classification of bacteria as per the second edition of Bergey's manual of systematic bacteriology.	3hr

UNIT 2: PROKARYOTIC MICROBIAL DIVERSITY — 15hrs

General characteristics of Rickettsia, Mycoplasma and Chlamydia	3hr
Structural and physiological diversity of Archaea bacteria, metabolic characteristics of extremophiles (Methanogens, Halophiles, Thermoacidophiles).	7hr
Gram negatives: Cyanobacteria and Proteobacteria	5hr
Gram positives: Firmicutes and Actinobacteria	

UNIT 3: EUKAROTYIC MICROBIAL DIVERSITY — 15hrs

Eukaryotic microbial diversity. Structural, physiological and metabolic characteristics of Algae - Cyanophyta, Chlorophyta, Bacillariophyta, Phacophyta, Rhodophyta	6hr
Fungi -Phycomycetis, Basidiomycetis, Zygomyecetes, Oomycets, Ascomycetes, Deuteromycetes (imperfect and perfect stages)	5hr
Protozoa - *Giardia*, *Entamoeba* and *Plasmodium*	4hr

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UNIT 4: MICROBIAL ECOSYSTEMS **15 Hrs**

Microbial interactions: Symbiosis, neutralism, commensalism, competition, antagonism, synergism, parasitism.	6hr
Understanding microbial diversity with Cultivated vs Uncultivated microorganisms - The Great Plate count anomaly.	2hr
Cultivation independent methods to assess microbial diversity-	2hr
Preserved and perturbed microbial ecosystems, microbiome for sustainable agro-ecosystems and Human microbiome	5hr

Reference Books

1. Vedic Microbiology- Gurus of Vedic Microbiology. Dr Chakradhar F 'Anjista' and Dr Shriji Kurup.
2. Pelczar Jr. M.J. Chan. E.C.S and Kreig.N.R (2006)."Microbiology"- 5th Edition McGraw Hill Inc. New York.
3. David, B.D., Delbecco,. R., Eisen, H.N and Ginsburg, H.S (1990) "Microbiology" 5th Edition. Harper & Row, New York.
4. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L and Painter, P.R. (1986). "General Microbiology" -Mac Milan Education Ltd. London.
5. Brown J.W. (2015) Principles of Microbial Diversity, ASM Press
6. Epstein S.S. (2009) Uncultivated microorganisms, Springer-Verlag Publishers
7. Madigan M.T., Bender K.S., Buckley D.H., Sattley W.M. and Stahl D.A. (2017) Brock Biology of Microorganisms, 15th Edn. (Global Edn.)Pearson Education

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II SEMESTER PRACTICALS (2 HPW-1Credit)
MB231 P Paper I Microbial Diversity

1. Isolation of Methanogenic bacteria from manure by anaerobic culturing
2. Isolation and enumeration of halophiles from saline environment
3. Isolation of bacteria from diversified habitats to demonstrate antagonism, commensalism and synergism
4. Isolation of *Cyanobacteria* and fungi from different habitats
5. Identification of fungi by staining techniques
6. Microscopic observation of soil algae and Protozoa
7. Winogradsky's column to demonstrate microbial diversity
8. Visit and observe any nearby unique ecosystems to understand the role of microorganisms
9. Demonstration of the great plate count anomaly

References:

1. Aneja, K.R. (2001). Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd., New Delhi.
2. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
3. Burns, R.G. and Slater, J.H. (1982). Experimental Microbiology and Ecology. Blackwell Scientific Publications, USA.
4. Peppler, I.L. and Gerba, C.P. (2004). Environmental Microbiology – A Laboratory Manual.Academic Press. New York.
5. Gupte, S. (1995). Practical Microbiology. Jaypee Brothers Medical Publishers Pvt. Ltd.
6. Kannan, N. (2003). Hand Book of Laboratory Culture Medias, Reagents, Stains and Buffers.Panima Publishing Co., New Delhi.
7. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition.Himalaya Publishing House, Mumbai.
8. Reddy, S.M. and Reddy, S.R. (1998). Microbiology – Practical Manual, 3rd Edition, SriPadmavathi Publications, Hyderabad

Course Outcomes:

The student will be able to

MB231.CO1. Understand and appreciate the diversity of microorganisms and conservation, for the substance of life on Earth in general.
MB231.CO2. Able to classify and compare various bacteria
MB231.CO3. Aware of general characteristics of protozoa, fungi, algae and their economic importance
MB231.CO4. Appreciate the microbial communities inhabiting a multitude of habitats and occupying a wide range of ecological habitats.

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