

**B.Sc Academic
Year**

2026-2029



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
Structure for B Sc under CBCS
(With effect from academic year 2026-29)

Course Title	Course Type	Course Type	HPW	Credits
FIRST YEAR-SEMESTER-I				
English		AEC-1A	4	4
Second Language		AEC-2A	4	4
Introductory Microbiology	Major-1	DSC-1A	4T+2P=6	4+1=5
Optional paper-2	Major-2	DSC-2A	4T+2P=6	4+1=5
Optional paper-3	Major-3	DSC-3A	4T+2P=6	4+1=5
TOTAL			26	23
SEMESTER-II				
English		AEC-1B	4	4
Second Language		AEC-2B	4	4
Biomolecules and biochemical techniques	Major-1	DSC-1B	4T+2P=6	4+1=5
Optional paper-2	Major-2	DSC-2B	4T+2P=6	4+1=5
Optional paper-3	Major-3	DSC-3B	4T+2P=6	4+1=5
TOTAL			26	23
SECOND YEAR-SEMESTER-III				
English		AEC-1C	4	4
Second Language		AEC-2C	4	4
Applied Microbiology	Major-1	DSC-1C	4T+2P=6	4+1=5
Optional paper-2	Major-2	DSC-2C	4T+2P=6	4+1=5
Optional paper-3	Major-3	DSC-3C	4T+2P=6	4+1=5
			26	23


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SECOND YEAR-SEMESTER-IV				
English		AEC-1D	4	4
Second Language		AEC-2D	4	4
Immunology and Clinical Microbiology	Major-1	DSC-1D	4T+2P=6	4+1=5
Optional paper-2	Major-2	DSC-2D	4T+2P=6	4+1=5
Optional paper-3	Major-3	DSC-3D	4T+2P=6	4+1=5
			26	23
THIRD YEAR-SEMESTER-V				
Multi-Disciplinary Course (Paper proposed across other disciplines)		MDC	4	4
Skill Enhancement course-1		SEC-1	2	2
Skill Enhancement course-2		SEC-2	2	2
Value Added Course		VAC-1	2	2
Molecular Microbiology & Microbial Genetics	Major-1	DSC-1E	4T+2P=6	4+1=5
Optional paper	Major-2	DSC-2E	4T+2P=6	4+1=5
			22	20
THIRD YEAR-SEMESTER-VI				
Skill Enhancement course-3		SEC-3	2	2
Skill Enhancement course-4		SEC-4	2	2
Value Added Course		VAC-2	2	2
IA. Industrial Microbiology or IB. Pharmaceutical Microbiology or IC. Microbial Omics	Elective paper for Major-1	DSE-IA or DSE-IB or DSE-IC	4T+2P=6	4+1=5
Optional paper	Major-2			5
Project work/ Internship			4	4
Total Semester VI			16	20
Program TOTAL				132



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Structure for B Sc (BTMC) under CBCS
(With effect from academic year 2026-29)

Course Title	Course Type	Course Type	HPW	Credits
FIRST YEAR-SEMESTER-1				
English		AEC-1A	4	4
Second Language		AEC-2A	4	4
Introductory Microbiology	Major-1	DSC-1A	4T+2P=6	4+1=5
Cell Biology, Genetics and Biostatistics	Major-2	DSC-2A	4T+2P=6	4+1=5
Chemistry-1	Major-3	DSC-3A	4T+2P=6	4+1=5
TOTAL			26	23
SEMESTER-II				
English		AEC-1B	4	4
Second Language		AEC-2B	4	4
Biomolecules and biochemical techniques	Major-1	DSC-1B	4T+2P=6	4+1=5
Microbiology and Immunology	Major-2	DSC-2B	4T+2P=6	4+1=5
Chemistry-II	Major-3	DSC-3B	4T+2P=6	4+1=5
TOTAL			26	23


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Syllabus - B Sc I Year Microbiology
(w.e.f academic year: 2026-27)
Semester I

Course:Introductory Microbiology
Course Code:MB131 (60 Hours)

Hour/week:4
Credits:4

Course Objectives:The objectives of this course are

- 1.To remember the historical contributions in the development of microbiology.
- 2.To understand the principles of microscopy and staining techniques used for observing microorganisms.
- 3.To apply classification systems and distinguish structural differences between prokaryotic and eukaryotic cells.
- 4.To analyse characteristics of diverse microorganisms including bacteria, viruses, fungi, algae, and atypical microbes.
5. To evaluate sterilization, disinfection methods, and biosafety practices in microbiological work.
6. To create appropriate strategies for microbial cultivation, preservation, and growth assessment.

Contents of the course

Unit-1: Introduction to Microbiology	15Hrs
History of Microbiology: Contribution of Antony Van Leewenhock, Louis Pasteur, Robert Koch and Edward Jenner.	4hrs
Information about Microorganisms (sukshmjeevanu) in Vedas.	2hrs
Principles of Microscopy - Bright field, Dark field, Phase-contrast, Fluorescent and Electron microscopy (SEM and TEM).	4hrs
Principles and types of stains-simple staining, Differential staining- Gram staining and Acid Fast. Negative staining. Structural staining-spore, capsule, flagella.	
Bacterial motility- Hanging drop method.	5hrs


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Unit-2: Microorganisms: Classification & Structural Features	15Hrs
Classification of living organisms- 3-Kingdom, 5-Kingdom and 3- Domain	2hrs
Prokaryotes- Ultra structure of eubacteria. Structure of eukaryotic cell.	
Differentiation of prokaryotes and eukaryotes	3hrs
General characteristics of Chlamydia, Rickettsiae, Mycoplasma, Archaeobacteria, Cyanobacteria, Algae, Fungi.	5hrs
General characteristics and classification of viruses.	
Morphology and structure of TMV and HIV.	
Structure and multiplication of lambda bacteriophage	5hrs
Unit-3: Sterilization & Pure Culture Techniques	15Hrs
Sterilization and disinfection techniques - Physical methods- Autoclave, Hot air oven, Laminar air flow and Filter sterilization.	
Radiation methods - U.V rays, Gamma rays, Ultrasonic methods.	
Chemical methods - Alcohols, Aldehydes, Phenol, Halogens and Hypo chlorides.	5hrs
Use of Biological safety cabinets, types. Primary containment for Biohazards. Biosafety levels	2hrs
Isolation of pure culture; Techniques- Dilution plating, streak plate, spread plate, pour plate,	
Enrichment culturing and Micromanipulator	4hrs
Preservation of Microbial cultures - Sub culturing, overlaying cultures with minerals oils, lyophilization, sand cultures and storage at low temperature.	4hrs
Unit-4: Microbial Diversity, Nutrition & Growth	15Hrs
Basic concept of Biodiversity and its types and Conservation (Ex-situ and In-situ)	3hrs
National Biodiversity authority (NBA). Introduction to Metagenomics.	2hrs
Microbial Nutrition - Nutritional groups of microorganisms - Autotrophs, Heterotrophs, Mixotrophs.	
Components and types of bacterial growth media	5hrs
Microbial growth - Different Phases of Growth in Batch culture.	
Factors Influencing microbial growth. Synchronous, Continuous, Biphasic Growth.	
Methods for measuring microbial growth - Direct Microscopic, Viable count, Turbidometry, Biomass.	5hrs


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References:

1. Michael J. Pelczar, Jr. E. C.S. Chan, Noel R. Krieg Microbiology Tata McGraw-Hill Publisher
2. Prescott, L.M., Harley, J.P. and Klein, D.A. (2002) Microbiology: Food and Industrial Microbiology. 5th Edition, McGraw-Hill, Boston, 978-981.
3. Madigan, M.T., Martinko, J.M. and Parker, J. (1997) Brock Biology of Microorganisms. 8th Edition, Prentice Hall International, Inc., New York.
4. A. Mani, A.M. Selvaraj, N. Arumugam L.M. Narayanan. Microbiology- General and Applied. 2017. Saras publications
5. Chand Pasha and Hameeda Bee (2024) Text Book of General Microbiology. Professional Books Publishers, Hyderabad.

Course outcomes: By the end of the course, the students will be able to,

MB131.CO1: Recall key historical developments and ancient references to microorganisms.

MB131.CO2: Explain microscopy techniques and staining procedures for microbial identification.

MB 131.CO3: Classify microorganisms based on structural and functional characteristics.

MB131.CO4: Differentiate between various microbial groups, including viruses and atypical organisms.

MB131.CO5: Demonstrate sterilization techniques and pure culture methods in laboratory settings.

MB131.CO6: Interpret and analyse microbial growth patterns, nutritional requirements, and biodiversity concepts.



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Course Objectives: The objectives of this course are

1. To apply microbiological techniques for microscopy, media preparation, sterilization, isolation, staining, and cultivation of microorganisms.
2. To analyse and evaluate microbial growth, diversity, and preservation methods using standard laboratory procedures.

1. Handling and calibration of light microscope.
2. Preparation of media for culturing autotrophic and heterotrophic microorganisms-algal medium, nutrient agar medium, Mac Conkey agar and Potato dextrose agar.
3. Sterilization techniques: Autoclave, Hot air oven and filtration.
4. Isolation of bacteria, fungi and algae from soil.
5. Simple and differential staining (Gram staining), spore staining, negative staining and fungal staining.
6. Microscopic observation of cyanobacteria (Nostoc, Spirulina), algae and fungi (*Saccharomyces*, *Rhizopus*, *Aspergillus*, *Penicillium*).
7. Enumeration of bacterial numbers by serial dilution and plating (viable count and calculation of CFU and conversion to log value).
8. Pure culture technique: streak, spread and pour plate method.
9. Winogradsky's column to demonstrate microbial diversity.
10. Preservation of microbial cultures -Slant, Stab, Sand cultures, mineral oil overlay and glycerol stocks.
11. Turbidometry measurement of bacterial growth and plotting growth curve.
12. Isolation of bacteriophage from sewage sample.


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References:

1. Alfred Brown and Heidi Smith, 2017, Bensons Microbiological application: A laboratory manual in General Microbiology, Indian Edition, Mc.Graw Hill (13e).
2. Chand Pasha and Bhima (2024) Laboratory Experiments in Microbiology. ISBN no 978-81-969070- 5-1, Professional Books Publishers, Hyderabad.
3. Laboratory manual of Microbiology and Biotechnology by K.R. Aneja. 2014.
4. Practical Microbiology, R.C. Dubey and D.K. Maheshwari, 2012, Chand Publications.
5. Gopal Reddy.M., Reddy.M.N., Sai Gopal, DVR and Mallaiah K.V. Laboratory Experiments in Microbiology.

Course outcomes: By the end of the course, the students will be able to,

MB131P.CO1: Demonstrate laboratory skills including handling microscopes, aseptic techniques, staining, isolation, and enumeration of microorganisms.

MB131P.CO2: Interpret and assess microbial growth patterns, diversity and preservation techniques for maintaining pure cultures.


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Syllabus - B Sc I Year Microbiology
(w.e.f academic year: 2026-27)
Semester II

Course: Biomolecules and Biochemical techniques
Course Code: MB231 (60 Hours)

Hour/week: 4
Credits: 4

Course objectives: The objectives of this course are

1. To remember the structure, classification, and functions of biological macromolecules.
2. To understand the structural organization and biochemical properties of amino acids, proteins, enzymes, and lipids.
3. To apply fundamental concepts of molecular biology.
4. To analyse metabolic pathways.
5. To evaluate the role of biomolecules and metabolic reactions in cellular energy production and physiological functions.
6. To apply biochemical and analytical techniques in research studies.

Contents of the course

Unit-1: Biological Macromolecules-1 15Hrs

Carbohydrates-Monosaccharides: aldoses and ketoses, epimers, mutarotation and anomers
glucose, Sugar derivatives- Glucosamine, Galactosamine, Muramic acid, N-acetylneuraminic
acid. Disaccharides- Sucrose, lactose, Polysaccharides- Homo and heteropolysaccharides 4hrs

Amino acids- Structure of amino acid, Zwitterion, classification and properties 2hrs

Proteins- structure: primary, secondary, tertiary and quaternary level 2hrs


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Enzymes- Properties, Nomenclature, classification

Models of enzyme substrate interactions 2hrs

Lipids-Introduction to storage and structural lipids. Storage lipids: triacylglycerols, building blocks, fatty acids structure and properties, essential fatty acid. 3hrs

Saponification. Structural lipids. Phosphoglycerides- building blocks. 2hrs

Unit-2: Basics to Molecular Biology 15Hrs

Nucleic acids-structure and properties of purines, pyrimidines, nucleosides and nucleotides 2hrs

Structure of DNA- Watson and Crick model, forms of DNA 2hrs

Types of RNA- mRNA, rRNA and tRNA 2hrs

DNA and RNA as genetic material. 1hr

Extra chromosomal genetic elements-Plasmids and Transposons. 2hrs

Replication of DNA- Semi conservative mechanism. 3hrs

Concept of gene. Transcription and translation of prokaryotes. Introduction to operon concept- Lac operon model. 3hrs

Unit-3: Biomolecular Chemistry 15Hrs

Concept of aerobic respiration, anaerobic respiration. 2hr

Respiration - Glycolysis, HMP Pathway, ED Pathway, TCA Cycle. 5hrs

Electron transport chain (ETC): components of respiratory chain, comparison of mitochondrial and bacterial ETC, Oxidative and substrate level phosphorylation. 3hrs

Fermentation Common microbial fermentations- Alcoholic, lactic acid and acetic acid fermentation 5hrs

Unit-4: Biochemical Techniques 15Hrs

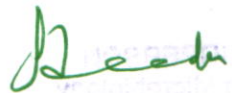
Buffers- Types of buffers and their use in biological reactions, Hydrogen ion concentration in biological fluids, measurement of pH. 4hrs

Principle and applications of Colorimetry and Spectrophotometry. 2hrs

Chromatographic techniques: Paper, Thin layer and column- Ion exchange, Gel chromatography and HPLC 5hrs

Electrophoresis. Agarose gel electrophoresis and PAGE (Poly acrylamide gel electrophoresis). 4hrs


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References:

1. Pelczar Jr .M.J., Chan.E.C., SandKreig.N.R (2006)."Microbiology"-5th Edition Mc Graw Hill Inc. New York.
2. Brown J.W. (2015) Principles of Microbial Diversity, ASM Press
3. Epstein S.S. (2009) Uncultivated microorganisms, Springer-Verlag Publishers
4. Madigan M.T., Bender K.S., Buckley D. H., Sattley W.M. and Stahl D.A. (2017) Brock
5. Biology of Microorganisms, 15th Edition (Global Edn.)Pearson Education. Principles of Biochemistry, by A.H. Lehninger
6. Berg, Tymoczko and Stryer, Textbook of Biochemistry. Fifth Edition.

Course outcomes: By the end of the course, the students will be able to,

MB231.CO1: Recall and describe the structure and functions of carbohydrates, proteins, lipids, and nucleic acids.

MB231.CO2: Explain enzyme mechanisms, protein structure levels, and lipid organization in biological systems.

MB231 CO3: Illustrate and interpret molecular biology processes such as DNA replication, transcription, and translation.

MB231.CO4: Analyse key metabolic pathways and differentiate between aerobic, anaerobic respiration, and fermentation.

MB231.CO5: Evaluate the significance of biochemical reactions in energy production and microbial metabolism.

MB231.CO6: Demonstrate and interpret results from biochemical techniques.


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B.Sc. I year: II Semester: MB231P BIOMOLECULES AND BIOCHEMICAL TECHNIQUES PRACTICALS

2HPW - Credits-1

Course objectives: The objectives of this course are

1. To analyse and evaluate biochemical properties of carbohydrates, proteins, lipids, and enzymes using laboratory instruments and methods.
2. To apply biochemical techniques for qualitative analysis, enzyme assays, buffer preparation, chromatography, and electrophoresis.

1. Qualitative analysis of carbohydrates (Glucose, sucrose, starch)
2. Study of protein structures with the help of models.
3. Determination of acid value of fatty acids.
4. Enzyme assay of Amylase and Protease.
5. Preparation of buffers and adjustment of pH using pH meter.
6. Demonstration for Colorimetry – Absorption maxima.
7. Separation of amino acids by paper chromatography.
8. Demonstration of agarose gel electrophoresis.

References:

1. Chand Pasha, Bhima (2024) Laboratory Experiments in Microbiology. ISBN no 978-81-969070-5- 1, Professional Books Publishers, Hyderabad.
2. Aneja, K. R. (2001). Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom Production Technology, 3rd Edition, New Age International (P) Ltd., New Delhi.
3. Dubey, R.C. and Maheswari, D.K. (2002). Practical Microbiology, S. Chand & Co., New Delhi.
4. Kannan, N. (2003). Hand Book of Laboratory Culture Media, Reagents, Stains and Buffers. Anima Publishing Co., New Delhi.
5. Gopal Reddy, M., Reddy, M.N., Saigopal, DVR and Mallaiah, K.V. (2007). Laboratory Experiments in Microbiology, 2nd edition. Himalaya Publishing House, Mumbai.
6. Microbial diversity with practicals. A. Madhuri and Bi Susmitha DLPD. 2021.

Course outcomes: By the end of the course, the students will be able to,

MB231P.CO1: Interpret and analyse experimental results related to biomolecules, enzyme activity, and separation techniques.

MB231P.CO2: Demonstrate laboratory skills in biochemical analysis, including pH measurement, colorimetry, chromatography, and electrophoresis.


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